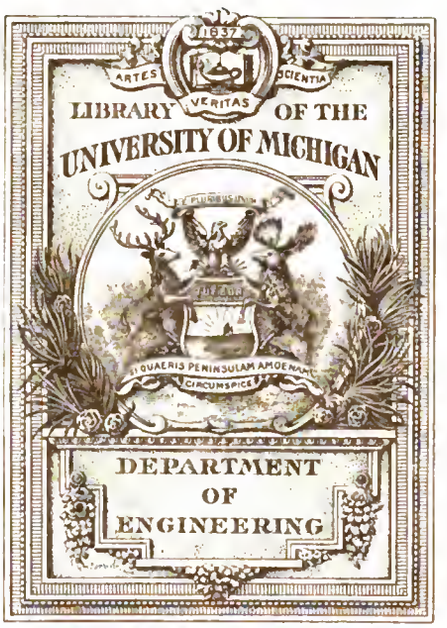

The Automobile

VOL. XXXV NEW YORK—JULY 6, 1916, TO DECEMBER 28, 1916—CHICAGO NOS. 1 TO 26

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TRADE NEWS

The Automobile

Vol. XXXV New York—Thursday, July 6, 1916—Chicago No. 1

De Palma Wins Twin City 150-Mile Race

His Mercedes Averages 90.8 M.P.H. for the Distance—Aitken Second—Christiaens Third —Poor Gate Almost Causes Postponement

MINNEAPOLIS, Minn., July 4 — *Special Telegram*—Ralph De Palma at the wheel of his cream-colored Mercedes was the bright particular star to-day of the sadly curtailed Mid-Continent races at the Twin City speedway. The veteran driver tooled his German-built American mount into first place early in the 150-mile event and held that position for a win. His time was 1:38:49.20, an average of 90.8 m.p.h. Aitken in the Peugeot put up an exciting battle but finished second, 1 min. and 25 sec. behind De Palma. His time was 1:40:14.5. Christiaens, whose English Sunbeam led De Palma for the first 8 miles and again from the twentieth to the fortieth mile posts and menaced De Palma's supremacy for 65 miles, took third in 1:43:28.75. This was 2 min. behind Aitken and over 5 min. behind De Palma.

The remaining four cars of the seven to finish in the money were Milton, Duesenberg, fourth, time 1:44:11.95; O'Donnell, Haskens special, a Duesenberg machine, fifth, time 1:47:37.95; Sorenson, Marse, sixth, time 1:56:14.45; Muller in Dans L'Argent, a special job with a Hudson motor, seventh, time 2:1:18.20. The last car to finish just barely lived up to its name Dans L'Argent, or "in the money."

Race Nearly Called Off

Until almost 4 o'clock prospects of any race at all were dubious indeed, not that there were not starters enough, for fourteen cars were ready for the signal, not that the track was any worse than normal, for, while there were clouds and showers in the morning the sky was clear and the sun shining by 11 o'clock, but because the promised $20,000 supposed to be hung up as prize money for the four events of the day was not forthcoming. The program scheduled four races, 150 miles, 50 miles, 20 miles and 10 miles, respectively, with the big event of 150 miles to start at 2 o'clock, but at that hour the grandstands and parking spaces were disappointingly bare, the expected crowd having failed to materialize, due to the morning's rain and to lack of proper advertising of the races. The speedway management had counted on the gate receipts to provide the funds for the prize money, and seemingly the total of the advance sales and the gate receipts did not amount to much more than $8,000 of the $20,000 announced prizes. W. C. Barnes, A. A. A. representative, refused to permit the race to start until the prize money had been placed in his hands as required by the rules of the association. The sparsely-settled grandstands were becoming impatient by 3 o'clock when Barnes called a meeting of the drivers, who first offered to stage a 10-mile exhibition for no prize if the management would return their money to the ticketholders. This not being received with enthusiasm by the management, it was decided to run the 150-mile event only for the $8,000 cash and Manager Sperry's check for the balance secured by speedway stock, Starter A. C. Bennett then sent the fourteen cars away at 3:55, nearly 2 hr. late.

The afternoon events began by the review of the State troops by Governor Burnquist, and this also may add to the difficulties of the speedway management for the contract with the State that the exhibition of the militia calls for a payment of 10 per cent of the gross receipts to the soldiers' fund. Now the State threatens to bring suit.

(*Continued on page* 42)

Buick Adds a Four

NEW YORK CITY, July 1—The General Motors Co. has again entered the four-cylinder field with a four-cylinder runabout, known as D-4-34, and touring car, known as D-4-35, selling at $650 and $665, respectively, f.o.b. Flint. The company will concentrate on this model and its small six, having discontinued the large six.

The new four-cylinder model will be designed for an initial production of about 75,000. The motor is of the same overhead valve construction as the present six and is 3⅜ by 4¾, developing 35 brake hp. Other specifications include: 106-in. wheelbase, Delco ignition, Stewart vacuum fuel feed, 31 by 4-in. non-skid tires, three-quarters floating rear axle, semi-elliptic springs on both front and rear, the front being 30 by 2-in. and the rear 48 by 2. The car has three speeds forward and is geared 4 to 1 on high.

New York and Chicago Show Dates Jan. 6 and Jan. 27

NEW YORK CITY, June 30—The National Automobile Chamber of Commerce has announced the 1917 show dates. The New York show will open at the Grand Central Palace Jan. 6 to 13, inclusive, while the Chicago date is Jan. 27 to Feb. 3, inclusive.

Want Funds for Aeroplanes

Aero Club Appeals for Assistance in Sending Planes to Mexican Border

NEW YORK CITY, July 5—The Aero Club of America has sent out a strong appeal for funds to enable private enterprise to raise a fleet of military aircraft which can be presented to the government. In the letter the club states that it feels Congress should provide the money. The U. S. army to-day has but twelve aeroplanes and there are but fifteen army aviators, yet every aeroplane is worth 1000 soldiers in campaigns such as that which may still have to be fought along the Mexican frontier.

"Aeroplanes are necessary to protect the lives of the thousands of soldiers participating in the Mexican expedition. The Aero Club of America is mobilizing the licensed aviators available, equipping them with high-powered aeroplanes, and keeping them in readiness to await the call of the War Department, which will gladly avail itself of this reserve in case of need. It will cost between $400 and $750 to train each aviator, and between $8,000 and $10,000 each for the high-powered military aeroplanes."

Peterson Joins Alloy Steel Spring

JACKSON, MICH., July 1—F. J. Keiser, superintendent of the Alloy Steel Spring Co., has resigned, and is succeeded by Gustave Peterson, now with the Carnegie Steel Co. at Detroit.

Fergus Car for Next Year

NEW YORK CITY, July 3—In a large office at 80 Maiden Lane, this city, J. B. Ferguson is working on the drawings of the Fergus car which created such great interest at the last New York show, in order to get it into shape for manufacturing. Up to the present the exact location of the plant has not been chosen, but it is certain to be close to New York. Mr. Ferguson expects to have the first cars ready for the market in about 10 months and plans an output of well under 1000 for the first year. It has been necessary to raise certain portions of the chassis to suit American road conditions, but the car will be altered in no essential feature otherwise.

Loomis Resigns from Packard

DETROIT, MICH., June 28—Allen Loomis, for the past 10 years with the Packard Motor Car Co., this city, has resigned his position as research engineer to devote his attention to private engineering. An announcement regarding the details of his new work will be made after Mr. Loomis' return from his summer home at Higgins Lake. During his connection with the Packard company, thirty-nine patents were granted Loomis, many of which are embodied in the current Packard cars.

Earle and Boggs Leave Continental

DETROIT, MICH., June 29—L. H. Earle, sales manager and G. A. Boggs, assistant sales manager of the Continental Motors Co., this city, have resigned and will become actively engaged in business together in the East.

Elliott, Haynes Production Manager

GRAND RAPIDS, MICH., July 3—E. M. Elliott, formerly in charge of the production of the United Motor Truck Co., Grand Rapids, Mich., and since then in charge of sales of the Mais trucks, has been made production manager of the Haynes Automobile Co., Kokomo, Ind.

Night stop of record-breaking King eight for supplies. Time and duration of stop checked by A. A. A. observer

King Covers 10,850 Miles in 2 Weeks

Averages 32 M.P.H. — Parallels 2 Years in Owners' Normal Service

SHEEPSHEAD BAY, June 29—Just a little after noon to-day the King eight-cylinder car, which has been undergoing a non-engine-stop test for the last 2 weeks, rolled across the finishing line of the board track here having covered practically 10,850 miles without a falter in its power plant.

The object of the test, which started at noon on June 15, was to demonstrate the stability of the King eight-cylinder engine and to approach a condition of actual service by concentrating the running and operation of 2 years' car service into 2 weeks of test work. To accomplish this the car maintained an average of over 32 m.p.h., including the stops to take on gasoline, oil and other supplies. Excluding the stops the speed was 34.31 m.p.h. The engine ran 24 hr. a day and was not stopped from the moment the test started until it was switched off by F. E. Edwards, technical representative of the A. A. A., before the New York King salesroom late this afternoon.

The test was methodically arranged and carried out from start to finish. It was under direct sanction and supervision of A. A. A. officials, who worked in shifts of 8 hr., observing the running of the car and noting, on the score sheet, the time of each lap around the 2-mile track. The drivers worked in shifts of 5 hr., with a 10-hr. rest period and with the driver rode a mechanic giving a full passenger load in the front seat while in the rear a bag of sand weighing 500 lb. was carried to represent the full passenger load in the tonneau.

The entire 10,850 miles were run upon the speedway except 200 miles which were made upon the roads of Long Island between the speedway and the Motor Parkway and on the Motor Parkway itself up and down the 40-mile stretch from Jericho turnpike to Lake Ronkonkoma. No attempt was made to speed the car excessively but the average was held consistently throughout the run. The car probably made its fastest time when put on the Motor Parkway, as it traveled at times close to 50 m.p.h. over the rolling country traversed by the parkway. Even at this speed, however, due to interruptions to and from the parkway, the average speed while off the board track dropped to about 26 m.p.h., showing the impossibility of maintaining a high average over the open roads.

As a service test of the car, the King company makes the point that this shows

actual performance as well as it possibly can be shown in a test because the distance covered by the car is equal to about 2 years of normal driving and the speed is not very far in excess of that often demanded by the car owner. The King car which made the test was certified by the King company and by A. A. A. officials to be a strictly stock job throughout, even including the details of equipment. This is a Model E car with an eight-cylinder, 3 by 5-in. motor, having an S. A. E. rating of 28.8 hp. and a piston displacement of 282.7 cu. in. The motor is a product of the King plant and follows conventional eight-cylinder practice with the cylinders cast in blocks of four at 45 deg. The valves are on the inside of the V and are operated from a chain-driven camshaft. Cooling circulation is by thermo-syphon, lubrication is by pressure and ignition by single Atwater Kent battery system.

Gasoline is fed by the Carter system to a Ball carbureter. Starting and lighting is by Ward Leonard. The drive is taken through a plate clutch through a three-speed unit plant gearset through a floating American rear axle. The gear ratio used on the test car was a standard 4.25 to 1 and the tires 35 by 4 Firestone plain tread front and non-skid rear. The only fitting on the car which does not coincide with stock practice was an additional speedometer which was installed as a double check on distance. The official distance readings, however, were not taken from the speedometer but measured by the laps made on the speedway. While on the road during Saturday, June 24, while the speedway was occupied by the New York police in their field games, the distance was taken from the speedometers corrected by a coefficient determined from a comparison of the readings and the known distance traveled on the 2-mile track.

Total Stops 160

During the course of the run the car made 160 stops. On 69 of these changes of either driver or mechanic were made. Besides stops for supplies and changes of drivers the other causes for stops were as follows: Testing electrolyte of battery on several occasions, replacing bulbs, oiling universals, oiling speedometer drive, tightening grease cups, tightening fan belt, cleaning gas line, taping leak in gas pipe, tire changes, renewing motor oil, splicing horn wire terminal, steering gear adjustment, and at important distances, such as 10,000 miles, the car was stopped for photographs. Throughout the run no adjustments or mechanical work was done that could not be accomplished by the ordinary owner, this being one of the objects of the test. The weather conditions were very severe during many parts of the run, in one instance the fog being so thick that the driver could hardly stay on the track and m.p.h. There were several thunder storms during the course of the run, three or four of which amounted to practically cloudbursts and also two or three days of steady, misty rain. About half the time the weather was bright and fair.

One of the features of the run was the oil economy. The car averaged 1172.7 miles to a gallon of oil, in spite of the speed, which was considerably in excess of average driving, with the added factor that the motor did not stop running for an instant after the test was started.

Specifications of the King Model E Car

Price—$1,350.
Body—7 pass.
Color—
Make of engine—King.
No. of cylinders—8
Shape—V.
How cast—4.
Bore—3.005.
Stroke—5.00.
S.A.E. hp.—28.8.
Ignition—Atwater Kent.
Carbureter—Ball.
Gasoline feed—Carter.
Lighting system—Ward Leonard.
Clutch—Plate.
Gearset—Selective three-speed.
Wheelbase—120 in.
Tires—34 x 4.
Wheels—wood.
Speedometer—Stewart.
Make of axle—American.

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Jordan Starts Manufacturing

CLEVELAND, OHIO, July 3—The new plant of the Jordan Motor Car Co., 1054 East 152d Street, has begun production of cars for the trade. The specifications of the new car include the following: Six-cylinder Continental motor; Timken bearings and axles; Bijur starting and lighting system; Stromberg carbureter; Bosch ignition; Brown-Lipe transmission and clutch; Parrish frame; Willard storage battery Stewart-Warner equipment; Gemmer steering gear and Firestone tires.

Repair Plant for U. S. Army Trucks

7000 Machines to Be Kept in Proper Condition at Fort Bliss

EL PASO, TEX., July 1—Seven thousand trucks belonging to the United States Government will be taken care of in an immense repair shop located at Fort Bliss, if the plans of the United States Army are carried through.

There are now, or will be within the next few days, a total of 1050 trucks and about 125 touring cars and roadsters in army service along the border. Repairs at present are made at the camp at Columbus or in private plants.

Two thousand trucks and their tenders were asked for early in the week for immediate delivery. Another lot of 4000 was ordered last Thursday.

There will be fifty-two big lathes in the shops at Fort Bliss. Mechanics will be paid approximately $100 a month, but will be required to enlist in the regular army for a period of 1 year.

The contract for gasoline held by the U. S. Government has expired. It called for the delivery of gasoline along the border at 10 cents a gal.

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Chevrolet Purchases Warner Plant

TOLEDO, OHIO, June 29—The Chevrolet Motor Co. has purchased the plant of the Warner Mfg. Co. on Central Avenue, and will open it, about July 15 as a factory branch.

Artemus Ward, Jr., president of the King Motor Car Co., congratulating driver Grindell at the end of the 1000 miles. Left to Right—C. Jacobs of King experimental department in charge of test, drivers Benson, Cork and Grindell, Artemus Ward, Jr., H. C. Bradfield, advertising manager, T. P. Chase, chief engineer, and G. J. Bates, commercial manager

National Gas Engine Assn. Members Advocate Affiliation with S. A.E.

Chicago Meeting Discusses Advantages of Close Co-operation With Other Engineering Bodies—Many Papers—Views on Kerosene and Tractors

CHICAGO, ILL., June 29—To-day the convention of the National Gas Engine Association came to an end after 3 days in session at the Sherman Hotel. Affiliation with the Society of Automobile Engineers was broached informally at the business meeting yesterday, while John T. R. Bell, engineering representative of the Norma Co. of America, and who is a member of both societies, in the informal discussion, pointed out that the standards committee of the Gas Engine association has been working in very close touch with the standards committee of the S. A. E. and has adopted wherever possible the standards already in force among the automobile manufacturers, and also that two other associations in allied industries, the marine engineers and the aeronautic engineers, have asked to become affiliated with the Society of Automobile Engineers.

Inasmuch as complete plans for the co-operation of these societies have not been worked out as yet it was decided to defer action for the time being. Comment in general was favorable.

The standards committee adopted standard specifications for a number of features of gas engines, and it was notable that recommendations were, in so far as possible, to follow the present standards of the Society of Automobile Engineers. The association formally adopted a standard guarantee for gas engines warranting them to be free from defects in materials and guaranteeing replacement of parts proving defective in material for a period of 1 year. This does not include ignition or other accessories guaranteed by the makers.

At the election of officers the president, secretary and treasurer were re-elected, as were most of the vice-presidents and executive committee. C. E. Bement of the Novo Engine Co., Lansing, Mich., is president, R. H. Brate is secretary, and Otto M. Knoblock treasurer.

Many Tractor Papers

There were a number of papers and discussions on tractors, and another series on various ramifications of the fuel problem. Other papers of interest, from the manufacturing standpoint, included scientific management of factories, uniform methods of figuring costs, ignition selections, reducing shop cost, and an address by Dr. Frank R. Rutter, assistant chief of the Bureau of Foreign and Domestic Commerce, on the internal combustion engine in foreign trade.

That the former low price of gasoline is a thing of the past, is the belief of E. E. Grant, secretary of the Independent Oil Men's Assn. of Chicago, who in an address entitled the Fuel Problem as it Pertains to the Internal Combustion Engine discussed the present factors which have caused the rise in the price of gasoline and the probabilities of the future. He stated that it was his belief the average price of the future would be from 15 to 25 cents, and did not anticipate that the cost to the consumer would be very much less than 15 cents or very much higher than 25, at least for several years. He confirmed the general impression among gasoline users that the demand for motor fuel has become enormous and that quite frequently the quantity of fuel is increased by adulteration. He made a plea for co-operation between oil men and engine makers and proposed an association of gas engine, automobile, marine and aviation engineers, together with the oil men—experts who could work together for the solution of a proper fuel.

Crude Oil Increase 700 per Cent

He brought out the point that during the last 2 years the increase in the price of crude oil has been 700 per cent and in addition to that it often was necessary to pay premiums over the market price. He figured that the consumption of gasoline for 1916 would be 1,934,000,000 gal., but stated that much progress in increasing the yield had been made within the past year, and that at present 2 per cent of the gasoline is made from natural gas. The gasoline from this source has a low boiling point of 65 to 85 deg. Fahr. and a high boiling point of 300 deg. Fahr. He mentioned the fact that a process of pressure distillation for increasing the yield from crude was patented by a Dr. Parker as early as 1907, this antedating both the Rittman and the Burton process patent. He emphasized the need of the development of engines to use low-grade distillates, and stated that when the troubles with Mexico are over that country will be able to supply sufficient crude oil for the entire world. This, however, is not rich in gasoline. Seventy-five per cent of the oil industry in Mexico at the present time is owned and controlled by American capital. Mr. Hall also confirmed the general impression as to the decrease in gravity of motor fuel during the past 2 years. He stated that not long ago gasoline of 76 deg. Beaumé was common. Now it is not over 58 deg. and sometimes as low as 50. Within the next 2 years it will be somewhat below 50 deg. Beaumé. He said that gasoline users are gradually coming to kerosene and that before long we may expect to be using kerosene. He believes that within 5 years engines will be so designed and the distillation process so refined that of the crude oil 75 per cent will be used as fuel and the remaining 25 per cent as lubricant.

In the discussion of E. W. Roberts's paper on liquid fuels present and future, the fact was brought out that in England there has been considerable experimenting with the use of pulverized coal, and in Germany with naphthalene, no one, however, recalled the fiasco of a few years ago with Zoline, which was supposed to be chiefly naphthalene and water. The statement was made that it would not be surprising in a few years to see gas engines using coal as fuel. In confirming this Mr. Knowles stated that his company has been experimenting with coal in solution in water, that it could be pulverized so fine that it partakes of the nature of deflocculated graphite and can be atomized and ejected into a burner just the same as fuel oil, and that subtracting the heat necessary to dispose of the water there would be left 13,000 B.t.u. per lb. from the coal. The chief difficulty with its use in internal combustion engines would be the ashes.

In a paper dealing with tractor engines, W. J. McVicker anticipates a return to favor of steam. "The gas tractor created so much interest that the steam tractor was left in its undeveloped condition and we do not yet know its possibilities. It will not be at all surprising to see a revival in the development of the steam tractor, and it may even become a strong rival of the gas tractor. However, this will depend somewhat on the nature of other fuels available in the near future."

Maxims of Engine Design

The author discussed different types of engines which had been and are being applied to tractors and set forth the advantages and the disadvantages that had been encountered in each, concluding with a statement that a successful tractor engine must have the following qualifications regardless of its type:

1—It must be so constructed that it can develop its maximum power continuously without self-destruction. The element of limited overload must be eliminated because it cannot be controlled.

2—It must start and operate without undue loss of time and must do a season's work with ordinary care and without the services of an expert. Instructions that the user must spend considerable time each day in doing expert work in order to keep it going must be discarded from the instruction books, because time is too valuable during that

period and such advice will be ignored.

3—It must develop its rated power economically and operate successfully with the kinds of fuel common in the locality where it is used.

Possibilities in Small Tractor

In a paper on the modern gas tractor W. A. Horthy stated that the present-day machines are in a state of evolution and a long way from perfection. He considers that purely as a manufacturing proposition, the small tractor with its initial low cost, great flexibility and present-day popularity, seemingly offers the greatest possibilities. No progress in the development of four-wheeled tractors is being made in this country, although much experimenting is done abroad with good success. It seems as if the high price and unusual construction do not sufficiently balance the guaranteed advantages over two-wheel-drive tractors. Regarding kerosene Mr. Horthy holds very strong views which may be summed up as follows:

A few years ago the market was flooded with kerosene attachments. Their disappearance warrants the truth of the assertion that to have a kerosene-burning tractor means a whole lot more than to equip the engine with a special carbureter. There is but one way to burn low grade fuels perfectly in internal-combustion engines, that is the Diesel way. This principle of fuel injection into the highly compressed air of the combustion chamber—this rational burning, not exploding, at 500 to 600 lb. pressure, gives some startling demonstrations of economy and reliability.

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Hatfield Roadster at $875

SIDNEY, N. Y., June 30—The Cortland Cart & Carriage Co., this city, maker of the Hatfield roadster, suburban car, light delivery and light express cars, and which recently increased its capital from $75,000 to $225,000 to take care of a more active production of its products, is now making distribution of its cars within a comparatively small radius of this city. The company states that it will not build more than a few hundred cars for the next year or so.

The models are equipped with a four-cylinder L-head block engine developing 32 hp., the bore being 3¾ in. and the stroke 4¼. Other features include thermo-syphon cooling; selective sliding gear transmission with three speeds forward; disk clutch positively coupled to transmission; constant level splash lubrication; Connecticut ignition; Stromberg carbureter; Hotchkiss drive with two universal joints; semi-elliptic springs in front and full cantilever, floating in rear; Disco starter; and full floating rear axle.

The model H, three-passenger roadster sells for $875, the suburban car for $800, the light delivery for $820.

2400 Cars and Trucks for U. S.

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Bids Received for Motor Equipment Estimated To Be Worth $15,400,000

WASHINGTON, D. C., July 3—Bids have been received by the Quartermaster's Department for supplying the Government with 2000 trucks, half of 1½-ton capacity and half of 3-ton size. Simultaneously bids have been made for supplying 400 cars in touring and roadster bodies intended for dispatch carrying and for moving officers rapidly from point to point. The truck order is estimated to be worth about $15,000,000 and the order for touring cars about $400,000.

Naturally the Ford Motor Co. has made the lowest bid for the touring cars, offering them at $440 each, f.o.b. Detroit, and undertaking to complete delivery within 1 week from receipt of order. Another offer is of 400 Elkharts at $975 each, the company stating that it has a large stock on hand. The Colt-Stratton Co. offers 400 Dodge cars at $785, guaranteeing shipment to be started 1 day after receipt of order and completed within 4 days, thus beating the Ford delivery offer by 2 days.

Willys-Overland offers its six-cylinder model for $973.25 or the Willys-Knight at $956.25. Packard offers the standard seven-passenger touring car for $2,475, and has a hundred for immediate delivery.

Maxwell offers forty cars per day at $500 each, f.o.b. New York, or $475 each, f.o.b. Detroit. Other bidders include Reo, King, Velie, Hupmobile and Studebaker, some of these bids being made direct and some through dealers.

Big Truck Orders

On the truck order there have naturally been a very large number of bids, since it is impossible for any one firm to hope to execute the whole order. It is obvious that if this quantity was required hurriedly it would be necessary to buy in tens and twenties from almost every maker. One of the bidders offering the most rapid delivery is the Four Wheel Drive Auto Co., offering fifty-six 3-ton chassis by the end of August and stating that it can speed up at the rate of 224 per month.

The Chicago Pneumatic Tool Co. has 100 trucks of 1½-ton capacity for immediate delivery and can produce 150 per month. White offers two trucks per week, the Locomobile five trucks in 28 days and thirty in the following 3 weeks. Pierce-Arrow offers 700 2-ton chassis, 300 to be delivered by Jan. 1, 400 by April 1 and ten per day thereafter. Packard bid for thirty-three 1½-ton in 2 days after Aug. 1, the subsequent deliveries at the rate of thirty-three each 30 days and also for a certain number of 3-ton trucks. Jeffery has a 1½-ton bid, delivery at the rate of seven per day. Most of the other bids are for small quantities and far too numerous to mention. It is noteworthy that the specifications for the trucks were finally drawn up after consultation with a committee brought together by the Society of Automobile Engineers, including prominent engineers. Several meetings attended by government representatives were held at the S. A. E. office and the specifications as drafted originally were modified in some respects so as to enable greater output in a short time.

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Homer Laughlin Builds 8-Cylinder Front-Drive Car

LOS ANGELES, CAL., June 28—The Homer Laughlin Engineers Corp. of this city has completed three of the new Homer Laughlin eight-cylinder front-drive cars and the factory is now turning out ten machines on order.

The new Los Angeles built car has been more than 2 years in the rough and now that the factory officials are sure of their product, active car building is to follow. The car weighs less than 1700 lb. and sells for $1,050. The builders have taken over the large factory on Long Beach Avenue, formerly occupied by the McCann Mechanical Works and are building every part of the car with the exception of the electrical equipment, wire wheels and tires.

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Fostoria Raises Prices

FOSTORIA, OHIO, July 3—The Fostoria Light Car Co., this city, has raised the price of its 1917 touring car to $735; the delivery wagon with an open body to $695 and with a closed body to $715. The width of the rear seat has been increased from 39 to 46 in. and the front seat from 37 to 42 in. The car has a floating rear axle, Remy ignition with distributer and automatic sparker. The car is now equipped with a natural wood cowl dash upon which are located all of the instruments.

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Pathfinder Starts High-Gear Run

SAN DIEGO, CAL., July 4—*Special Telegram*—Twenty thousand people witnessed the start of the Pathfinder twelve on its high-gear run across the continent today. The start was delayed an hour by reason of officials not being able to check specifications and place seals on the car by 12 o'clock. At 12.30 the crowd around the car in the Plaza de Panama was so dense that police and exposition guards were necessary to clear a passageway.

Simple Tests Show Car Condition

How Acceleration, Speed and Fuel Economy Are Inter-connected—Power and Gear Ratio Relations Analyzed and Explained—Aids for Owners

By Charles E. Manierre

BEGINNING with the issue of April 17, 1913, THE AUTOMOBILE contained a series of four exceedingly interesting articles by Prof. W. C. Marshall on Detecting Resistance and Saving Fuel.

The experiments mentioned by him were made through the use of an English invention known as the Accelerometer. This instrument is about the size of a rather small alarm clock and is laid face up on some surface or bracket on the car where its needle indications can be read conveniently. It contains a levelling screw, but needs only to be strapped in position and is in no other way connected with the car. Its needle indicates on a scale three things only, viz., grade, resistance in pounds per ton, and acceleration in feet per second.

Two things have prevented this instrument from coming into general use, viz., its price, $52.50, and the knowledge of mathematics and physics which seemed to be necessary to its successful understanding.

Professor Marshall, in order not to take up too much space in THE AUTOMOBILE, condensed his articles so that every sentence was concentrated. It must have proved difficult reading except by those to whom acceleration in feet per second per second, resistance, momentum, gravity constants, torque curves and horsepower formulae were a daily diet. Nevertheless his article contained much of vital interest to every car owner and it is by no means necessary to own or use the instrument mentioned to get valuable results from the line of thought he followed.

For the practical man who wants neither exact mathematics nor science and who will never be on speaking terms with a torque curve, the study of Professor Marshall's article suggests two simple tests of the condition of one's car and engine.

Testing for Friction

Every car owner has at times the knowledge that his car is in fine condition and is running its full number of miles per gallon of gasoline. When this is so, let him pick out a convenient spot on the road near his home, bring his car to a definite speed and at a definite point on the road throw out his clutch and coast to a standstill and note the point where the car stops. Thereafter, whenever he wishes to test the friction of his machine from the gearbox to the rear wheels, and the rolling resistance, he can repeat the experiment at the same place and speed and can tell whether all is well, namely, whether he coasts as far. But he must remember that the passenger load, etc., must be the same and the tires must be pumped to a reasonable pressure.

The second experiment is for the engine, and is to be first made when the engine and car are running in extra good condition. It consists in selecting a hill not too steep to be ascended on high gear at, say, about 20 m.p.h. The test consists simply in determining with the throttle wide open what is the exact maximum speed of the car on the hill. Later on when it is desired to test the running of the engine it will first be necessary to try the coasting test; and be sure that some such evil as dragging brakes is not causing trouble. If the coasting test proves satisfactory, then diminished speed on the hill will reveal the need of attention to the engine, which is not delivering its proper horsepower. Of course the diminished mileage per gallon of gasoline will tell the same story, but it will not indicate, as the above tests will, whether the trouble lies in front of or behind the flywheel.

In the hill test, as in the other, the weight carried by the car must be the same as in the original experiment.

An Ability Diagram

Even though one has no intention of putting his engine through a series of exact tests, it is worth while to have knowledge of the subjects of grade, resistance and acceleration, and to have an intelligent comprehension of the facts which are revealed by a diagram showing curves of resistance, torque on several gears and grade. In fact such a diagram for a given car shows very completely its ability. It gives much more information than a mere horsepower curve.

No doubt manufacturers would be only too glad to display such a diagram as showing what might be expected of their respective cars if any considerable part of the public were prepared to appreciate the facts to be gleaned therefrom. In such case of course the diagram should indicate the performance of the car with its normal passenger load. The vertical lines on such a diagram would indicate speed in miles per hour, while the cross lines, beginning at zero at the bottom, would indicate resistance in pounds per ton of 2000 lb.

The first and most important curve would be a coasting resistance curve, starting at zero pounds and zero miles per hour, and sweeping upward to a rapidly increasing rate of pounds of resistance as the speed became great.

This resistance is exactly what would be shown if the car were drawn along by means of a spring balance and the pounds indicated on the balance were divided by the number of tons weight of the car, it being understood that the clutch of the car was depressed.

The resistance so indicated does not include any friction in the engine, as the clutch is depressed, but it does include the friction in the gearbox and the jack shaft, the friction of the universals, the rear pinion and the large pinion of the differential, the wheel bearings and the resistance to rolling of the rubber tires, and finally the resistance of the air. It assumes a hard, smooth road, no grade and no wind.

Air Resistance and Speed

One rapidly increasing factor as speed increases is that of air resistance. It is a necessary part of the coasting resistance and there is no need to give special attention to it except perhaps to say that it is estimated that the average touring car presents a surface of about 12 sq. ft. to the air

through which it travels, and that the air resistance increases as the cube of the speed.

Stated in terms of horsepower, it may be said that at 15 m.p.h. it is almost negligible. At 40 m.p.h. it consumes about 10 hp. and at 50 m.p.h., 21 hp. and soon thereafter has so increased as to consume practically the whole horsepower of the car.

To illustrate how much of resistance the air may offer, it may be sufficient to refer to the nightly meteors, most of which become so heated in the very rare upper atmosphere of the earth as to be entirely consumed in their passage through it.

By reference to Fig. 1, which is reprinted from the article by Professor Marshall, the coasting resistance will be noted as the lowest curve. It would have been possible to include in the diagram below this a curve of resistance due to the air, and also a curve which might be deemed the theoretical curve of resistance, being a curve toward which it would be the ideal of manufacturers to bring their product.

Referring again to the illustration, it will be noted that certain grade curves are drawn which in each case are exactly parallel to the coasting resistance curve and correspond to increased resistance in pounds at the rate of 20 lb. for each 1 per cent of grade. This means that that number of pounds is added to the coasting resistance on the level when the car is required to mount the given grade.

The four torque curves are drawn to show, for each gear setting, the number of pounds of resistance per ton which the engine is capable of overcoming at the several speeds indicated on the diagram.

For example, in high gear, which on the diagram is denoted fourth speed torque at 15 m.p.h., the capacity of the engine is about 230 lb. per ton. It will be seen that this is far more than sufficient to maintain a speed of 15 m.p.h. on the level and is considerably more than sufficient to enable the car to mount a 5-per-cent grade, but will not quite permit it to mount an 8-per-cent grade. At 20 and 25 m.p.h., the torque curve shows substantially the same ability in number of pounds per ton, which means, in view of the increased speed, actually considerably more engine power, but at the same time, by reference to the diagram, it will appear that a grade which at 15 m.p.h. could be climbed, cannot be climbed at 25 m.p.h. and in fact, at about 37 m.p.h. although there is little diminution in the capacity of the engine to overcome resistance in pounds, there is a crossing of the torque curve with the 5-per-cent grade curve, which shows that the utmost speed of the car on such a grade is 37 m.p.h.

If the diagram were continued ¼ in. farther to the right, to the crossing of the coasting curve with the torque curve, we would arrive at the point where the coasting resistance just equalled the ability of the engine to overcome resistance and the maximum speed of the car, about 55 m.p.h., would thus be indicated.

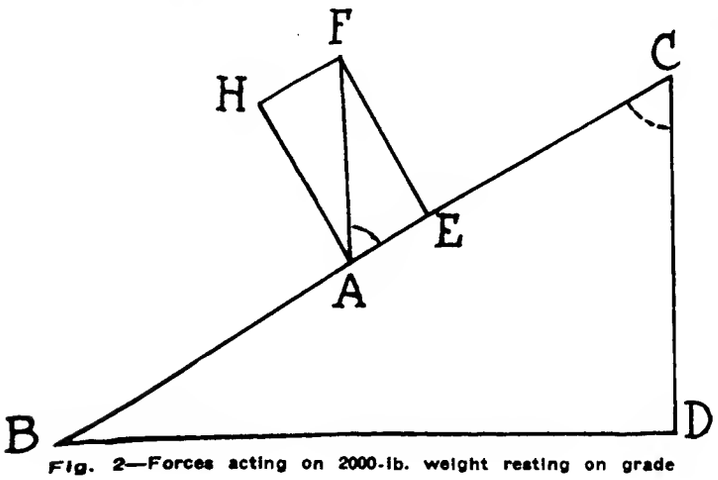


Fig. 2—Forces acting on 2000-lb. weight resting on grade

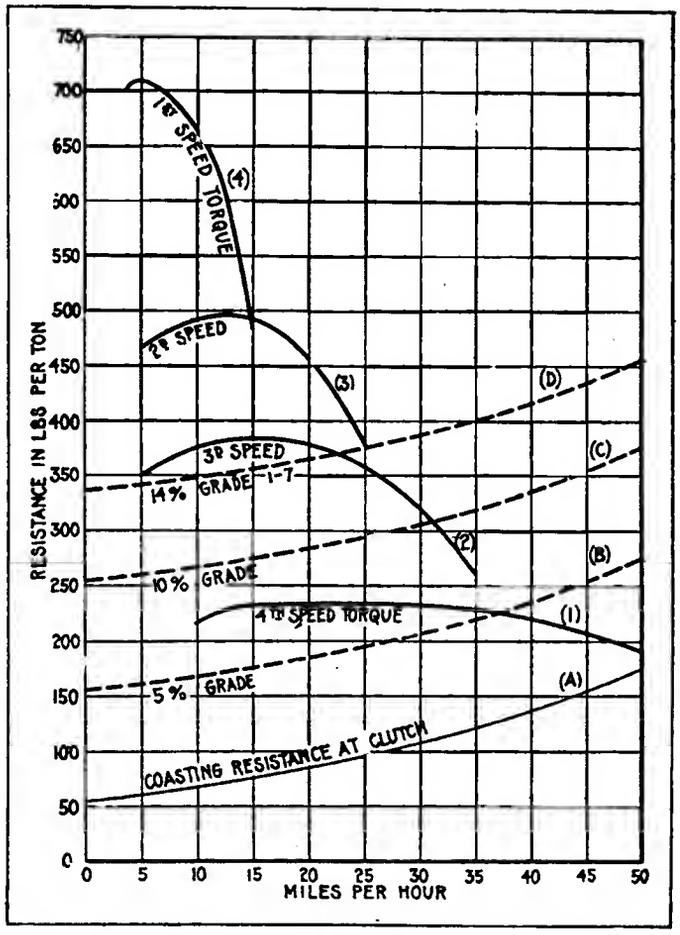


Fig. 1—Relationship of engine torque, gear ratio and grade climbing ability

For low gear, which on the diagram is spoken of as "first speed torque," the increased number of revolutions as compared with the speed of the car enables the engine to overcome a vastly increased number of pounds of resistance running up, at 5 m.p.h., to an excess of 700 lb., and indicating a capacity at that speed to ascend a grade of 35 per cent. As the speed of the car increases, however, the capacity of the engine, as measured by pounds of resistance, rapidly decreases, so that at 10 m.p.h. a 30-per-cent grade would be its greatest capacity and at 15 m.p.h. it would scarcely be able to mount a 20-per-cent grade.

In the second and third gears, the torque curves curve upward from 5 to 15 m.p.h. In other words, the capacity of the engine to overcome pounds of resistance actually increases as the speed increases.

Power and Speed

Of course the increased speed delivers more horsepower but it delivers so much more that the ability of the car to mount higher grades is increased. It is for this reason that on any given grade the car may be able to mount a grade provided it starts at a considerable speed, which grade it could not mount on that gear if starting at a lower speed.

The diagram also indicates that in each case there is a capacity, greater or less, to accelerate on the grade except at the point where the torque curve and the grade curve cross each other, which crossing marks the maximum speed for that car and gear.

While the rolling resistance and the wind resistance and the other items which make up the coasting resistance are more or less matters of experiment and uncertainty, the grade resistance is capable of being stated with mathematical exactness.

In Fig. 2, let the point A represent 2000 lb. of weight resting on the grade BC. Let CD be vertical, BD being the horizontal earth surface. Draw AF also vertical and of a convenient length to represent the 2000 lb. of weight acted upon by gravity. Then, on the theory of the parallelogram of forces, which in this case will be a rectangle, let HA be drawn at right angles to BC. AE will then represent in direction and length the amount of resistance necessary, friction not being considered, to prevent the motion of A down the grade, and HA in direction and length will be the pressure of A upon the grade surface. The two triangles FAE and BCD will be similar, by reason of the fact that each of them have a right angle and also one of their other angles equal, viz., the angle at C and the angle at A as indicated on the diagram.

We therefore have the proportion:

$$AE : CD :: AF : BC$$

$$\text{Therefore } AE \times BC = CD \times AF$$

$$AE = AF \times \frac{CD}{BC}$$

But AE equals the pounds of resistance per ton. AF equals 2000 lb., and $CD \div BC$ is the grade per cent. That is to say the weight of 2000 lb. multiplied by the percentage of grade gives the length of the line AE, or in other words, the resistance in pounds necessary to prevent motion down grade.

In passing it may be noted that the length of the line HA added to the line AE makes it evident that between them they account for much more than the 2000 lb. But the fact that $H - A$ is shorter than $A - F$ indicates that the body if in motion does not rest on the incline with its full weight of 2000 lb. This will be the more evident as the slope approaches the perpendicular, the weight on the slope reaching its vanishing point when the slope has become quite up and down.

Incidentally it may be remarked that a 2000-lb. ton lends itself very conveniently for grade calculations, which thereby run 20 lb. to each per cent of grade.

Grade Measured Up the Slope

It is also to be noticed that grade is not measured along the horizontal but up the slope. This is convenient for outdoor purposes but not quite so convenient in consulting contour maps although, for grades used in road work, the difference between the two measurements is comparatively slight.

Closely related to the resistance necessary to prevent motion down the grade is the acceleration which grade produces where the resistance is not met. The word "acceleration" has begun to appear quite frequently in car advertisements and is sometimes used rather vaguely. It is, however, evidently a word to which the public is expected to attach some meaning.

In this connection it will be necessary to recall certain physical facts, which are that, omitting air resistance which does not greatly affect the acceleration at low speed, it is approximately accurate to say that a body dropped from rest will have fallen at the end of 1 sec. 16 ft., but its acquired speed at the end of the next second will be at the rate of 32 ft. per second. This is called its acceleration. If it continues to fall and the air resistance is eliminated, its speed at the end of each successive second would be 32 ft. greater than at the end of the preceding second, while its actual travel will have been at a mean speed equal to the speed at the beginning of the period plus the speed at the end of the period, divided by two, viz.,

Speed at beginning of second period, 32 ft. per second
Speed at end of second period, *i.e.*
$32 + 32$ 64 ft. per second
$32 + 64 = 96 \div 2 = 48$, or mean speed and drop of second period.

The total drop for the 2 sec. would be the mean speed of the first second, viz., 16, plus the mean speed of the second second, viz., 48, a total of 64 ft.

At the end of the third second, the speed would be, as above indicated, *i.e.*

Speed at beginning of third period, 64 ft. per second
Speed at end of third period, *i.e.*
$64 + 32$ 96 ft. per second
$64 + 96 = 160 \div 2 = 80$, or mean speed and drop of third period.

The total drop for the three periods or seconds would be the total of the drop for the first 2 sec., 64 ft., plus the mean speed of the third second, 80 ft., a total drop of 144 ft. for the 3 sec.

If the number of seconds which the body falls is successive, 1, 2, 3, 4 and 5, the increased spaces during each interval will be as 1, 3, 5, 7, 9, respectively, and the total space passed through will be as the square of the number of seconds, viz., 1, 4, 9, 16, 25. If these spaces and the total distance are multipled by 16, the results will be the distances in feet.

The rule is equally true with regard to fractions of a second. If a body starts from rest, in a quarter of a second it will have a speed of 8 ft. per second with a mean speed of 4 ft. per second, and as the interval is but ¼ sec., its actual drop will have been 1 ft. At the end of ½ sec. it will have dropped 3 additional feet, and at the end of ¾ sec. 5 additional feet, and between ¾ sec. and the full second, 7 ft. to a total drop of 16 ft.

It is also a fact that eliminating the question of friction, a body descending a slope will at the foot of it have acquired the same speed as if it had dropped perpendicularly to the lower level. Of course it does not arrive at that point on the slope in the same number of seconds.

Referring again to Fig. 2, if $B - C$ is assumed to be a 5-per-cent grade, it will of course be twenty times longer than the perpendicular $C - D$. Assuming for convenience that $C - D$ is 16 ft. in length, then $B - C$ will be twenty times 16 ft. in length. As in the case of a falling body, the average speed of the body on the grade will be one-half of the acquired speed, and as we have assumed $C - D$ to equal 16 ft., the speed will be at the foot of the grade the rate of 32 ft. per second and the average speed at the rate of 16 ft. per second. In other words, it will have taken 20 sec. to have descended from C to B, and its total acceleration being 32 ft., its acceleration per second for each second of its journey will be 1.6 ft. In other words, the acceleration on the grade per second will be found by taking that percentage of 32 ft. which shall be the grade percentage.

Calculation Is Simple

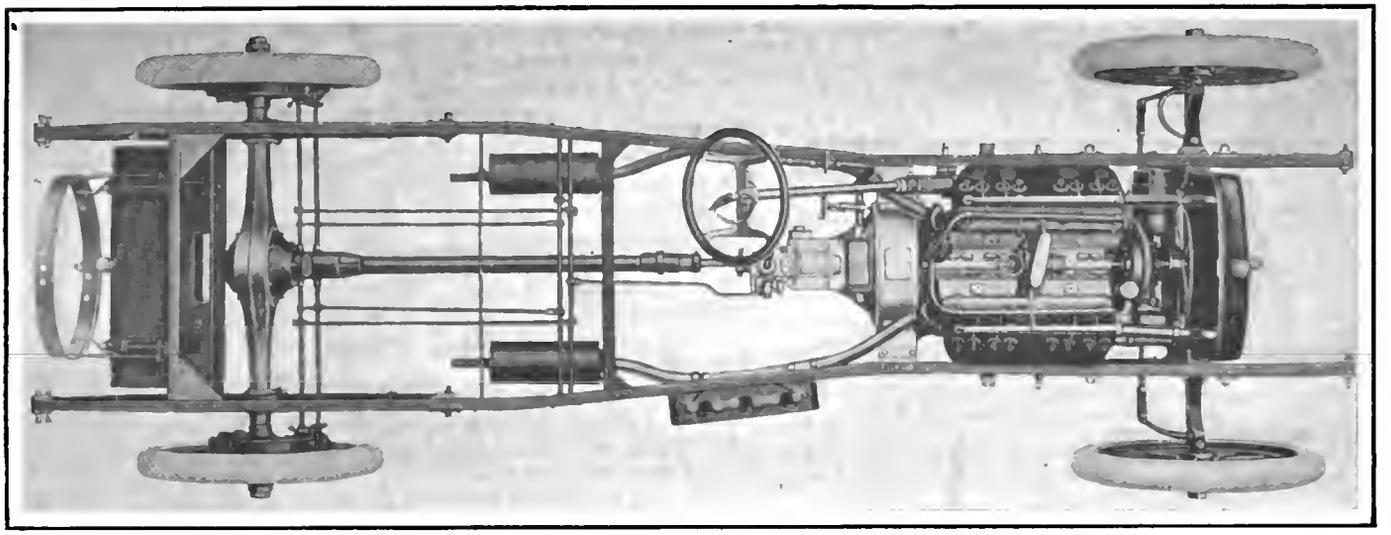
We have, therefore, three expressions relating to grade which are in a sense interchangeable, and any one of them being given, the other two can be calculated easily. If we multiply 32 by the grade percentage we get the acceleration in feet per second. If we multiply 2000 lb. of resistance by the grade per cent, we get the resistance per ton for that grade. And conversely, if we know the resistance per ton, dividing it by twenty will give us the grade per cent, expressed as a whole number instead of a decimal. (Dividing by 2000 will produce the decimal grade, 0.03, or 0.05, or 0.07, which is read 3 or 5 or 7 per cent as the case may be.) If on the other hand one has the figures 1.6 acceleration, dividing by 32 will give the grade per cent.

Or by multiplying by 62.5 the corresponding resistance in pounds per ton will be found. The whole operation in this case is the division of the acceleration by 32, which has the effect of producing the grade per cent, and multiplying that by 2000. The equation then stands:

$$R = \frac{1.6 \times 2000}{32}$$

Cancelling out the 32 against the 2000 produces the 62.5,

(*Continued on page* 17)



Plan view of the Ross eight chassis for 1917, which has a 130-in. wheelbase and uses 34 by 4 tires

Better Body Lines in Ross Eight

1917 Model Shows Practically No Mechanical Changes —Double Cowl a Feature—Chassis Is Strongly Built

FOR 1917, the Ross eight-cylinder car appears in a new dress that is in accord with latest body fashions in every particular. The vehicle is practically the same mechanically as it was when this model was first brought out by the Ross Automobile Co., Detroit, over a year ago, but there have been some important revisions of its lines that make it a very attractive car. However, the price remains unchanged at $1,350.

Equipped with a standard eight-cylinder Herschell-Spillman engine with dimensions of 3¼ by 5 in., it has ample power under all conditions, and, although it is a big car with a wheelbase of 130 in., it is lively and responds readily to the throttle. Ross has taken care of the suspension so that riding is in comfort whether the full quota of seven passengers is being carried or only one or two.

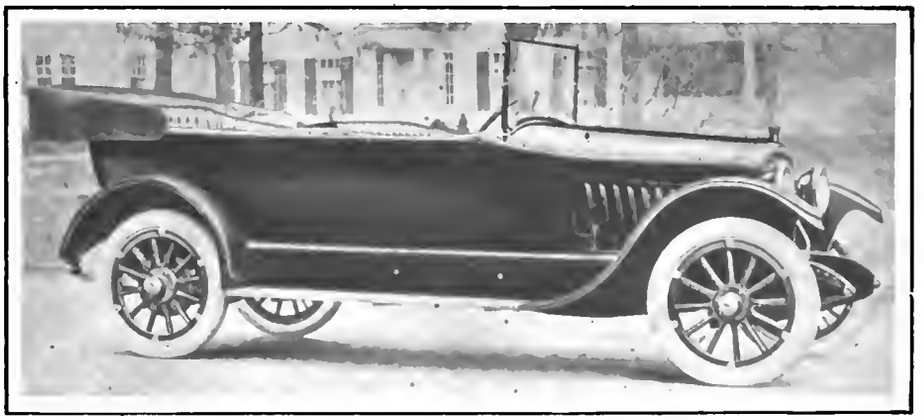
The modern double-cowl effect has been worked out at the back of the front seat, and the hood slopes into the cowl without a break, the radiator shell also sloping to the hood in a very pleasing manner. Doors are wide and fit snugly, and there is enough rake to the steering column to assist in giving the racy appearance so often sought by designers but sometimes not attained.

Stripped of its new body, the chassis presents a most substantial look, with a tapered frame of deep section, sturdy drive members and long and wide springs. In unit with the motor are the clutch and gearset, and the driveshaft is inclosed within an efficient torsion tube. The specifications include a multiple-disk clutch, floating rear axle, semi-elliptic springs all around, rear gasoline tank with Stewart vacuum feed, Zenith carbureter, Ward Leonard two-unit starting and lighting system and 34 by 4 tires.

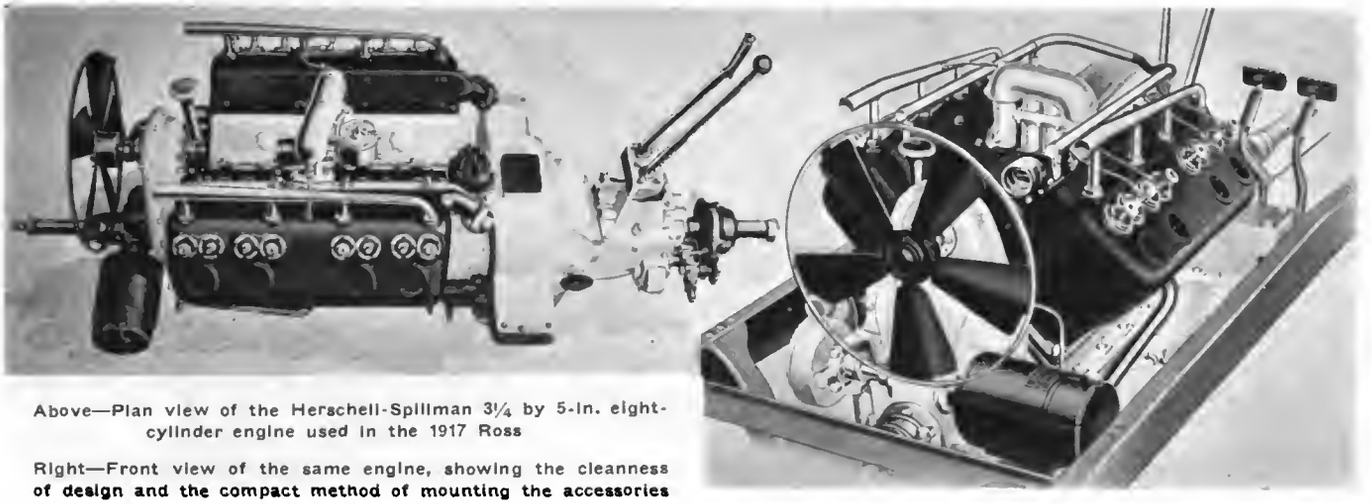
Turning to the most important unit, the engine, it is at once noted that no alteration has been made in the standard Herschell-Spillman design. The cylinder dimensions give a rated power of 33.84 hp., with a displacement of 331.8 cu. in., but the motor is capable of delivering upward of 75 hp. on the block, an evidence of the fact that there is plenty of power under the Ross hood to take care of the car under all conditions.

Inasmuch as this engine has been described on several occasions, it is not necessary to go into very great detail. The photographs indicate the general arrangement, with the two blocks of cylinders at 90 deg. and staggered to allow the two opposite connecting-rods to be mounted side-by-side on the common crank bearing. The valves are made reasonably accessible by the disposition of the parts that of necessity have to be in the V between the cylinder blocks, the carbureter being so mounted that it is little in the way, and the exhaust manifolds being well above the valve compartments. Although the ignition distributer is mounted vertically at the extreme rear of the cylinders, it is really not in the V, and so the carbureter is practically the only obstruction.

Conventional practice holds throughout the internal construction of the motor, there being a sturdy crankshaft, directly above which is mounted the single camshaft that actuates both sets of valves through rockers that are hinged to the top of the crankcase. At the front there is a cross shaft that is connected to the crankshaft by a worm gear and on



The Ross eight-cylinder seven-passenger touring car for 1917 which sells for $1,350



Above—Plan view of the Herschell-Spillman 3¼ by 5-in. eight-cylinder engine used in the 1917 Ross

Right—Front view of the same engine, showing the cleanness of design and the compact method of mounting the accessories

its right end this shaft drives the double water pump, while the left end connects to the generator armature. This cross shaft drive is inclosed by the same plate that houses the spiral gears, driving the camshaft and the fan shaft above this latter. Thus a very compact front end is obtained with not even an exposed fan drive. The drive of the vertical ignition distributer is through bevel connection with the camshaft at its rear end.

On the right rear side of the engine is carried the starting motor, this connecting automatically with the flywheel teeth by means of the Bendix drive unit, whereby, when the current is switched to the starting motor through the starter pedal, the rotating of the armature shaft automatically throws the pinion gear into mesh with the flywheel. After the engine picks up and rotates faster than the armature shaft, the pinion is again automatically thrown out of mesh.

No Exposed Mechanism

As the flywheel is inclosed, there is practically no exposed operating mechanism in this power plant, a feature that is commendable from a mechanical and maintenance standpoint, although it adds slightly to the weight.

Lubrication is given special attention, as it is an important part of the proper operation of an eight. There is no splash to it; distribution to the various bearing surfaces is entirely by pressure maintained by a regulating valve between a minimum of 10 lb. per sq. in. and a maximum of 40 lb. per sq. in. The gear pump is located in the crankcase well on the bottom of a vertical shaft which takes its drive through spiral gear connection with the camshaft. Oil is delivered through a longitudinal tunnel running the length of the crankcase, and from this by individual branches to the three main bearings of the crankshaft and the three camshaft bearings. The crank webs are drilled, and the oil is thus led by centrifugal force to the lower rod bearings, from which it is piped through steel tubes to the wristpin bearings, these tubes attached to the rods. An overflow valve allows the excess over the requirements of these bearing surfaces to be delivered to the front gears, keeping the gear assembly submerged well above the cross shaft.

Ross is using the Borg & Beck clutch, which is the type in which there is only one plate, this running dry between two wire-woven asbestos plates, and by a series of levers the force holding the plate in engagement is stepped up to a very large amount without the use of an extraordinarily heavy spring. A 200-lb. spring is sufficient to produce a pressure of 2500 lb. at the point of plate engagement, due to the construction. This therefore prevents any clutch slippage, and at the same time the unit is easy to operate, requiring only a light pressure on the clutch pedal to disengage it. In connection with the clutch mechanism, the pedal is adjustable for position, due to the use of a flange drilled with several holes and attaching to a flange on the pedal in a number of different positions wherever any set of holes in the two flanges will register.

A Grant-Lees gearset is also incorporated with the engine, this being a very compact unit affording the usual three speeds and reverse. The gears and shafts in this unit are constructed of chrome-nickel steel, and the gears have wide faces with stubby teeth for strength. Just back of the gearcase is the speedometer drive gearing, and then a universal joint, after which the propeller shaft enters a torsion tube that is in unit with the rear axle. The front end of the tube is supported in and slides in an arm that hinges to the bottom of the gearbox.

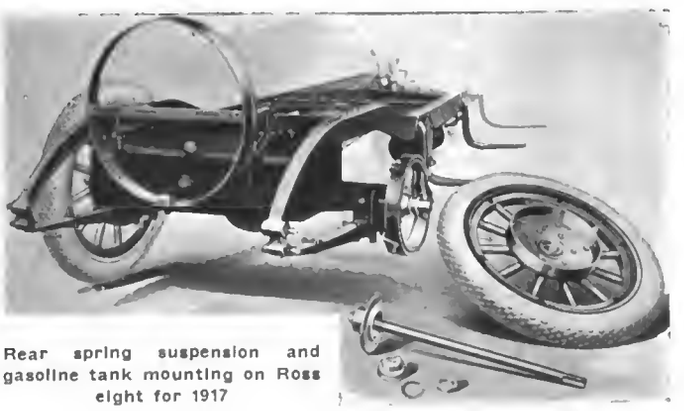
Rear Springs Slung Under Axle

Both axles are manufactured by the American Gear Co., and follow standard lines. The rear unit has a pressed-steel housing that is webbed outside at top and bottom as a strengthening factor, and the springs are underslung from it. The gear ratio is slightly lower than 4 to 1 in order to give the engine plenty of consideration. This ratio is such that the car affords excellent accelerative possibilities.

Now quite familiar is the semi-elliptic form of spring suspension at the rear. In the Ross adaptation, the springs have a length of 57 in., and due to the generous bend down of the rear of the frame, they are normally nearly flat, even though they do pass below the axle. This allows them to work efficiently to dampen road shacks and to promote easy riding as well as being better for them.

Hung from the rear cross member of the frame is a large gasoline tank, so positioned that it is practically balanced on its mounting, preventing any bending strains being set up.

Nothing has been forgotten in the equipment of the new Ross, the list of articles including a motor-driven horn, one-man top, Stewart speedometer, ammeter, demountable rims and the usual complement of tools.



Rear spring suspension and gasoline tank mounting on Ross eight for 1917

Motor Trucks Aid Army in Mexico

First Official Photographs Taken Below Border of Motor Truck Equipment of Punitive Expedition in Action on Villa Pursuit

Photographs by Underwood & Underwood

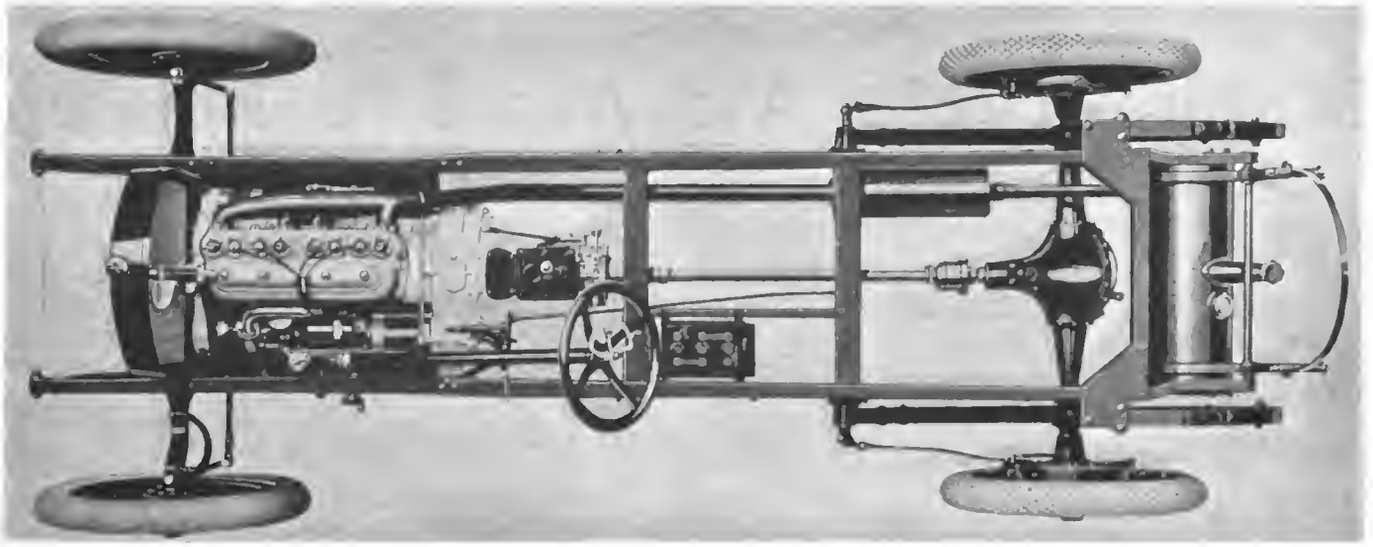
1—*Section of White trucks with the Pershing expeditionary forces arriving at Boca Grande, Mexico.*

2—*Armored car which Cap. Wm. H. Forrest, of the Eighth Machine Gun Company, Massachusetts National Guard, is driving across the continent in a preparedness campaign.*

3—*Motor trucks with troops and rations bound for San Antonio, Mexican base of the expeditionary forces in pursuit of Villa. This photograph was taken near Nanaqnipa, Mexico.*

4—*Packard army trucks making good time on a road through the low sand dunes of northern Mexico.*

5—*An excellent view of the latest Mack armored car built for the New York National Guard.*



Chassis of the Jeffery Roll-Edge Four for 1917, showing the mounting of the 3¾ by 5¼ block engine, three-speed selective gearset, etc. It is stated that 93 per cent of the parts used in this car are manufactured in the Jeffery plant

New Body Feature of Jeffery Four

No Chassis Changes in 1917 Model Which Is Called Roll-Edge Four—Price $95 Higher—Body Lines Unbroken from Front to Rear — New Cellular Radiator Used

FOR 1917 the Jeffery four is continued with no changes in the chassis, a price increase of $95, the new car selling for $1,095, and a new body which gives the car the trade name of the Roll-Edge Four. A new cellular radiator is the only other change.

Body Lines Unbroken

The roll-edge four comes upon the demand of Jeffery dealers who have been insistent since the six was announced last January with a roll-edge body, that the four be furnished them in the same style, according to the announcement of the factory.

A particularly noteworthy feature of this new Jeffery body is its unbroken lines from the radiator to the rear seat and between fenders. The roll edge on the top of the body blends into the hood without any break whatever from the straight line effect, making the car look exceptionally long and clean. The divided front seat feature which was a part of the 1916 body design is continued without change.

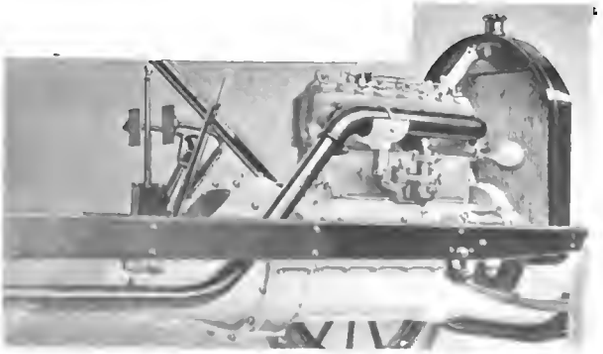
93 per Cent of Car Jeffery-Built

The new four has a 3¾ by 5¼ in. block engine, disk clutch, three-speed gearset, and semi-floating axle. The wheelbase is 116 in. and the tires are 34 by 4. Practically every part of the car is Jeffery built, in fact the manufacturers state that 93 per cent of the machine is constructed in the Jeffery factories.

Comfort an Important Consideration

The new bodies are finished in Savoy green with a fine gold stripe, fenders and running gear black, and the wheels green with a gold line. Upholstery is in black leather with deep double-deck springs. Auxiliary seats which disappear in the back of the front seats are standard equipment on all models. Inasmuch as the rear seat is 48½ in. wide the car provides for seven passengers very comfortably.

Side view of the Jeffery Roll-Edge Four for 1917, showing the unbroken body lines and the feature which gives the car its name. Wheelbase is 116 in. and tires are 34 by 4. The car sells for $1,095 with complete equipment



Three-quarters rear view of the four-cylinder, 3¾ by 5¼-in. block engine used in the new Jeffery Roll-Edge Four, showing the control levers mounted directly on the gearbox. Note the rake of the steering column

Rate Tractors by Drawbar

Present Horsepower Rating Misleading to Farmers—Rating Should be U. S. Standard

By Raymond Olney*

ONE of the greatest needs in one of the greatest fields in agricultural engineering is that of a standard basis for rating farm tractors.

The present method, which any engineer must admit is unsuited to the purpose, is to rate the drawbar capacity of a tractor at about one-half the brake or belt-power rating of the engine. This is a relic of the early days of the gas tractor industry. But worse than that, it gives the farm buyer no definite idea as to the actual pulling capacity of a tractor. Such a method is not only unsatisfactory; it is misleading.

The engine rating should be in terms of horsepower; I believe all engineers are agreed on that point. But the drawbar rating is another matter.

The term "horsepower" is one that is easily misunderstood by the average farmer, especially so when it is applied to drawbar power. His knowledge of mechanics being limited, he ordinarily thinks of a tractor rated at so many drawbar horsepower as the equal in pulling ability of that number of horses, which, of course, is not true.

In his experiments on the draft of horses, F. H. King found that about the maximum walking draft of a horse is one-half its own weight; and pulling with this intensity at a speed of 2½ m.p.h., the power developed by a 1200-lb. horse would be 4 mechanical horsepower. For steady and continuous work 10 hr. a day, at the same speed, it is commonly allowed that the horse should not be called upon to pull more than one-tenth his own weight; at this rate a 1200-lb. horse would develop 4/5 hp. The average farm horse, particularly for heavy work, will not travel as fast as 2½ m.p.h., and will probably develop at the slower speed an average of not more than 2/3 hp.

Why Rating Is Misleading

Assuming a 25 per cent overload, your tractor capable of 12 drawbar horsepower will develop 15 hp. as its maximum load. On the basis of a maximum walking draft, as recorded by King, a four-horse team will also develop 15 hp., but only for short distances, of course. Now if a farmer gets a 12-hp. tractor into a tight place and finds that it will then pull no more than a four-horse team, he is quite apt to wonder what is wrong, and the cause of his wonder is the confusion resulting from our method of rating.

This is not the most important reason, however, why the rating should not be given in terms of horsepower.

Suppose the man who wants a tractor visits one of our public power-farming demonstrations, where he sees machines of nearly every make and size demonstrating their ability to pull plows. Here we will say he finds three different tractors, each pulling a gang of four plows, which we will assume is the normal full-load capacity of each. One may be rated at 12 hp., another at 15 hp., and another at 18 hp., but each pulling the same number of bottoms. This is no puzzle to the engineer, but it is to the farmer; it is decidedly confusing to him, because he is not familiar with the relation of speed to power.

Again he may see two tractors plowing within a few yards of each other, each with a drawbar rating of 12 hp., but one pulling three plows and the other four. In this case, as in the former, the engineer would readily appreciate that the factor of tractive speed accounts for these differences, but the farmer might not.

The greatest objection, as I see it, to the present method of rating is that it gives the prospective purchaser no understandable means of comparing at once the actual pulling ability of the different makes and sizes of tractors.

There is a tendency at the present time to rate the pulling capacity of tractors according to the number of plows they will haul under average soil conditions, say, a two, three or four-plow machine. But this method is equally as unsatisfactory as the one now in use, for the reason that the terms "average soil conditions" means something different for different kinds of soil. The draft of plows not only varies widely in different kinds of soil but in the same soils under different conditions.

I am convinced that the only logical method of rating the pulling ability of tractors is in pounds. Tractor engineers have already discussed this subject to some extent and this method seems to be gaining some support. A tractor concern which has taken the lead in this direction, makes the following statement in its catalog as to why it favors a pounds-pull rating:

"We rate the power of our tractors in actual pounds pull developed at the drawbar, because the wide difference in ratings of identical size motors given by various manufacturers, and the variation of mechanical efficiency of different tractors, makes a horsepower rating of little real value to the purchaser in determining just what any tractor with merely a horsepower rating will pull."

I will show graphically why it is more logical, as well as scientific, to rate the pulling capacity of a tractor in pounds pull instead of in terms of horsepower. The two sets of curves shown illustrate my contention very clearly. The curves of "engine torque" and "brake horsepower" were reproduced from the data obtained from an actual Prony brake test on a 3½ by 5¼ tractor engine of the four-cylinder, heavy-duty type.

Two facts of prime importance are brought out by the curves: 1—The torque is practically constant throughout a wide range of engine speeds; this is characteristic of gas

TABLE OF ENGINE AND TRACTOR DATA

R. P. M	Brake H. P.	Torque In.-Lb.	Drawbar Pull-Lb.	Drawbar H. P.	Speed M. P. H
400	8	1260	2010	535	1
600	13	1370	2250	900	1½
800	18	1420	2360	12.60	2
1000	22.5	1420	2360	15.75	2½
1200	27	1420	2360	18.90	3
1400	31.5	1415	2340	21.80	3½
1600	34.5	1360	2220	23.70	4
1800	36	1260	2010	24.20	4½

Size of Engine—3½ x 5¼; gear ratio, 84 to 1; transmission efficiency, 85 per cent.; rolling resistance, 16 per cent.; drive wheel diameter, 70½ in.; weight of tractor, 4500 lb.

*Paper read at N. G. E. A. convention in Chicago, June, 1916.

power motors; 2—The brake horsepower varies directly as the speed up to a certain point.

For the purpose of illustration I will suppose that this engine is installed in a tractor, for which I will assume a gear ratio of 84 to 1, a transmission efficiency of 85 per cent, a drivewheel diameter of 70½ in., and a total weight of 4500 lb. My object is to calculate the drawbar pull.

The torque of the engine and the gear ratio determine the pulling ability of a tractor. The pounds pull at the drawbar is the product of the engine torque, gear ratio and transmission efficiency divided by the radius of the drivewheel, less the tractive resistance, which I will assume is 15 per cent in this case. This gives me the column "drawbar pull" (in the table), and from this is plotted the curve of "drawbar pull," which, of course, is similar to the torque curve since drawbar pull varies directly as the torque of the engine.

The drawbar horsepower is the product of the pounds pull and the tractive speed divided by a constant, and varies directly as the speed.

By referring to the "drawbar horsepower" curve, it is evident at once that we might give our tractor a drawbar rating of from 8 to 20 hp., depending upon the speed of the motor and assuming that the gear ratio remains unchanged. And herein lies the chief objection to a rating in terms of horsepower.

On the other hand, the engine torque, and likewise the pounds drawbar pull, remain practically constant throughout a wide range of speed, so long as the gear ratio does not change. Between a motor speed of 800 and 1400 r.p.m., or a corresponding tractive speed of 2 and 3½ m.p.h., as shown by both curves and table, the pounds pull at the drawbar is practically constant. Also between tractive speeds of 1¾ and 4 m.p.h., which represents the extreme limits of working speeds of tractors, the variation in pounds pull at the drawbar is exceedingly small.

The farmer is not so much interested in the amount of horsepower that a tractor is supposed to develop at the drawbar; he is more concerned with the actual pulling force it is capable of exerting on a plow or other implement. If the drawbar rating of your machine is in pounds pull, you are giving him something tangible, and throughout a fairly wide range of engine speeds this pull will remain practically constant. There is no confusion in his mind as to the tractor's actual drawbar capacity.

In case this method of rating is adopted as standard, as no doubt it will be sooner or later, it will be essential to have the tests on which the different ratings are based carried on under some sort of official supervision. Equipped as it is with its fine corps of trained experts and the excellent facilities at its disposal, it is a wonder to me that the United States Department of Agriculture did not long ago see the vital need of a standard rating for farm tractors, to the extent of taking some action in this direction. It is only within the past few months that the department seems to have taken the problem seriously.

In the first place, provided the manufacturers adopt the plan that is being worked out, it is my opinion that the U. S. D. A rating should include an engine as well as a drawbar rating. A Prony brake test should be made to obtain data for determining the torque and brake horsepower at various speeds. The torque curve of any engine, like the one shown here, will indicate the normal or critical speed, or the speed at which the engine produces the greatest torque. The brake horsepower rating should be given on the basis of the torque at this speed.

The basis for the drawbar rating should be the pounds pull exerted in an actual pulling test. The drawbar test should be made with the engine running at its critical speed and with the tractor traveling at its best working speed as fixed by the gear ratio.

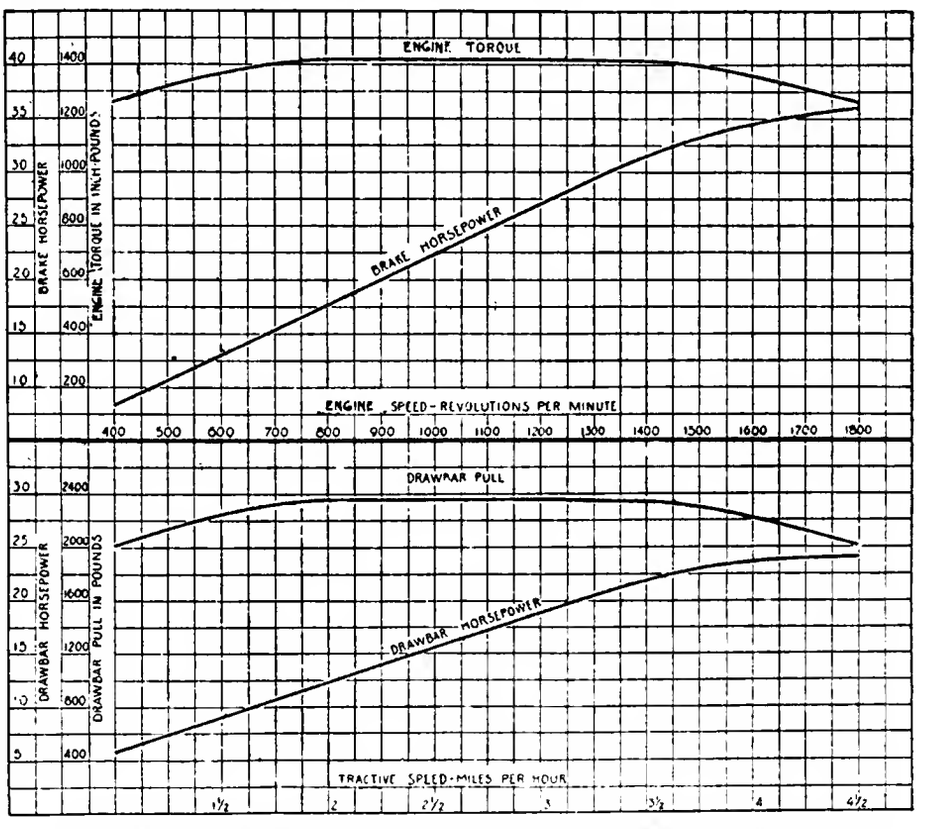
Just what equipment, conditions, etc., should be standardized for conducting such tests is a big problem in itself and I will touch on it only briefly.

Personally, I am of the opinion that, for all practical purposes, it would be sufficient to have tests for establishing drawbar ratings made on hard, level ground, such as a good, dragged dirt road, where slippage for most tractors would be practically negligible. The necessary data could be obtained by means of a recording traction dynamometer such as the one developed and perfected by the Hyatt Roller Bearing Co., with which the majority of tractor manufacturers are already familiar.

Draft Tests on Dirt Road Easiest

While draft tests conducted on a dirt road would show a higher drawbar pull than a tractor would be capable of delivering in a sod, stubble or plowed field, it would be a much less difficult problem to secure standard conditions of footing there than in a field where ground conditions may be extremely variable.

A method of indicating a tractor's rating, that has already been suggested, is by means of a double figure, as is the present practice, but to use pounds pull instead of the drawbar horsepower; as 1500-20 instead of 10-20, or 2000-25 in place of 12-25, the first figure in the combination representing the pounds pull and the second the brake horsepower. With this rating should also be included the tractive speed at which the machine will operate best under load.

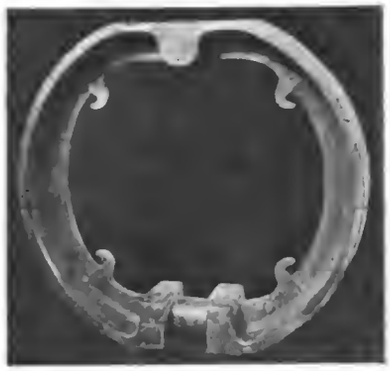


Curves based on results of Prony brake test of four-cylinder 3½ by 5¼-in. tractor engine, illustrating advantages of rating pulling capacity of tractors by pounds pull

Aluminum Engines Coming in France

Peugeot and Panhard Make Aluminum Engines Without Cylinder Liners — Aluminum Brake Shoes Popular

By W. F. Bradley



Aluminum brake shoes for Peugeot truck

THE general adoption of the aluminum piston, which has been such a remarkable feature of the American automobile industry, has had no counterpart in Europe. This is all the more surprising when it is remembered that the initial experimental work was done in France and Germany, and that the Cothias process of aluminum die casting—known in America as the Lynite—was extensively employed in France as far back as 1897 for a variety of small mechanical parts.

Six or seven years ago, when the question of motor efficiency was beginning to receive close attention, experiments were made with aluminum pistons by practically all European firms. At that time, however, certain details remained to be perfected and, after tests which were not completely satisfactory, the factories one by one decided that aluminum was not practicable for pistons. Where light reciprocating parts were required, steel pistons were used, and for racing purposes steel pistons machined from the solid billet were the invariable equipment. The only French firm having changed unhesitatingly for the aluminum piston is the Chenard & Walcker company, which has used it on all its stock motors for the last 4 or 5 years. The general public, however, is not aware of this fact; and so small is the amount of publicity concerning aluminum pistons that it probably would have done the firm more harm than good to state that they had departed from the ordinary methods.

Panhard & Levassor's Work

For the last two or three years the Panhard & Levassor company has made use of aluminum pistons on a little 10-12-hp. poppet valve model of 2¾ by 5½-in. bore and stroke. This is a very successful and very popular model, but even dealers generally are not aware that they have been selling a car with aluminum pistons.

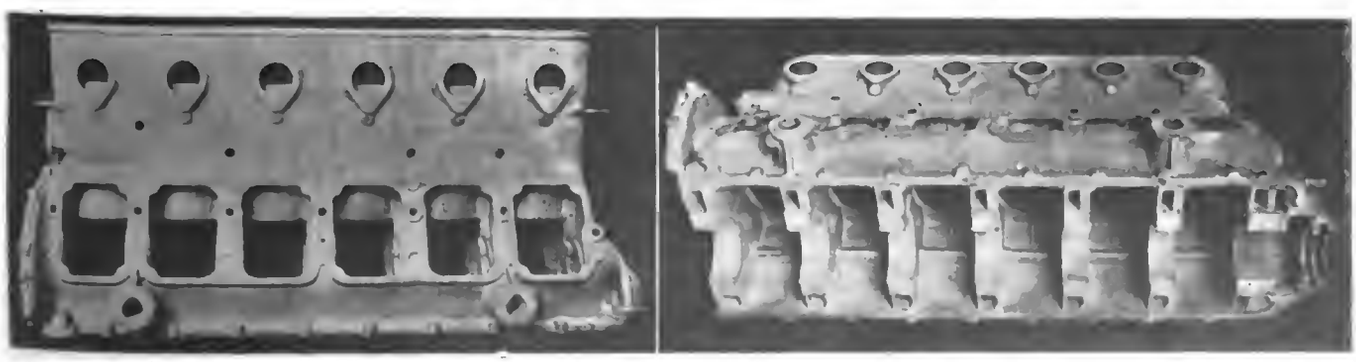
The D. F. P. company has made a practice of fitting its sporting models with aluminum alloy pistons, again without informing the public of this fact.

In Italy the general situation has been similar to that of France. All the Italian factories experimented with aluminum alloy pistons, but with the exception of the comparatively little-known Chiribiri company of Turin, not one firm adopted them for stock models. The Aquila-Italiana company did much experimenting, but does not appear to have been decided about the complete adoption of aluminum alloy pistons. The Fiat company, which maintains its own aluminum foundry, is also much interested in this question. It has used aluminum alloy pistons on its racing cars, particularly on the three machines which ran in the last French Grand Prix at Lyons. These cars had engine trouble, but the pistons stood up in a very satisfactory manner. Aluminum alloy pistons are also employed exclusively on Fiat aviation motors—and this firm is the biggest aviation motor producer in Italy. For stock models the firm appears to be hesitating. For some of the latest models experimental cars were given hard running on the road for a full year in order to get a definite opinion as to the value of aluminum, without, however, so far as can be learned, a decisive result being arrived at.

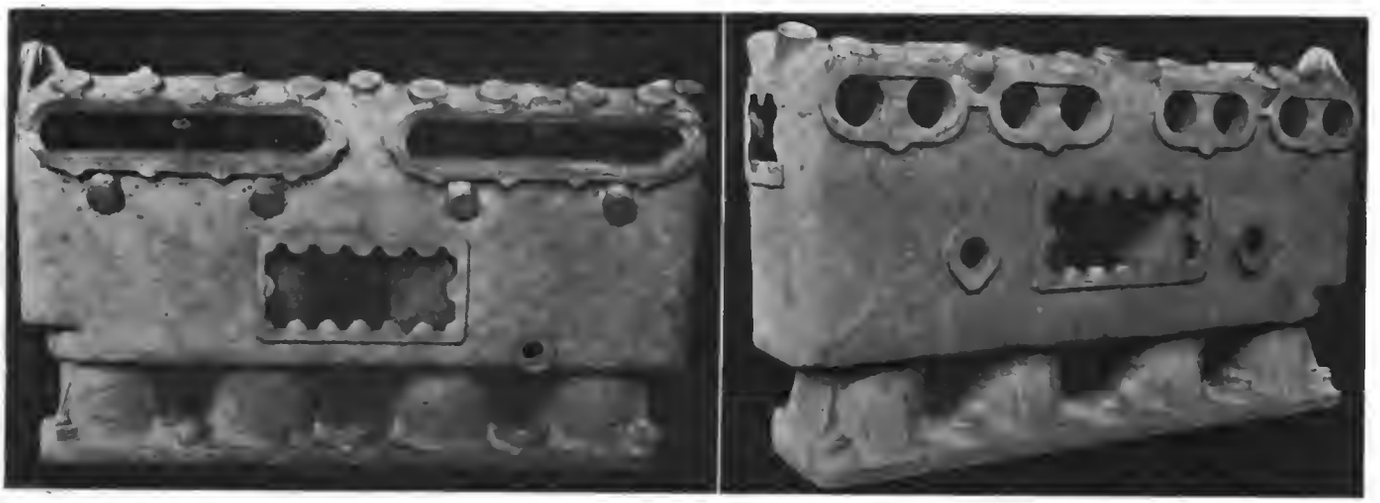
Steel Reigned for Years

No important European races have been won with aluminum pistons. Peugeot, who during the last 5 years has done more racing than any half dozen firms combined, has invariably employed steel pistons and been fully satisfied with them. The same applies to Delage. Sunbeam, until quite recently, has been satisfied with steel pistons machined out of the solid. At the annual Monaco motor boat races, where much experimental work was seen, the steel piston was supreme.

Since the outbreak of the war, with the requirement of large numbers of high-efficiency aviation motors, manufacturers have been led to reconsider the claims of aluminum pistons and in many cases have taken up the type of piston



Left—Exhaust side of Panhard & Levassor sleeve-valve motor with cylinders and crankcase cast in aluminum alloy. Right—Interior view of Panhard & Levassor sleeve-valve motor with 5¼-in. bore. Cylinders and crankcase are cast in aluminum alloy by the Cothias method. This process has been used in France for casting numerous small aluminum mechanical parts since 1897



Left—Intake side of Peugeot four-cylinder, sixteen-valve racing type motor cast in aluminum alloy. Cylinder liners and separate valve seats are still to be installed. Right—Exhaust side of Peugeot racing motor casting

they cast aside 6 or 7 years ago. Quite recently the Le Rhone aviation engine company—now combined with the Gnome—produced a new engine from which 120 hp. was obtained. The result was not considered satisfactory and the cast-iron pistons were changed for Cothias die-cast aluminum alloy pistons, when the power was increased to 150 hp., no other changes being made.

As a result, the whole of this series will have aluminum alloy pistons and many of the Gnome engines, with steel cylinders, will also be fitted in the same way.

The Lorraine-Dietrich Co. has had a similar experience. After using cast-iron pistons in an eight steel cylinder water-cooled aviation engine, they got better results with aluminum and completely adopted Cothias die-cast pistons. These pistons are deeply ribbed from the head to the skirt. The Cothias pistons are known in America as Lynite, the Cothias rights having been acquired by the Aluminum Castings Co. of Cleveland.

Peugeot and Hispano-Suiza Interested

Among other firms now making use of aluminum alloy pistons, either completely or partially, are Peugeot and Hispano-Suiza. It is certain that the outcome of present aviation experience will be an extensive adoption of aluminum pistons for car motors. Not a few firms have been experimenting in this direction while the war is in progress, but without making known their results. It is certain, however, that firms will not be rushed into the adoption of aluminum alloy pistons. One factory ran a set of pistons 60,000 miles without dismounting before being convinced. Another put three cars on the road and ran them 12 hr. a day for a full year in order to be sure that the change from iron to aluminum was a wise policy.

Aluminum cylinders also have come to the front during the war period. There is no stock car on the European market fitted with aluminum alloy cylinders, but it would appear that the first commercial adoption of this type of cylinder was made by the Hispano-Suiza Co. of Paris and Barcelona. Engineer Birkigt, of this company, 2 years ago produced an eight-cylinder V engine with each set of four cylinders forming a single aluminum alloy casting, into which thin steel liners were screwed. The head was detachable and of cast iron, and it carried the vertical valves operated by an overhead camshaft. Several patents have been obtained covering the methods of constructing this motor, particularly the system of screwing the liners into the aluminum cylinders and the valve-operating mechanism. The aluminum cylinders are enameled inside and out to guard against any possible porosity of the metal, and the final finish of the outside of the cylinder is a fine black enamel. This motor has been produced in series for a full year and has been most successful. Before its construction was decided on in big quantities it went through 50 hr. full load official brake test. The weight of this motor is 2.4 lb. per hp. without water or oil. Its consumption of gasoline and lubricating oil is very moderate.

The Panhard & Levassor Co. has been running an aluminum cylinder engine, driving factory machinery, for 22½ hr. a day, 7 days a week, for a full year. This engine has no cylinder liners, but the valve seats and head are of cast iron. Although this motor ran constantly for 365 consecutive days, with the exception of the 1½ hr. each day the factory was shut down for meals, no troubles have developed.

The same firm has had on the road during the past year a number of cars with Knight engines, 4⅛ by 5½-in. bore and stroke, fitted with aluminum alloy cylinders without liners. These cylinder castings weigh 46 lb., but in iron the weight is 115 lb. One of the most interesting examples is a big six-cylinder block Knight engine with cylinders and upper half of crankcase forming one casting of aluminum alloy. This with a bore of approximately 5¼ in., has sleeves operating direct on the aluminum walls, and weighs only 202 lb. rough from the foundry. Completely machined, the weight is reduced to 145 lb. A similar casting in iron weighs 510 lb., rough from the foundry, and 375 lb. completely machined. Several of these big motors are in service, with good results so far.

The Peugeot Racing Motor

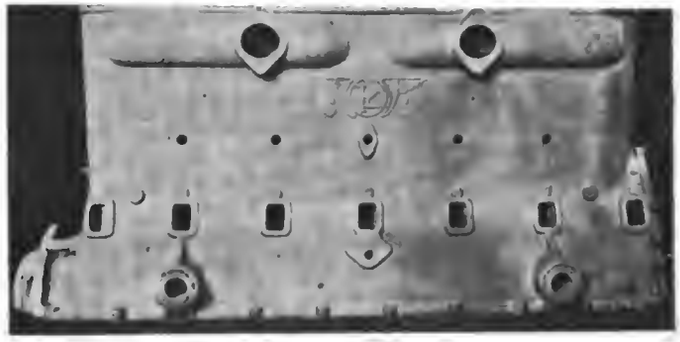
Another important aluminum cylinder engine is a four-cylinder, sixteen-valve Peugeot racing type, shown in one of the illustrations. This has neither cylinder liners nor separate valve seats. In its general design it is exactly similar to the racing engines used by Peugeot on the 1914 Grand Prix cars now in America. The casting shown in the illustration weighs 63 lb. in the rough—that is, before any machining has been done. The cylinders are approximately 2.7-in. bore. The same rough casting in iron weighs 170 lb. On an eight-cylinder engine there is a saving of about 200 lb. by the use of aluminum alloy in place of cast-iron cylinders. These engines are a high-efficiency type running normally at 2800 r.p.m. and several of them are in service.

Another aluminum cylinder engine is a twelve-cylinder horizontal with cylinders cast in groups of six, pistons and valves operating direct on the aluminum. Another make is a six-cylinder vertical with superimposed valves in the head, also without cylinder liners or separate valve seats. It is obvious that the use of aluminum cylinders for cylinder castings is of the greatest importance to aviation engine manufacturers. By this means only has it been possible to get the

weight of fixed cylinder engines down to the low figure of such engines as the Gnome, which are practically all steel, machined out of the solid. The V-type aluminum cylinder costs considerably less to produce than the rotary Gnome type, and is much easier to assemble and keep in condition; while the two types are about equal in weight on the scales, the V engine has a decided advantage when account is taken of gasoline and oil required for a long period of running.

European firms are studying after-the-war models while fighting is in progress. It is too early to say what these models will be like, but it is practically certain that aluminum alloy will replace cast iron for the cylinders of the bigger touring car engines. What may be expected is the appearance first of Knight engines with aluminum alloy cylinders, followed later by poppet valve engines in the same metal.

A development which does not appear to have received the same amount of attention in America as in Europe is the use of aluminum for brake shoes. These are very common on both trucks and touring cars made by the leading French makers. With the tendency toward unit construction of engine and gearbox, both brakes have to go on the rear wheels. European ideas will not admit of internal and external brakes on even the cheaper classes of car, thus the shoes are placed side by side within big diameter drums. Here the use of aluminum enables an appreciable saving of weight to be effected. Panhard-Levassor cars are a good example of this; the rear axle of all this firm's models has an aluminum differential housing, and the big diameter brake shoes are aluminum die castings. Peugeot is another firm making use of aluminum shoes on both touring cars and trucks. Naturally these shoes are lined with asbestos fabric or similar material.



Panhard & Levassor Knight type motor of about 5¼-in. bore with cylinders and crankcase in aluminum alloy

Simple Tests Show Car Condition

(*Continued from page* 8)

which is conveniently known as a constant of gravitation.

If one has found by experiment the resistance at a given speed, and thereafter by a second experiment has found the acceleration in feet per second, he is enabled to find the point on the torque curve at the speed mentioned by multiplying the acceleration in feet per second by the constant 62.5, which gives him the additional capacity of the engine necessary to overcome resistance in pounds per ton, which result is added to the known pounds of coasting resistance, the total indicating the proper location of the torque curve point.

Referring again to Fig. 1, it is evident that if a car is running on the level and at a speed which shows the resistance curve considerably below the torque curve, the opening of the throttle will produce acceleration and the opening of it wide will produce the energy necessary to overcome the number of pounds of resistance per ton which are measured between the coasting resistance curve and the torque curve. It should be remembered, however, that at once the speed of the car will begin to increase and immediately the acceleration will fall off. Otherwise, the speed increases indefinitely.

This does not, however, interfere with the accuracy of the acceleration indication because the definition of acceleration does not require that the force should act through a complete second, but merely that when the force begins to act it shall have the capacity indicated if its action continues through a complete second.

In several of Professor Marshall's diagrams the difference was made evident, by means of curves, between cutting off the ignition, declutching, and bringing the gearshift into neutral, these three being the three ways of cutting off the engine power and coasting.

The usual effect, as shown by him and illustrated by the curves plotted from experiments, showed that the least resistance to coasting was produced when the engine was left running and the gear shifted to neutral, the explanation of this being that the running of the engine took care of the friction in the jackshaft which otherwise had to be absorbed in the coasting resistance, and of course the greatest resistance to coasting was produced by merely cutting off the ignition, for in that case the resistance of the engine, both by compression and friction, had to be overcome in addition to the ordinary resistances.

The distance between each of these curves, measured on the upright lines showing pounds of resistance, indicated the engine friction in one case and the friction in the jackshaft in the other case.

For most purposes there would seem to be no necessity for converting resistance and speed into horsepower, but Professor Marshall exhibited a number of figures showing horsepower, comparing several cars with each other.

The horsepower formula assumes the value of 33,000 lb. lifted 1 ft. in 1 min. as the unit of horsepower. A car traveling 1 m.p.h. covers 88 ft. in 1 min., and 88 ft. divided into 33,000 lb. gives as a quotient 375. The utilized horsepower of any given car then is equal to resistance in pounds per ton, multiplied by the number of tons weight of car and passengers, multiplied by the number of miles per hour and the whole divided by 375. It will be seen, therefore, that, by taking the necessary time for the calculation, a diagram may be produced in which instead of resistance in pounds per ton, the horizontal lines shall represent either horsepower capacity or horsepower expended. The horsepower so exhibited would be the brake horsepower. It is, however, usual, as Professor Marshall points out, to consider that there is a loss at the rim of some 23 per cent of horsepower generated by the engine, so that, having determined the actual brake horsepower by plotting the curve which shall show 23 per cent additional horsepower, one will arrive at the horsepower delivered at the clutch.

The most obvious difference between a horsepower curve and a resistance curve is that the effect of multiplying resistance by speed, in producing the horsepower curve, is to cause the curve to sweep more rapidly upward so that in comparing the curves of two cars a difference which might seem slight in a resistance curve becomes more pronounced when the horsepower curves are examined.

As a matter of general interest, it may be mentioned that a car coasting down a given grade will, if permitted, reach a maximum speed which it will not exceed, that speed being the point where the coasting resistance curve intersects the resistance due to grade. For example, a 5-per-cent grade corresponds to 100 lb. of resistance. If the coasting curve indicates a resistance of 100 lb. at 20 m.p.h., the car cannot exceed 20 miles on that grade.

Wisconsin Adds Aviation Engine

Aluminum Cylinders With Hardened Steel Liners—Many Features Like Racing Engine—Detail Highly Ingenious

IN designing their aviation engine the Wisconsin Motor Mfg. Co. of Milwaukee, Wis., have adhered very closely to the general principle of their racing automobile engines. That is to say, the overhead valves are operated by an overhead camshaft with rocker arms and many of the details are arranged the same way. The aviation motors, however, are much larger, having a bore of 5 in. and a stroke of 6½ in., they being intended for coupling direct to the propeller which mounts on the end of the crankshaft. There is still much argument among aeronautic engineers regarding the relative advantages and disadvantages of direct-driven and gear propellers. The Wisconsin company have chosen to make an engine developing maximum power at a moderate speed, believing that they can thereby obtain the greatest dependability. At present two models are being made, one with six and the other with twelve cylinders, the dimensions being the same.

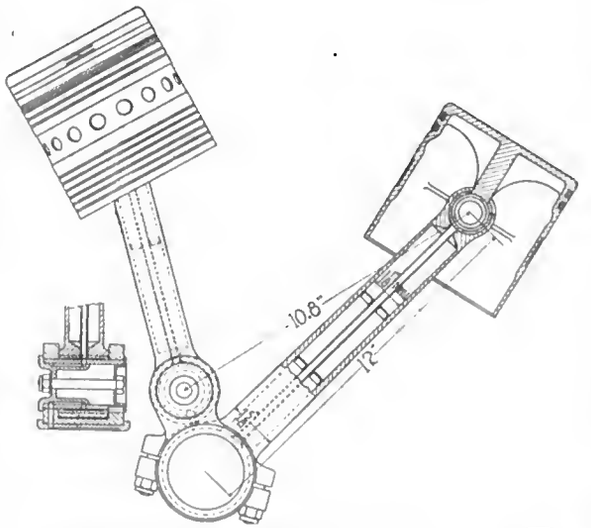
Aluminum Used Extensively

Aluminum enters very largely into the construction of these engines, the cylinder castings for which were illustrated in THE AUTOMOBILE last fall. For the valve seats cast-iron rings are machined and copper plated. They are then heated and placed in position on the core before the casting is made. Cylinders which have been cut up show that the copper makes an intimate connection between the aluminum and iron; in fact if the cylinder is cut in two across the diameter of the valve seat it is only possible to remove the half circle of iron by applying considerable force with a hammer.

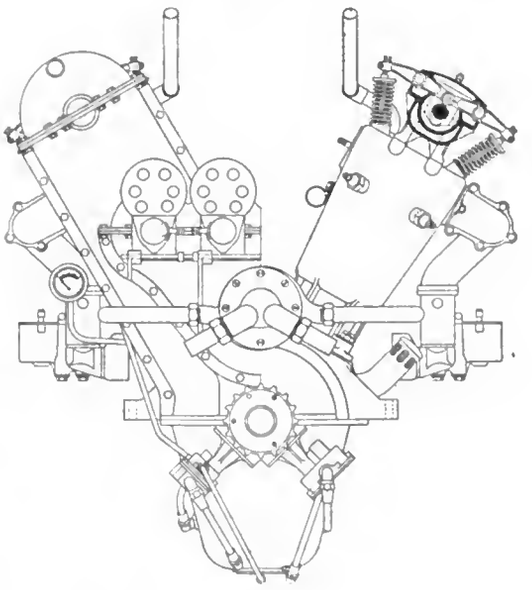
Instead of using cast-iron linings for the cylinders, hardened steel sleeves are employed, the pistons being made of the same grade of aluminum alloy as the cylinders. These pistons are typical examples of the aluminum type having substantial supporting ribs beneath the head. There is no wristpin bushing, the pin being fixed in the upper end of the connecting-rod, operating directly in the piston, as the particular alloy employed is found to be a satisfactory bearing metal.

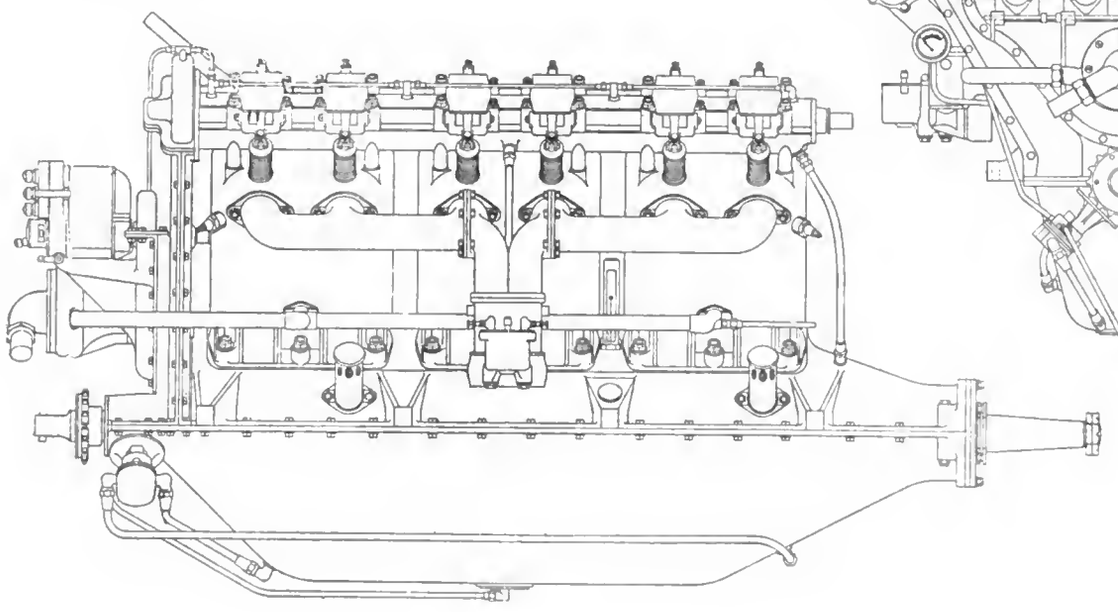
Plain Crank Bearings

A point of difference from the racing car engine is seen in the crankshaft bearing layout as ball races are not employed at this point. Instead, there are three main bearings of bronze with babbitt facing, these being fed with oil under pressure which is thence transferred to the lower connecting-rod bearings, via the crankshaft. There are no less than three oil pumps, these being arranged on the system origi-



Pistons and connecting rods of twelve-cylinder Wisconsin aviation engine. In the cross section of the pin securing the small connecting rod it can be seen that a recessed plug is used to carry oil from the crankpin to the side rod attachment. Notice the oil pipe within the main rod carrying oil to the piston pin





Wisconsin twelve-cylinder, 5-in. by 6½-in. aviation engine

nated by the Wolseley Co. of England, as two of them are used to remove oil from the crankcase, the third only being employed to force it to the bearings. Both the scavenging pumps, as they are termed by the makers of the engine, are larger than the pressure pump since their object is to keep the crankcase entirely free of oil accumulation. The purpose of this is to guard against any part being flooded should the engine be tilted to a sharp angle.

The scavenging pumps are arranged with different points of suction so that while they both exhaust the crankcase when the engine is horizontal, if it is tilted either one or the other of the pumps will still be in operation.

Oil Is Water-Cooled

It will be remembered that the oil pump and some of the pipes on the Wisconsin racing engine were placed well outside the crankcase where they were exposed to a draft of air, the cooling effect undoubtedly assisting to improve the lubrication. This idea has been elaborated in the aviation engine, since the discharge pipe on the pressure pump is taken through the interior of the lower water pipe on its way to the main standpipe from which oil is delivered to the crankshaft bearings and to the camshaft housing.

As in the racing engine, the surplus oil in the camshaft overflows down the vertical passages containing the bevel driveshaft, thus lubricating the camshaft drive gears. In addition there are also a number of oil return tubes running straight to the crankcase.

Complete Double Ignition

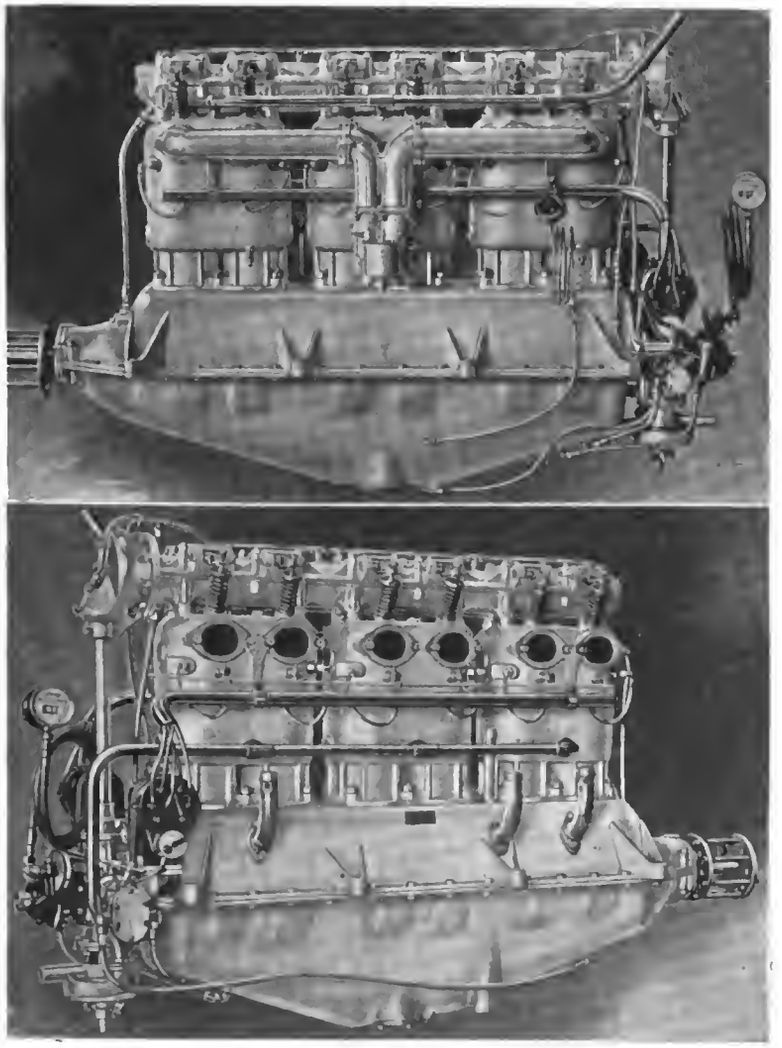
Ignition has been a constant source of trouble in aircraft and, in consequence of this, the Wisconsin engines have complete duplicate magneto systems operating simultaneously. This means that the six-cylinder has two magnetos and the twelve-cylinder four, the spark advance being interconnected. This, of course, means that in each cylinder there are normally two sparks and the Wisconsin company states that the failure of one of these sparks results in slight loss of power. There is very little difference between the six and the twelve-cylinder models, both being of the same bore and stroke and both having 3-in. valves.

In passing, it may be remarked that there are only two valves per cylinder, as against four in the racing engine, this being explained by the fact that the single large valve will operate perfectly at moderate speeds and neither of these engines is intended for very high crankshaft revolutions. One difference between the six and twelve is that the former has an I-beam connecting-rod while a tubular type is used for the twelve.

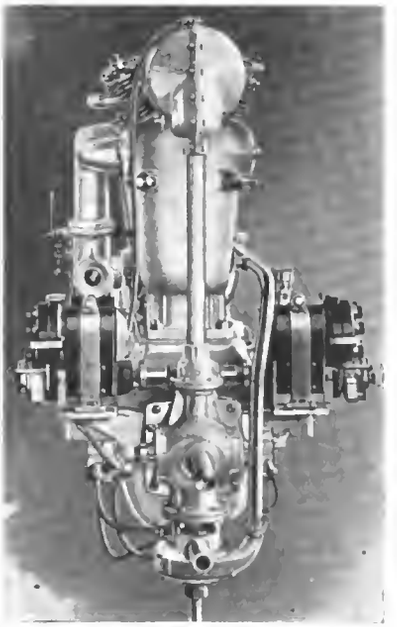
As shown in the cut, the Wisconsin company have adopted the least used type of connecting-rod for the twelve in that it is neither of the forked nor side-by-side pattern, but has a secondary rod linked to the main rod via a lug on the side of the latter.

An outstanding feature of both engines is the extremely fine workmanship employed and the use of the strongest possible kind of steel. The makers state that the six-cylinder engine weighs 600 lb. with carbureter and magnetos and develops 138 hp. at 1200 r.p.m., rising to 145 hp. at 1400 r.p.m. The fuel consumption is 0.6 pint per b.hp. hour. The twelve-cylinder is said to develop 250 hp. at 1200 r.p.m. and 280 hp. at 1400 r.p.m., while the weight of the twelve is listed at 1000 lb. with magnetos and carbureters.

These two engines, while of entirely original design, contain nothing that is abnormal. Like the other automobile engineers who have turned to the problems of flying machine power plants, the Wisconsin company has preferred to make the utmost use of its own wide experience, rather than to adopt some completely new construction. That this has been the American method is a good thing for American flying, because if there is ever a sudden demand for many engines it will not be necessary to find the weak spots in freak constructions as was the case in France in the first months of the war. American firms are tackling the job just as the European automobile manufacturers have tackled it, but America has escaped a very wasteful stage through which the European nations passed.



These views of the six-cylinder Wisconsin show the layout of all the accessories



End view of Wisconsin aviation twelve, showing the location of the two scavenging oil pumps. The layout of the two magnetos is also shown and the drive for the overhead camshaft. This illustration shows well how narrow the engine is, this being a distinct advantage for aeroplane work

Refinements in Truck Design

Abstract of a Paper Read Before the Society of Automobile Engineers at the Summer Meeting on the SS. Noronic

By H. D. Church

Chief Engineer, Truck Division, Packard Motor Car Co.

IN developing the present line of Packard worm-driven trucks, nine different experimental trucks were built and tested. The tests were run over a route in Detroit which was selected to obtain about 75 per cent of the distance over very rough, broken down block pavements. The trucks tested were overloaded continuously, were overspeeded during a portion of their testing, and were, as far as possible, kept in motion 22 hr. a day, 7 days a week.

Under these severe conditions, any faults in design were rapidly brought to light, and this paper will deal briefly with some results obtained from such test service, and also with conclusions drawn from the service result standpoint of 8 years of truck manufacture.

Front Axles

In our worm drive development work we started the use of a front axle design of I-beam section, using the inverted yoke type of steering knuckle, and it is interesting to note that the weight of the 3-ton axle of I-beam design, proved to be 17 per cent less than that of the rectangular Elliot knuckle type of axle formerly used, the stresses remaining the same in both cases. This decrease in weight was obtained in spite of the fact that the I-beam axle was of wider gage than the old type.

In the earlier experimental front axles the steering-knuckle pins were straight where they passed through the axle stock proper, and we experienced a lot of trouble due to the straight pins "belling" out the ends of the hole in the axle. This wear was, of course, in the more expensive piece of the two, and could not be corrected after it took place without re-machining the axle and putting in bushings, which in turn would do the same thing that the straight pin did.

This difficulty was entirely overcome by fitting the steering knuckle pin into the axle end on a long taper, holding it tightly in place with a nut and sleeve at the lower end, as shown in Fig. 1. This practice, in service, proved so satisfactory that it was used for the torque-arm rear end pin, where it passes through a heavy lug on the rear axle cast-steel center housing, a point where wear, due to the "belling" out of the hole, would eventually involve an expensive replacement charge.

On a heavy truck it is difficult to make a substantial connection between the steering knuckle and the steering arm, for the steering gear connecting-rod, this being the arm which carries the entire steering effort. We tried pressed hexagon fits, brazed hexagon fits, and pressed cylindrical fits, with four-key dowels, but all these constructions gave more or less trouble, and we finally forged this one lever integral with the steering knuckle, making the lever a heavy oval section.

Prior to our experimental work on worm driven trucks, we had experienced some trouble with our steering connection joints, which were of the clevis type. As originally designed, the pins were prevented from turning in the clevises by the engagement of a flatted side of the pin head with a machined lug on the steering rod clevis, and the lever eyes were bushed with bronze. The bronze bushings pounded out; so hardened steel bushings were substituted. Then we found the pins pounding out and over-sizing their holes in the clevises, and that the weight of the cross tube and connecting-rod pounded and wore the faces of the eyes and clevisee. We than commenced using hardened steel collar or "plug hat" bushings in the steering lever eyes, and in both sides of each clevis. These bushings were so arranged that the weight was carried on large diameter hardened surfaces, as shown in Fig. 2. This construction was only fairly satisfactory, as the continual pounding from solid tires, coupled with inability to retain lubricant, was the cause of too rapid wear.

We felt that we had exhausted all the possibilities of the pin and clevis type of joint, and turned to the ball-and-socket joint construction, using hardened and buffed balls and sockets, no springs being employed behind any of the sockets. This construction was an improvement over the final bushed eye and clevis design, as shown in Fig. 2, but still wore and rattled. The wear was obviously due to the slight clearance between the bearing surfaces, through which the vibration resolved itself in a succession of light hammer blows, the intensity of which increased with wear.

We next tried placing a spring behind one of the ball sockets in each joint, in order always to retain all three parts in close contact. Some experimenting was necessary to determine on a spring pressure heavy enough to allow only a slight deflection under steering effort and road shocks, in conjunction with balls of a size such that the unit pressures could be kept low enough not to cause hard steering. This construction is shown in Fig. 3.

Excellent results were finally obtained on a 3-ton truck with ball of 1⅝ in. diameter, in conjunction with a spring compressed to 300 lb. The balls and sockets are made of steel and hardened. The writer has measured balls after 30,000 miles of service, which showed less than 0.003 in. wear on the diameter, clearly indicating how the construction stands up.

Rear Axles

In 1911, when we started experimental work on worm-drive rear axles, very little information on worm gearing for truck rear axle work was available in this country, and our decision to develop an axle of this type was based largely on foreign practice. We investigated carefully the construction and service results of internal gear and worm drive axles in Europe, and were deeply impressed by the wonderful results obtained with worm gearing on the chassis of the Dennis and the London General Omnibus companies.

At that time the Hotchkiss drive looked promising, and that construction was embodied in our first worm-driven vehicle. After many months of spring breakage trouble we arrived at a design of spring with the driving eye at the rear end, which gave good satisfaction in ordinary service. On a heavy vehicle we found it impossible to make the springs as durable with the Hotchkiss drive construction as with the torque-arm and distance-rod construction, and after exhaustively testing a model with distance-rods and no torque-arm, which

resulted in an objectionable chatter when using the transmission brake, we finally decided upon the conventional type of construction, using both distance-rods and torque-arm.

Right at the start we began to have trouble with the axle driveshafts twisting off at the outer ends. European practice is to use a rigid connection at this point, between the driveshaft and the wheel hub, chiefly in connection with a floating bronze bushing for the rear wheel bearing. With the taper roller bearings, which are largely used in wheel hubs in this country, a slight amount of play is necessary in the bearings, which permits the wheel to rock slightly. This slight rocking of the wheel, in conjunction with a rigid connection between the driving shaft and the wheel hub, subjects the shaft to bending, and we found that these bending loads, in our case, were the cause of shaft failure.

For the rigid connection between the shaft and the wheel hub, we substituted a four-lug semi-universal construction, which permits a slight rocking of the rear wheel without placing any bending loads on the shaft, as shown in Fig. 4. The driving plate, which attaches to the hub, is hardened, and the driveshaft, on account of its heat treatment is also hard, so that the driving loads are taken through hardened surfaces. The pressures per square inch on these driving surfaces are as follows:

On low gear.....4230 lb. per sq. in.
On high gear.....1290 lb. per sq. in.

The wear in normal service should not exceed 0.004 in. in 30,000 miles. Since using this construction we have, so far as the writer is aware, never had a failure at the outer end of the shaft, either experimentally or on any of the thousands of trucks in service.

We also had trouble at the inner end of the axle shafts, where they engage the differential gear hubs, these failures occurring on trucks in extremely heavy service, which were fitted with high reduction worm gears. The shafts twisted off where the six splines on the inner end run out into the round of the shaft, and practically at the end of the differential gear hub. These axle shafts were made of a nickel-chromium steel, heat treated to the following physical properties:

Tensile strength.....155,000 lb. per sq. in.
Elastic limit.....120,000 lb. per sq. in.
Elongation .....16 per cent

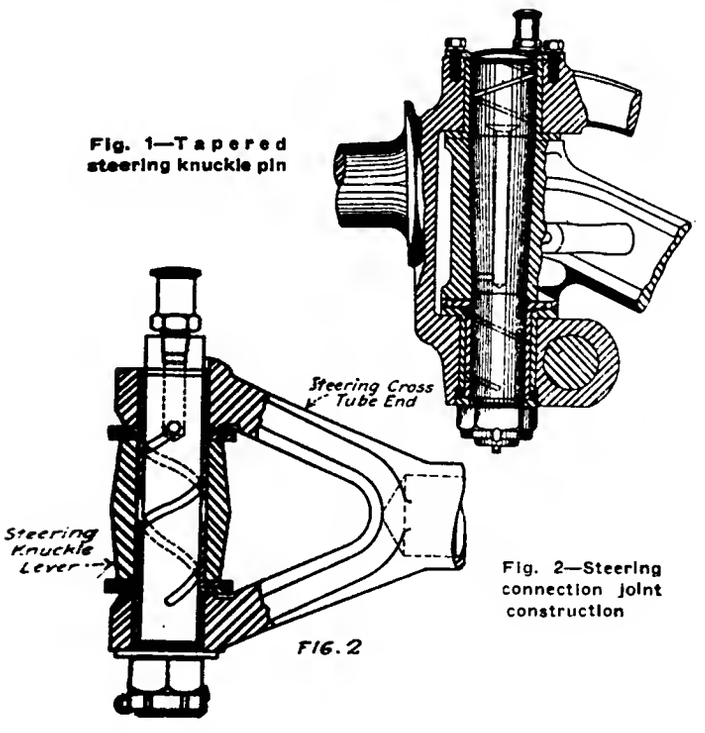
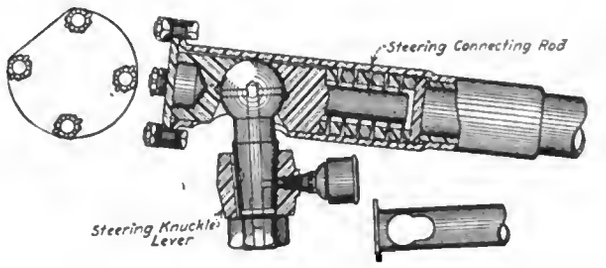
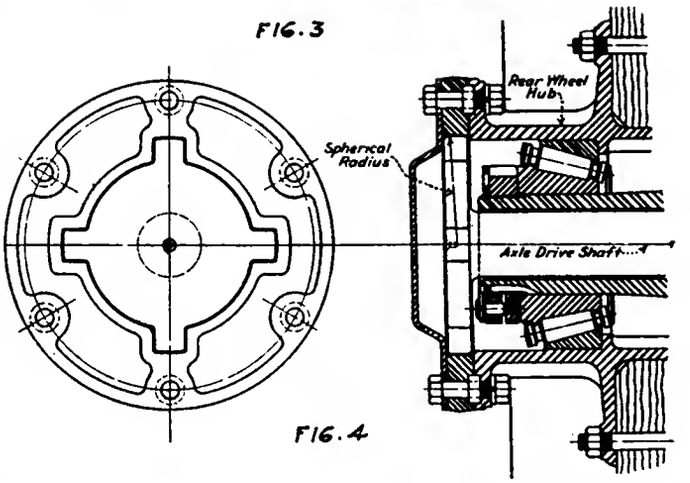


Fig. 1—Tapered steering knuckle pin

Fig. 2—Steering connection joint construction





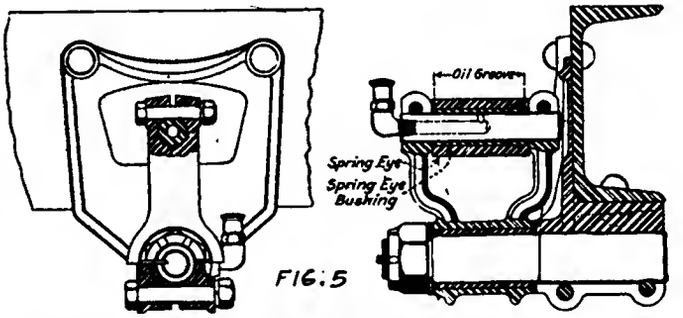


Fig. 3—Rod with ball-and-socket joint. Fig. 4—Connection between driving shaft and wheel hub. Fig. 5—Method of lubricating shackle pin

Reduction of area.....48 per cent
Hardness (Scleroscope).....50 per cent

On the 3-ton truck, with high reduction worm gears, these shafts were stressed as follows:

On low gear.....26,400 lb. per sq. in.
Due to foot brakes*.....63,400 lb. per sq. in.

And it is interesting to note that in every case of failure the shafts were twisted off from the low gear loads and not from the transmission brake loads.

In order to overcome this twisting off of shafts, we made slight changes in the chemical composition of the steel, and changed the heat treatment to obtain the following physical properties:

Tensile strength.....185,000 lb. per sq. in.
Elastic limit.....175,000 lb. per sq. in.
Elongation .....11 per cent
Reduction of area.....50 per cent
Hardness (Scleroscope).....64 per cent

To obtain these properties two heat treatments are required. The only way high stresses in the shafts can be avoided is to increase the shaft diameter materially, and such a proceeding is not desirable, as the weight of the entire axle structure builds up around the driveshaft diameter.

On our experimental worm-drive axles we experienced some trouble with overheating and subsequent failure of the double

*Stresses for foot brake determined by using coefficient of friction of 0.6 between tires and road.

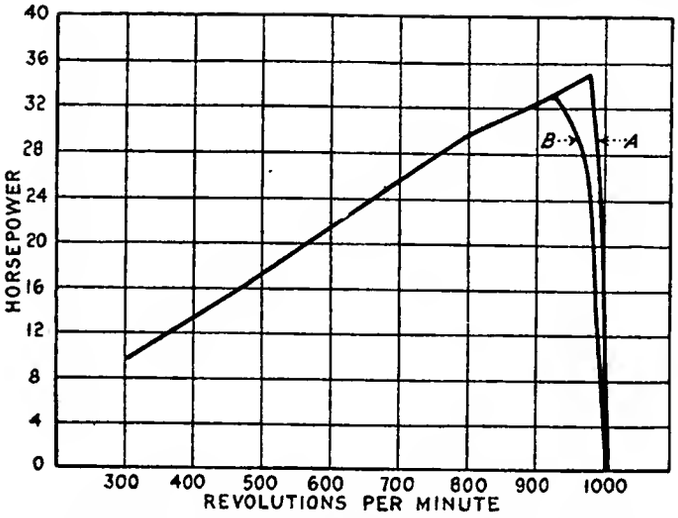


Fig. 6—Effect of governor operating and closing. Curve A, action going up. Curve B, action going down

ball thrust bearing behind the worm. By building up a dummy housing with cutout sections on top, and driving the worm by belt, we found that practically all the surplus oil carried up to the worm by the wheel impinged against the front annular ball bearing on the worm shaft, and that very little of it was forced into the thrust bearing and the annular bearing at the rear.

A cast oil trough inside the housing was provided to catch the oil thrown off the worm, and from the trough the oil was led through a cored passage into the thrust bearing housing, and allowed to find its way back into the axle case through the worm rear annular bearing. This practice provides a gravity circulatory oil feed for both rear bearings, and has been found, in service, to insure adequate lubrication.

There has been some discussion recently concerning the efficiency of worm gearing, as against that of the double side chain or the internal gear final drive. If a side chain or internal gear final drive is new, and properly lubricated, then under conditions of low rotative speed and heavy torque, the worm drive is less efficient. However, neither side chains nor internal gears can be kept lubricated, and are consequently subject to rapid wear and deterioration, while the worm drive, being completely inclosed, and running at all times in a bath of oil, is just as efficient after 30,000 miles or more of service as it is when new.

It has been the writer's experience that the truck owner is very much more interested in obtaining the minimum cost per ton mile, than in any theoretical discussion of efficiency. In considering the various forms of final drive, there are many factors which are of greater importance than the efficiency consideration. Minimum maintenance cost, durability, silence, freedom from the necessity of frequent attention, are all of more importance than efficiency, when the efficiency differences are so slight that they cannot be measured in gasoline or oil consumption.

While the manufacturing cost of a worm drive is greater than that of side chain or internal gear drives, the fundamental reason for its wide-spread use and success lies in the fact that over a given period of time and mileage, its maintenance cost is materially less than that of either of the other two forms.

Spring Shackles and Pins

These parts have been the source of a great deal of trouble in the past, because of improper lubrication and wear. The writer has never seen any grease cup having sufficient power to force grease into the loaded side of the bearing, even with no load on the truck. Grease can be forced in by using a special gun, but such a procedure, while it might be satisfactory for the owner of a fleet of trucks, is hardly feasible for the owner of one or two vehicles. When grease cups are used in conjunction with grease grooves in the pin, these grooves can be filled up with grease, but further screwing in of the grease cup only squeezes the grease out on the non-loaded side of the bearing, or by the grease cup plunger or cap. It has been our experience that grease in such grooves is never properly distributed over the loaded surfaces, as the angular motion between surfaces at this point is too slight.

This lubrication difficulty can be overcome by using oil instead of grease, feeding it into a groove along the top side of the shackle pin, whether it is the loaded side or not. The groove should be shorter than the spring bushing, and the oil-cup so arranged as to give a slight head above the groove, as shown in Fig. 5.

When the oil cup is filled, the truck is stationary and the bushing acts as a seal over the oil groove. In motion, road vibration lifts the bushing slightly away from the pin and permits the oil to flow over both sides of the groove and around the entire pin to the bottom, or in the case of a shackle pin, where the load is normally on the bottom, the oil runs over the sides of the groove and flows down around the entire pin. If desirable, felt can be used in the communicating hole between the oil cup and the oil groove, in order to cause a gradual flow of oil. This system has proved very satisfactory in service, one filling of the oil cups in the morning providing sufficient lubrication for a day's run of the truck.

The writer's experience has been that even if the shackle pin is a good fit in the shackle, and is held either by a key or a flatted lug against any rotative motion in the shackle, it cannot be prevented from wearing the holes in the shackles out of round. In time this condition also partially cuts the pin in two, and after much of this kind of wear has taken place, replacement of both the shackle and the pin is necessary; and removal of the pin for replacement is very difficult. Working on the assumption that the wear is caused by countless little hammer blows, due to inability to make the pin initially a tight enough drive fit in the shackle, the construction was changed to clamp each end of the pin in the shackle, the clamp bolt being notched into the pin and so arranged as to hold the two surfaces tightly in contact. This construction, shown in Fig. 4, has been the means of obviating entirely any trouble due to wear of the shackle or the shackle pin where they come in contact.

Radiator and Hood Mounting

The writer has experimented with several different radiator mountings, rubber cushions, coil springs, and C-shaped flat springs. The results of these experiments showed a rigid mounting to be impracticable, and that flexibility in mounting is more essential than extreme cushioning. Truck radiators are more frequently injured by the strains put upon them from chassis frame distortion than from vibration, and the most desirable mounting is one which permits frame distortion without straining the radiator assembly and which, while giving a certain amount of cushion effect, is still rigid enough to prevent excessive vibration of the entire radiator on its mounting.

It has been the writer's experience that it is impracticable to carry the front end of the hood on a ledge which is integral with the radiator casing, as if the radiator is carried on a semi-flexible mounting, it has a slight vibratory motion, relative to the chassis, which results in destroying the hood hinges and tearing out the rivets at the front end.

We are now carrying the front end of the hood on an angle-iron frame which is bolted to the chassis frame, just back of the radiator. This frame is entirely independent of the radiator and carries a water drip molding to prevent the entrance of water between it and the radiator. The construction is simple and cheap, and has quite overcome the trouble we have experienced in the past, due to the hood rubbing and

chafing its supporting ledge entirely off the radiator casing, and destroying itself and its hinges in the process.

The subject of radiators naturally brings up the fan-belt question. A fan-belt is one of the most troublesome little things with which a truck designer has to contend. Of course, in truck practice, the conditions under which the fan-belt must operate are unusually severe, as the fan speed is fairly high and the pulley center distance is short. We run our fan at approximately 1400 to 1000 r.p.m. of the engine, and have never yet found a belt which, running on 14-in. centers, has what we consider sufficient life. We have tested many different kinds of belts, both flat and V-section, but have found nothing better than the riveted segmental V-belt, and that is not entirely satisfactory. It is to be hoped that some of the belt manufacturers will develop in the near future a fan-belt which will give at least 100 per cent more life than the types at present available.

Governors

All our experimental and regular service data point to the advisability of using a governor to limit the maximum engine and truck speed. It is the writer's opinion that chassis depreciation increases almost directly as the square of the road speed, but it is manifestly illogical to try to govern all trucks of the same capacity to run at the same maximum speed, irrespective of operating conditions. For instance, a truck which is governed to the best speed for proper life and maintenance costs for operation over the rough streets of Pittsburgh, ought to be capable of running faster with no greater depreciation over level asphalt streets in Detroit.

Higher Speeds Expected

As truck engine and chassis design improves, higher engine and road speeds are going to be permissible, and the increase will probably be obtained by speeding up the engine and possibly making it smaller, using somewhat higher gear ratios in order to obtain the present activity factors on direct drive. Betterment of city road conditions will also help to make higher road speeds allowable. The writer has carried on a great deal of experimental work on centrifugal governors in order to obtain the minimum speed range for governor action without "surging" or "hunting." Assuming maximum engine governed speed is 1000 r.p.m., the governor should not cut into the horsepower curve any earlier than necessary. Our earlier governors used to start acting at 925 r.p.m., closing the throttle tight at 1000 r.p.m. After a great deal of experimental work, we have developed a governor which starts to close the throttle at 950 to 975 r.p.m., and completely closes it at 1010 r.p.m., giving a range of 6.4 to 3.4 per cent. With the engine running at 1000 r.p.m. under light loads the governor should open the throttle as quickly as possible, when the engine speed decreases from an increase in the load, but owing to the friction to be overcome in starting governor action, the governor will not open within as close a range as it closes the throttle. This difference in opening and closing action is shown on the curve in Fig. 6. The curve was made from a 4½ by 5½ in. engine, the loads being checked in speed increments of 25 r.p.m. at all speeds above 900 r.p.m. The governor, with the characteristics shown, does not hunt or surge on the road, and has a very "snappy" action, opening or closing very quickly, according to variations in the road resistance offered to the progress of the vehicle.

Unsprung Weight

There has been considerable discussion recently concerning sprung versus unsprung weights on trucks, with particular reference, of course, to the rear axle construction. While the writer has as yet no conclusive data on the subject, it is his opinion that within reasonable limits, unsprung weight on a truck is not a disadvantage. Unsprung weight on solid tires, at comparatively slow speeds, is not analogous to unsprung weight on pneumatic tires at high speeds. We once made a visual check on contact between the tires and the road, by running a worm driven and a chain driven truck at the same speed over a stretch of rough pavement, making the test with the trucks both loaded and unloaded. When loaded, both trucks carried the same weight on the rear tires, but when unloaded, the worm driven truck was slightly heavier in the rear. So far as could be judged by careful observation, the tires of the worm driven truck left the road fewer times than those of the chain driven truck, either when carrying a load or running light. This condition could indicate greater tire mileage for the worm driven vehicle, as it is obvious that when the engine is pulling, tire wear must be increased when a tire leaves the road and accelerates somewhat while in the air, due to the differential, and is suddenly brought back to its original speed by slippage against the road surface upon its return to contact.

The rear axle unsprung weights of the two vehicles tested were 2162 lb. for the worm driven, and 1612 lb. for the chain driven, both trucks being of 3-ton capacity. The side chain driven truck admittedly results in the lightest unsprung weight construction. It is interesting to note that the increase in unsprung weight of the worm drive axle over the chain drive axle is only 550 lb. or 275 lb. per wheel.

Watson Tractor for Contractors

IN designing the Watson tractor the Watson Wagon Co., Canastota, N. Y., aimed especially to meet the requirements of the contractor. The 5-ton tractor is illustrated herewith attached to the Watson 120 cu. ft. semi-trailer. This outfit can turn without backing in a 31-ft. circle. The tractor's wheelbase is 80 in. and that of the semi-trailer, 11 ft.. 3½ in. The tractor uses a four-cylinder Continental motor with 4½ by 5½-in. cylinders cast in pairs, the power plant, radiator seats and steering gear being carried on a subframe to eliminate jar. Other features are: Timken worm gear rear axle; Bosch DU4 high-tension magneto with Duplex coil for starting; Pierce governor; Brown-Lipe four-speed selective gearbox; Gemmer steering and Sheldon springs.

Watson 5-ton tractor and 120 cu. ft. semi-trailer

The Search for the Army Truck Wheel

The Composite Wheel (1) as Front and Trailer Wheel (2) as Driving Wheel—An Examination of Its Possibilities

(Continued from June 22, pages 1122-1124)

By Marius C. Krarup

AFTER dealing in the first part of this article with the characteristics in the operation of composite wheels—of the type diagrammatically shown in Figs. 1 and 2, which are repeated herewith—for use as front wheels or trailer wheels (that is, as wheels that are pushed or pulled from the axle), the more doubtful use of the type for driving wheels now comes up for consideration, and this must be less general and more searching with regard to all quantitative factors, since this type of wheel has been tried, though only in primitive forms and under primitive conditions of service, more than once in the past and yet has failed to make its way into general automobile practice or even into the heavy transportation work for which it is probably best adapted.

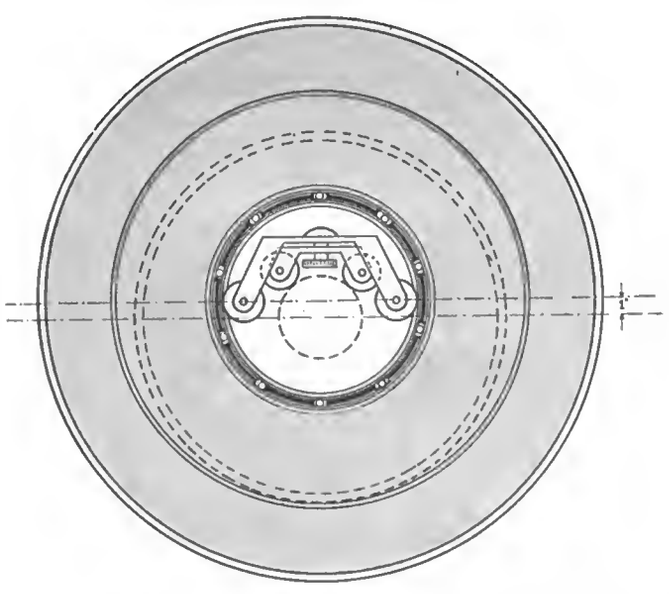
An inaccuracy in the first installment may be corrected first. Lines 16 to 11 from the bottom on page 1123 should read: The change in the location of the load pressure *in conjunction with the direct pull which may be received from the tractor additionally* must be sufficient to turn the road wheel over before the point of slippage is reached—the words here printed in italics having been omitted.

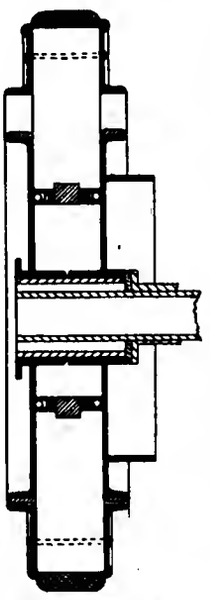
Fig. 3 illustrates diagramatically the factors and considerations which enter most prominently in the operation of the type as a driving wheel. The eccentricity of the driving wheel component in relation to the road wheel component is shown somewhat greater than in Figs. 1 and 2, partly to make the drawing plainer and partly as an indication that for heavy traction the more marked eccentricity figures out more favorably, while less desirable in the matter of making the wheel compact and attractive in appearance. The test equation presented in the following supplies a ready means for deciding the degree of eccentricity which it may be necessary to incorporate in a driving wheel of this type for any given set of service conditions, l and R being the factors affected which may be tried in the equation with different values or isolated and worked into separate formulas.

The first thing to be shown is the (1) general capacity for operating, and for this purpose the condition of a level but very heavy road is chosen. It is assumed that the friction between the driving wheel component and its track upon the road wheel component is secured by the choice of suitable materials, so that the contact point between them can rise to an angle of at least 60 degrees without chance of slippage occurring. While no greater angle than 45 degrees is employed in the example relating to steady running against heavy traction resistance, the larger angle may be desirable for starting or emergencies.

The Doubtful Points

Other conditions to be considered separately, but to which the test equation furnishes the principal clue, relate to (2) maximum speed, to (3) driving on rough roads, to (4) uphill work, to (5) downhill work and (6) braking, to (7) slippery roads and to (8) the possibility of designing this type of wheel in such proportions that the total gear ratio of a vehicle remains unchanged if the composite type is substituted for the ordinary type. Similarly the question of arranging the composite type in such manner that it may be transformed by simple adjustment into a wheel with ordinary wheel action comes up for consideration, provided it is made clear or probable that the type can be used advantageously for certain sets of conditions but not so well for other conditions which also may be encountered in the same service.





Figs. 1 and 2—Diagrams showing principal features in wheels of composite type

Fig. 1—Side view of the middle or road wheel component with tracks and thrust bearings. Device for maintaining contact of wheel sheaves with the tracks is shown in the central circular opening. Relations to axle and hub carrying the wheel sheaves are indicated in dotted lines

Fig. 2—Vertical section of assembled wheel, with omission of hub details and the central device. Brake drum is shown as integral part of the driving wheel sheave on the side of the wheel nearest the vehicle

The general capacity for operating is now to be looked into.

When power is applied and driving wheel Q is rotated forward from contact point a, there comes a moment, as when contact point b has been reached and the load L is held by the motive power at angle α, when the pressure of the load is balanced by the traction resistance. The road wheel Y still does not move, or its movement can be considered as infinitely slow. But any more advanced position of the driving wheel, such as with contact at c, causes the road wheel to turn and the vehicle to advance and to acquire momentum, the speed being determined by the angle β and a number of other factors subsequently referred to.

There is first to be determined whether the angle α is likely to be small enough to agree with practical requirements in the

starting of a vehicle, since it represents the minimum advance of Q necessary for producing vehicle movement. One has the equation

$$L \times \frac{R \sin \alpha}{p} = L f + W f \text{ or } \frac{R \sin \alpha}{p} = f\left(1 + \frac{W}{L}\right)$$

Where f is the coefficient of resistance to traction, L the load on the wheel at b, W the weight of the road wheel Y and p the distance in front of A at which traction resistance may be considered as concentrated, as depending on the hardness of the road (for given values of L and W and the wheel dimensions). $\frac{R \sin \alpha}{p}$ is then the leverage with which L is to overcome the traction resistance $f(L + W)$.

The equation, since it represents equilibrium, determines the maximum value for f.

$$f \text{ (maximum)} = \frac{R \sin \alpha}{p\left(1 + \frac{W}{L}\right)}$$

As W should be relatively small, one has approximately $R \sin \alpha = pf$ or, more accurately, $R \sin \alpha = pf\left(1 + \frac{W}{L}\right)$.

As f does not exceed 20 per cent in deep sand and p under this condition reaches perhaps a maximum of 6 inches, the system can begin to start a vehicle under these very unfavorable circumstances when $R \sin \alpha = 6'' \times 0.20$ (approximately) $= 1.20''$; and this makes α quite a small angle if the value for R—the radius of the driving-wheel track—is in the neighborhood of 15 in.

In the case of a steam vehicle or a gasoline motor truck with hydraulic transmission, these relations should be decisive to show that the composite driving wheel system will permit starting and operation at one speed or another. But for ordinary gasoline motor trucks the practical question relates to starting and running at the speed giving maximum torque for driving wheel Q, and this is the speed obtained on low gear with the motor running at normal speed. It may be 3 or 4 m.p.h. Let it be given as m m.p.h. vehicle speed. The question is then: At m m.p.h. what are the limit values for β, f and p, β being the angle, larger than α, at which a desired vehicle speed is produced)?

To avoid considering the initial acceleration of the vehicle at the start and the storing of kinetic energy, which is kept constant during running at uniform speed, the running conditions only are considered. This should be permissible, since it has been shown that a start at one speed or another is effected as soon as load L is rolled forward to contact b, even if f and p are very high.

The question of being able to apply the driving power to advantage now becomes that of deciding if the traction resistance encountered in moving the vehicle at m m.p.h. can be overcome for a given distance by the wheel action in the same length of time that the vehicle speed places at disposal. While vehicle advances the length of the arc ac at m m.p.h., can L fall the distance l which it must fall by reason of this vehicle movement and at the same time overcome the resistance to traction?

It is noted that while the power is continually keeping Y in contact with Q at c and keeping β constant (under the supposition of uniform vehicle speed here contemplated), the gravitation of L takes place independently. The rotation of Q nullifies the fall of L by exactly offsetting it, but when Q rotates as far as from a to c it offsets just the opposite movement of Q which would take place if no power were applied. The power thus raises L the height l, and the power thereby stored is the power available for overcoming the traction resistance. If this power is superior to the traction resistance, acceleration takes place, but it is here the question of examining the conditions for uniform speed. Hence we use an equation expressing the driving action taking place in the same length of time as required for the corresponding

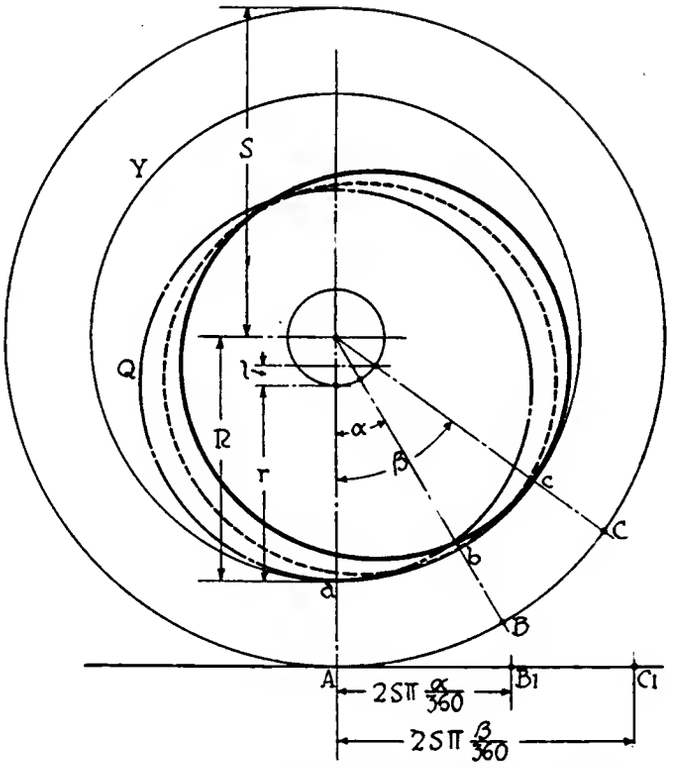


Fig. 3—Diagram illustrating factors which enter quantitatively in the operation of composite wheel type as traction wheel

vehicle movement (to make low gear torque of gasoline motor vehicle fully applicable):

L unrestricted would fall through height l in the time in seconds, $\frac{1}{4}\sqrt{l}$, (taking acceleration g as 32 ft. per second), but with resistance to overcome which equals $fp\frac{L+W}{R \sin \beta}$ if the fall of L shall be made uniform in velocity (in accordance with the foregoing), the time t for the fall is increased in the proportion which the resistance holds to L. One has therefore

$$t = \tfrac{1}{4}\sqrt{l} + \tfrac{1}{4}\sqrt{l} \times \frac{fp\frac{L+W}{R \sin \beta}}{L} = \tfrac{1}{4}\sqrt{l}\left(1 + \frac{fp}{L} \cdot \frac{L+W}{R \sin \beta}\right)$$

And as this time must equal (not exceed) the time in which vehicle advances $\frac{2S\pi\beta}{360}$ at m m.p.h., which is equivalent to $m \times 17.6''$ per second, the test equation becomes

$$\tfrac{1}{4}\sqrt{l}\left(1 + \frac{fp}{L} \cdot \frac{L+W}{R \sin \beta}\right) = \frac{2S\pi\beta}{360} \cdot \frac{1}{m \times 17.6} \text{ second}$$

in which all the linear measurements are inches and S the radius of the road wheel Y.

Example in Figures

If this equation gives a value for m (which stands for number of miles per hour) that agrees with practical values for l, f, p and β and with the vehicle speed at which a gasoline motor vehicle is best able to handle a heavy load on difficult roads, then a presumption seems to be established to the effect that the composite wheel system can be used, but it must be shown thereafter that it has special advantages and can be used on hills.

The values to be inserted in the equation may be as follows, making f and p represent high traction resistance, as in sand:

$S = 20'' =$ Road wheel radius
$R = 15'' =$ Radius of driving wheel track
$r = 12'' =$ Radius of driving wheel
$\beta = 45° =$ Angle maintained for high resistances to traction

$$l = R - r\,(1 - \cos\beta) = 3 - \frac{3}{\sqrt{2}} = 3 - 2.127 = 0.873$$

L is not important, since it is divided by itself in the equation, but its value may be taken at 1000 lb. with the value for W, the weight of Y, at 50 lb.

$f = .20$ = Coefficient of traction resistance in sand

$p = 6''$ = Distance in advance of A where f operates

These figures make the equation:

$$\tfrac{1}{4}\sqrt{0.873}\left(1 + \frac{0.20 \times 6}{1000} \times \frac{1050}{15 \sin 45}\right) = \frac{20\pi \times 45}{180} \cdot \frac{1 \text{ second}}{m \times 17.6}$$

$$0.2335\left(1 + \frac{1260}{10640}\right) = 0.2612 = \frac{15.7295}{m \times 17.6}$$

Here the left side of the equation shows that the wheel action involved, including the overcoming of the traction resistance, occupies 0.2612 sec. or about ¼ sec. Proceeding to get a value for m, one has

$$m \times 17.6 \times 0.2612 = 15.7295$$

$$m = \frac{15.7295}{4.59712} = 3.41 \text{ m.p.h.}$$

Even under the difficult traction conditions assumed vehicle can thus be operated with full benefit of the best torque and power, if the motor and gear reduction are such as to provide for normal motor speed when low gear produces a vehicle speed of 3.41 m.p.h. and the load on front wheels is not excessive. The load on the front wheels is here supposed to be taken care of in the large allowance for traction coefficient and p, in the margin left for increasing β, if necessary, up to the point where slip is likely to occur, and in the presumption of having front wheels of the same system as the traction wheels and thereby avoiding excessive resistances. But it is, of course, possible to modify the equation so as to make it include the front wheel resistances directly. The equation can, of course, be tested for high vehicle speed and smaller traction coefficients, as well as for different values of the dimensions.

[It may be doubtful, it occurs to the writer in revising these pages, if the leverage with which load L overcomes traction resistance should not be accepted as $R \sin \alpha - p$ instead of $R \sin \alpha$ divided by p. If this view is taken, however, the driving ability of the system is shown more favorably.]

(*To be continued*)

Paragraphs on Current Topics

By Marius C. Krarup

Motto: Radical Thought, Conservative Action

The real subject of this week is: Dusty or Dustless America—Which Shall it Be? For the roads make the only clouds that obscure the brightness of the belated summer. But the haunting vision of Dustless America calls for the building of one million miles of dustless roads—which would only be a road around every township six miles square, or at that rate. The cost would be that of a war, a pretty big war, but having the prosaic fault of being likely to come back with interest on the investment it seems excessive to the taxpayer who first of all wants dramatic interest. No, no more; a ten line paragraph would burst with insufficiency for holding this subject down. Dust, Roads and War, mentioning them in their order of importance, are combinedly more than a mouthful.

The Boundless Gangster Philosophy

Fewer persons know all the facts worth knowing in the management of any big thing to-day than ever before in history; mainly because there are more facts to be known. The complication of the world machinery becomes the ignorance of the individual. He is more liable to be fooled. The art of co-operation among specialists must be the cure for the resulting biological incompetence, extending alike to the leaders and the led, as in Europe's war. And here, in the art of co-operation, business men and engineers can give pointers to statesmen.

On this profound basis we begin to realize that the S. A. E., having now started on a policy of expansion of its activities and scope, should deliberately embrace statesmanship. The Automobile Club de France did so long ago. Industrial Preparedness furnishes the entering wedge. One S. A. E. foot is firmly jammed in the doorway and can hold it open for a spell, while plain members are warming up to their opportunities. Then there is the presidential campaign offering a chance for any S. A. E. orator who can learn not only to drop his pies and exes—that is easy for most of us—but also to shout fallacious platitudes with real fervor and to abandon completely that fine reserve by which engineers who respect the rules of the guild manage to convey that they would have a world of more interesting things to say if they were not restrained by grave professional considerations and responsibilities—but which is lost ignominiously on an untutored populace.

Perhaps there is not really any good reason why the S. A. E., or any other society which has gained a foothold, should not aspire to rule the world. Any society can stick to its last, like a shoemaker. Saint Simon, Auguste Comte and Nietzsche might all be quoted for expanding the activities of a bunch of men as far as they will stretch. How may the world otherwise find out who is fit to rule it?

On Advertising and Culture

As noticed last week, fastidious literary persons are finding fault with automobile advertisements. This is serious. Literature has had ample time to get used to the automobile way of doing things. Yet it does not always fall in line in the right spirit. It cajoles one minute and jeers furtively the next. Automobiles and Culture are not referred to in one breath, in the public prints affecting literary selectness, as often and spontaneously as needed for inculcating a proper and instinctive perception of their intimate association in the social structure. Being practical persons and determined to remedy this situation, we issue the following:

NOTICE.—Every now and then ex-President E. of Harvard receives press notices from other sources. No doubt, they are paid for. If he will shorten up that 5-foot shelf of books which he recommends as sure to produce a high grade of culture (if read), making it about 9 inches, and will include two or three substantial works on motors and automobile construction, we will let him have some free and high-class advertising. Until then, nothing doing.

We want a 40-hp. culture, if you please; one with a honk that scats the crowd.

Mechanical Inklings

A few months ago the number of cylinders was eagerly discussed. To-day it has been tacitly resolved that this subject is a good one to turn over to public opinion without comment. But now the slap of the piston has caught the ear of the wakeful. And what is the slap? Something like the Emperor's New Clothes in Anderson's tales, which could not be seen by anybody who was not fit for his job. It takes

special ability to hear the slap. Yet there is a murmuring about crossheads, with all they imply, to be sure of getting away from the faint sound. The exaggeration must wear itself out, but the refinement of suppressing the slap will surely be effected, wherever it may be needed, by some simple means quietly devised—perhaps only a change in dimensions of rings and grooves for aluminum pistons; perhaps a new little find in the design of steel pistons of the divided type with lengthened trunk and reduced weight.

The most dissenting opinions may be heard as to what the final type of heavy business truck will be. One of them, we venture to say, though with fear of contradiction, will have front driving with fifth wheel steering, a short wheelbase and an auxiliary small motor to drive the rear axle when needed. There will be no mechanical connection between the motors, but one will time the other through the resistance to propulsion. The rear one will have a single radical reduction gear, giving 4 m.p.h. at 800 r.p.m., with twice this speed possible and the fuel charge and composition under positive control at any speed. It will be air-cooled and easily dismountable. It will be started and stopped by clutching and unclutching it by action from the driver's seat. The fuel will not be fed through a carbureter.

If every city had X/a square miles of central area within which 4 m.p.h. was maximum vehicle speed, excepting bicycles only, a development of low-gear mechanism or low power application would follow whose effects would be incalculable. For eventually people must learn that they are not really very often in such a hurry as they now assume they always are. At the same time, belt line automobile streets would come into existence and soon would become modern Pradas, centers for light, leisurely and elegant activities along the sides and bustling with rapid vehicle traffic between the curbstones. Whether desirable or not, such an evolution comes logically hard upon the heels of the exploded contention that speed relieves congestion, which is mathematically correct but humanly impossible where little Fluffy with the saucy eyes, deep in the cushioned corner of the limousine, would rather occupy 100 sq. ft. in the street than 2 sq. ft. on the sidewalk, and insists on it.

□□□□

"Again a man having much to live with, if not for, died from skidding," is the brief obituary noticed in *Index of Contemporary Thought*—a journal often found in taxicabs and streetcar seats. But is this a mechanical, a psychological or a sociological item?

Aeroplanes for Sport and Utility

By Marius C. Krarup

WHETHER aeroplane construction is or is not to be taken up by a goodly number of automobile manufacturers, several are contemplating the possibility. Two years of hammering reports on the aeroplane feats of the war have made the expectation of a public demand for aircraft more plausible than it was previously. The impression created is one of enormous strides of progress in their construction and of huge profits in supplying the machines. In reality, though the metallic construction details are better and more easily obtained than they were, the general design shows so far no radical progress. The equipment with gyroscopic safety devices represents the most important improvement. The rest is greater size, more powerful motors; hence more speed or more carrying capacity, one or the other or a little more of both. Increased speed capacity means a quicker and therefore a safer start, but on the other hand a greater demand for skill in both starting and landing. In the air it means additional safety in some degree, but mostly when held in reserve for instantaneous application in the atmospheric emergencies known as holes or rivers in the air, which can render the steering gear and even the gyroscope ineffective for a moment that becomes fatal to the less skillful and, if the machine is near the ground, to any operator. The earth remains attractive and hard to dodge. The greater number of skillful operators and the much wider diffusion of knowledge useful for deciding on the type of aeroplane that is best for a given purpose seem to constitute the most promising factors, in addition to the gyroscope accessory, which make the situation different from what it was two years ago—so far as aeroplanes for pacific purposes are concerned.

No reports on the gyroscope are so explicit as to make it safe to infer that this balancing device is worth more in peace than in war, where it does not seem to be used extensively, interfering perhaps with the daring swoops and rapid maneuvering demanded for military efficiency. The hydro-aeroplane type is still at the mercy of rough waves and weather when it lights on the water. No small-power hydro-aeroplane has been evolved.

The automobile manufacturer in looking into the situation takes note of these things of course. Either he contemplates to manufacture for military purposes alone, in which case the cost of the machines and the danger involved in operating them are secondary, or he figures that he can also produce machines which will be in demand under peaceable conditions. As everybody understands that if peace comes tomorrow the ardor for war machines will cool the day after, or at least that such is likely to be the result here and that Europe will take time to produce her own war machines, the business viewpoint would seem to be mostly concerned with machines for peace and to rest largely on the assumption that some change has taken place which now makes the aeroplane fit for peace, although the public said unmistakably before the war that it held a different opinion.

Looks Like Doubtful Business

As heroism without due cause has no strong appeal, a good measure of safety is probably indispensable to make the aeroplane a popular civilian success, and it must be a safety that is under control by caution, not depending too much on high skill or the mere unlikelihood of encountering high-stress conditions in the elements—in the air, on water, on the ground.

Very high motor power, very great size of the machine, very great cost are all factors which would militate against popularity. The need of large storage space and sheds, large and smooth starting and landing ground would constitute another objection. Necessity for rising high in the air to be out of danger from gusts of wind would interfere with the acquirement of skill, and the civilian aeroplane must be one that invites to practice.

Taking all these things into consideration, one asks: How must then the aeroplane be constituted which shall be safe enough, good enough, cheap enough and interesting enough for the average American civilian of the class who under present conditions would consider the aeroplane at all as an instrument for sport or transportation? Does such a type exist or must it be created?

The Santos Dumont aeroplane with which Garros gained his skill at first had strong features to recommend it. It was light with a relatively large sustentation area and only a

small motor. It fluttered over the ground as a butterfly and bounced as a rubber ball, harmlessly, when it struck rough spots before rising. Its angle of incidence was naturally high until it got up and some speed was gained. But it was not much more than a learning-machine. It was less safe in the air than the machines—heavier, more powerful and with narrower and more flattened planes—which gave beginners more trouble and danger on the starting ground. It was a monoplane, which is not what war experience now recommends. On the other hand, the monoplane can readily be made with folding wings, so as to require small storage space, while no biplane has so far been made which can be taken down or set up in a few minutes by hitching the two planes separately to the body of the machine.

Perhaps easy storing is one of the requirements which must be sacrificed for the present, and in that case one turns to the demand for safe starting and safe practice without the handicap of demountable construction but short of one popular advantage. The hydro-aeroplane seems at once the most plausible type. It is practically always a biplane but with the lower plane shorter and stouter than the upper. It might be called a sesquiplane. It can be stored at the edge of a lake or river in most cases, which is usually convenient and inexpensive, but with a construction adapted for starting from water only its use would be too restricted from a business point of view. The popular type must be easy to start on either land or water, or at least easily convertible in this respect. No type of this description has made its appearance as yet. Dimensions and prices are far beyond popular limits.

In order to really invite to such frequent practice and use as alone can make a vehicle of any kind popular, the hydro-aeroplane should be sure to dump its pilot into the water gently and free of entanglements in case of a spill, or else to come down upright with the occupants on top.

The most diligent survey fails to disclose any basis for expecting a boom in private aeroplanes for either sport or utility until some radical change has been brought about in all the features relating to the convenience and safety in using them. Farmers are as a class best situated for making use of aeroplanes. People living or summering at lakes or sea shore or in the mountains come next in numbers. But one cannot imagine that many of these classes would invest in machines costing much more than one thousand dollars or machines which their children could not be trusted to use. Automobile manufacturers cannot but know that this market will not pay for the work of gradually developing an individual aeroplane from the data at present available until it may finally meet popular requirements. The transition stages in such a development are missing. But as an industrial sport for wealthy manufacturers participation in such a development should be interesting.

The aeroplane omnibus, stage or excursion craft is more nearly in line with the improvements which the aeroplane has received during these two years of war than the low-priced individual machine. It may be reserved for the public service aeroplane of large size to familiarize people with flying and constructively to bridge the gap separating the existing types of "heavier than air machines" from popularity.

Universal Has Cast Iron Bearing

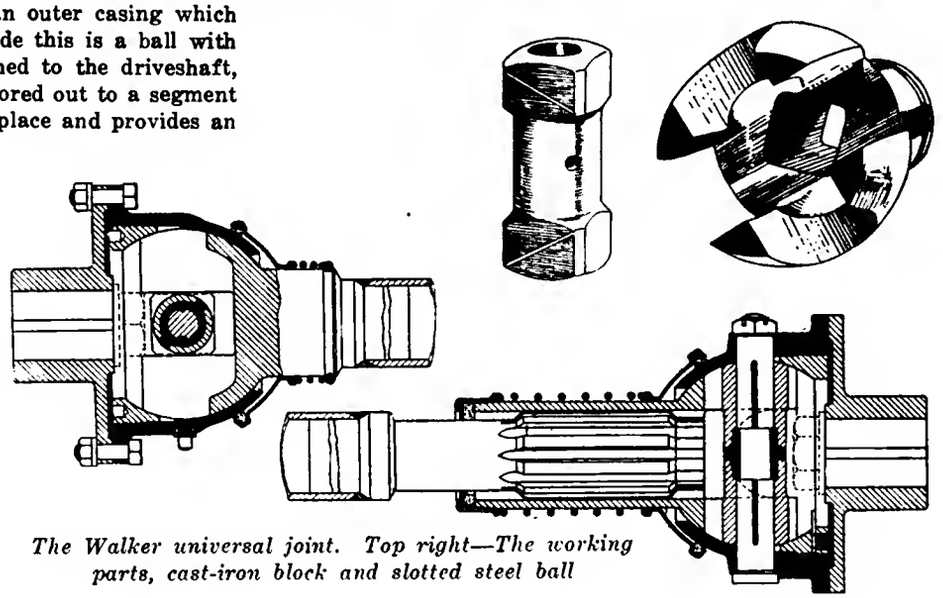
Large Surface and Ready Adjustment Features of New Joint—Contains Lubricant Which Is Distributed Automatically to Working Parts

THERE seems no end to the possibilities of universal joint design as, despite the almost endless number of patterns already in use, patents for new types are granted fairly often. The latest to appear on the market is the Walker, made by the Walker Joint Co., Detroit, and this is interesting in many ways. Firstly, it has a bearing surface composed of cast iron working against steel; it has also an adjustment for taking up slack and uses the principle of the spherical joint to hold the driveshaft absolutely central, while also insuring the retention of lubricant.

The details are made amply clear by the illustrations, the sectional cut showing two right-angle views through the center of the joint and the perspective sketch the two main parts of the joint. Briefly, there is an outer casing which is bored out to a spherical form. Inside this is a ball with a shaft integral with it that is attached to the driveshaft, and an adjustable securing ring, also bored out to a segment of a sphere, holds the ball member in place and provides an adjustment for keeping the ball from developing any shake in its casing.

In the ball four slots are cut, as shown in the sketch; two of these slots are rough, being merely for the sake of saving weight, while the other two are finished accurately. Within the latter slots is placed the square-ended block, also shown in the sketch, and it is this that is the cast-iron part. There are two holes opposite each other in the outside casing, and a bolt is passed through these holes and also through the cast-iron piece. The bolt is locked in the casing so the cast-iron block turns on the bolt, giving motion in one direction, while the ball can rock to and fro within the limits of the slots, thus giving motion in the other direction.

It is easy to see that the whole joint, when assembled, can retain a considerable quantity of lubricant. In the sketch it will be noticed that there are holes drilled near the middle of the cast-iron piece, and in the sectional drawings the path of the oil within the bolt is shown by solid black. Centrifugal force takes oil or thin grease from the center and carries it out to the working surfaces at the ends. When it escapes from these it lubricates the spherical surfaces, and the rocking of the ball keeps all the lubricant churned up so that there is a continual circulation. The remaining mechanical details are made completely clear by the drawings.



The Walker universal joint. Top right—The working parts, cast-iron block and slotted steel ball

AUTOMOBILE

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NEW YORK, JULY 13, 1916

Ten cents a copy
Three dollars a year

Stewart

Speedometers for Fords

The Market Grows Bigger Every Day

Run through the pages of this book.
Note the preponderance of Ford accessory advertisements.
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The History of the Pneumatic Tire—9

Advantages of the Wired-Base Tire—Many People Did Not Believe in the Pneumatic Construction, But Favored the Solid Type—Inventions of 1892

The History of the American Automobile Industry—36

By David Beecroft

WITH the wire-edged tire the fabric could be rather long for a given rim size, and therefore loose and free to yield longitudinally. Accordingly, it could pass over an obstacle without lifting the wheel to such an extent or straining the fabric so much.

Wired-Base Tire Gains

To state the matter in another way: We may consider the constrictive tire tread as a section of a boiler shell, having the diameter of the wheel, whereas the strain on the fabric of the wired-base tire is that of a boiler shell, having the diameter of the tire itself. These diameters vary extremely, the wheel diameter being in modern automobile practice eight to ten times the tire diameter. It is not possible, however, to find in tires as actually constructed this difference, because the fabrics used are generally placed so that their threads are more or less diagonal and each tire partakes to some extent of the advantages and disadvantages characterizing the other. The wired-base tire, at first in a very small minority because the Dunlop was never properly introduced in America, has grown until it has a wide following. Its progress therefore has been more rapid than that of the clincher type.

In this struggle for a solution of the tire problem there were a very large number who did not believe in the air or pneumatic tire. It seemed incredible that the busy American public would bother with vehicles having tires that could be incapacitated by the distressingly common tack or nail in the city streets or the osage orange hedge thorn of the Middle West. Many inventors, therefore, clung to the belief that the pneumatic tire would be short-lived and some all-rubber substitute take its place, while others aimed to make such a compromise as would give them a rideable cushion tire in case the pneumatic deflated.

The Victor Arched Tire

Not only was the Victor arch tire pushed as a substitute for the pneumatic, but the Pope company held for a considerable time to the cylindrical all-rubber tire and gradually worked from this to the cylindrical inflated tire, later called hose pipe. These tires, however, would crack longitudinally above the rim where the most bending occurred and finally the top would separate from the base with results often dangerous to a bicycle rider.

To overcome this, Duryea, in 1891, brought out a cushion tire having its cushioning chambers placed radial to the wheel instead of the circumferentially placed. These holes, or air spaces, permitted the rubber around them room to compress but did not cause this rubber to bend or fold upon itself, and so it was free from the breaking so common to the other tires. Instead of the rim extending up each side of the rubber base, and inclosing a considerable weight and cost of dead rubber in the base, this Duryea cushion tire had lips at each edge of its base which extended into grooves in the rim and were cemented therein. This made a secure fastening, as it was almost impossible to pull these lips out of the grooves and the amount of dead rubber in the tire was almost nil.

Many Forms in 1892

The year of 1892 brought out a constant succession of new tire forms, some of which were radically different, and others were simply modifications of the better known types. The ideal tire of Phelps & Dingle resembled the Dunlop except that the wires were not endless, but were passed through the rim at one point and tightened by nuts. The tendency of any tire to creep around the rim rendered this form likely to tear the fabric where the wires came out of it and entered the rim, so this fastening did not find success.

Another inventor brought out a similar fastening, except the wire was endless and of double length. By putting the tire in place and drawing the wire coil tight in the tire edge, enough slack was secured in the second coil of the wire which was not in the tire edge to permit getting it over the edge of the rim. This left the tire with some slack as soon as the two coils or lengths of the wire had found their position, but with the lightly inflated bicycle tires this slight looseness did not matter much. The great danger was that the fabric would tear when the wires came through it. so this form was abandoned.

The Rostrum

Operation of an Automobile Engine

EDITOR THE AUTOMOBILE:—Please publish particulars regarding the work of an engine in an automobile. Can you explain to me the running of an automobile motor from the time it is started until it has stopped? By this, I mean, just what parts come into action, at what time and how?

Flint, Mich. M. P.

—This is a very elementary proposition as there is nothing very complicated to the automobile engine. From the time it is started until it is switched off at the end of the run the following operations take place:

The engine is first cranked. In the older cars this is done manually by turning a hand crank on the end of the crankshaft. In the modern engine the cranking is done mechanically by an electric motor. The starting switch is closed, allowing current to flow from the storage battery to the starting motor. This motor is in engagement with the crankshaft of the engine and as it turns over due to the electric current from the storage battery it cranks the engine. During the cranking of the engine the downward motion of the pistons on the suction stroke draws in air into the carbureter and gasoline from the carbureter jet. These mix in the mixing chamber of the carbureter and pass into the engine through the intake valve. The next stroke compresses the charge in the cylinder and when the piston reaches the top of the stroke a spark occurs, due to the electric ignition apparatus operated in connection with the engine.

This spark explodes the gas compressed in the cylinder which causes it to exert a pressure due to its quick expansion upon the head of the piston, pushing the piston down which in turn carries with it the connecting-rod that rotates the crankshaft. The crankshaft is connected with the clutch and then the drive passes back through the gearbox, driveshaft and axles to the wheels. Once the first explosion has occurred the action of the engine after that becomes automatic and necessity for the cranking medium ceases to exist. While one cylinder is exploding another is taking in a fresh charge, in the multi-cylinder engine. The action of the four-cycle engine as used in automobiles is to draw in the gas on one stroke, compress it on the succeeding, explode it on the next and exhaust it on the last. The drive is from the piston to the connecting-rod and then to the crankshaft. Geared to the crankshaft is the cam action for the valve and the auxiliaries such as the generator, ignition distributer unit, etc. All motion is stopped as soon as the ignition is switched off, stopping the gases when exploded.

Order of Magneto Spark Delivery

Editor THE AUTOMOBILE:—A six-cylinder engine fires 1, 4, 2, 6, 3 and 5; the magneto is geared 1½ to 1. Are cylinders 1, 2, 3 sparked by one cam of the magneto and cylinders 4, 5, 6 sparked by the other cam?

Nashua, N. H. W. H. C.

—A magneto generally gives two sparks to the revolution, therefore, when geared 1½ to 1 the magneto furnishes six sparks for every two revolutions of the crankshaft or three sparks per revolution. Since the engine will fire 1, 4, 2 on the first revolution, cylinder No. 1 will have the top break, cylinder No. 4 the lower break, and cylinder No. 2 the top break. On the next revolution cylinders 6, 3 and 5 will fire allowing No. 6 to have the lower break, 3 the top and 5 the lower. Thus, the same cam breaks fire cylinders 4, 6 and 5 and 1, 2 and 3 as you state in your letter.

Adjusting Differential on 1915 Reo

Editor THE AUTOMOBILE:—Kindly publish diagram of differential of 1915 Reo and give manner of adjustment. This car has too much slack in driving shaft, which I believe to be from transmission back. Advise how to adjust this.

I have a friend who drives a Hupmobile and to every tank of gasoline he adds a quart of cylinder oil. He insists that it is a benefit and that it would likewise prove beneficial to the Reo. Both motors are in perfect condition. Kindly advise me whether or not this adding of oil would improve running of Reo motor and if so, please explain why.

Coushatta, La. S. M. C.

—The lost motion you speak of as existing in the driveshaft is something that cannot be adjusted without securing new universal blocks. This probably will remove the condition which now exists. The diagram you request is not necessary in making the matter clear.

The practice of adding oil to the gasoline is quite a common one and will do no harm. However, if the cylinders are securing sufficient lubrication from the regular oiling system there is no necessity of increasing the amount of oil feed by adding it to the gasoline. This method of oiling a motor was used to a large extent when two-cycle engines were employed in automobiles. It is quite common to use cylinder oil in the gasoline in two-cycle marine practice even to-day.

Information on the Diesel Engine

Editor THE AUTOMOBILE:—Kindly publish information as to how the fuel oil is forced into the cylinder of the Diesel motor.

2—Is the fuel mixed with air, or oil alone forced in?

3—Is the fuel injecting mechanism of necessity slow speed?

4—What is the lowest compression that could be successfully used in the Diesel type with kerosene fuel?

5—What are the faults of the fuel-injecting mechanism as used on Diesel types of motors?

Tampa, Fla. L. C. H.

—The principle of the Diesel engine is as follows: It operates on the four-stroke cycle and has exhaust and inlet valves just like a conventional engine. The inlet valve admits pure air only and the compression space is very small, so that the air charged is brought to a high pressure. In the cylinder head there is a small valve through which fuel is forced by air raised to a very high pressure indeed in a separate three-stage pump. The degree of compression in the main cylinder has to be such that the charge of pure air will be heated to a temperature sufficient to ignite the fuel. Thus a Diesel gasoline engine would require moderately low compression while a Diesel engine for burning the heaviest

kind of crude requires a much higher compression. The reason that the Diesel engine has not been developed in small sizes is mainly the difficulty in handling extremely small quantities of fuel. In the Diesel system the high pressure air is admitted to the fuel valve at the top of the compression stroke and fuel is thrown in during nearly the whole of the working stroke, burning in the compressed air as it enters the cylinder. When a cylinder is so large that it will consume a wineglass full of fuel each stroke, it is easy to measure and control the fuel, but where it would need only a few drops the measurement becomes far more delicate.

Use Standard Bulbs on Dodge

EDITOR THE AUTOMOBILE:—Can 40 candlepower nitrogen headlight bulbs be used on a 1916 Dodge car without battery damage?

2—Approximately how much daylight driving would be necessary to keep the battery up?

3—When driving at night and indicator shows charge with all lights on, is the generator not supplying enough current to take care of lights and charge battery?

Canton, Ohio. T. L.

—We do not recommend the use of any other headlight bulbs than the standard 12 volt., 15 candlepower.

2—It is impossible for us to make any statement as to how much daylight driving would be necessary to keep the battery up. It depends entirely on how much night driving is being done, and how many times the car is started during the day. The starter-generator under the usual running conditions will keep the battery properly charged. If for any reason the car is subject to a lot of abnormal driving such as driving most of the time at night at low speeds and doing a great deal of starting during the day, the battery should be checked up by means of a hydrometer about once every two weeks. This will show whether the car is being driven enough at charging speeds, to keep the battery in good condition.

3—It does not necessarily mean when driving with the lights turned on and the battery indicator shows charge, that the battery is being charged, as only enough current may be generated to light the lights, as the indicator simply shows whether the starter-generator is charging or discharging. However, when traveling at 18 miles or more, the starter-generator will be charging the battery whether the lights are turned on or not.

Graphite as Lubrication Aid

Editor THE AUTOMOBILE:—I do quite a little car driving but do not have time to take care of my car. I would like to know whether flake graphite in the oil would be of any help, and how much? An oil man told me that it would keep an engine in perfect order as it reduced friction.

Chester, N. Y. C. F. J.

—If the proper grade of graphite is used it will be an aid to lubrication. It is very important, however, that you secure the correct graphite as all graphites are not lubricants, strictly speaking. The manufacturers of graphites can furnish you with the proper grade for various purposes.

Timken 5-Ton Worm-Driven Truck Axle

UP to this time the popular sizes of worm-driven truck axles have been within the range from ¾-ton to 3-ton, there has been a growing demand for this type of drive in larger truck units, and to meet such, the Timken-Detroit Axle Co., Detroit, Mich., has come out with a 5-ton unit that has long been in the process of development. This new Timken product is doubtless one of the largest axle types of the worm-drive form yet produced, and it speaks eloquently of the ability of the engineers who are responsible for its design.

This new axle has a pressed-steel housing of great strength, and is equipped with the Timken-David Brown worm gearing with Timken roller bearings. The worm is mounted over the wheel, and throughout the construction is typically Timken. That a large factor of safety has been used is evidenced from the fact that the axle is capable of carrying on the rear tires a weight of 15,000 lb.

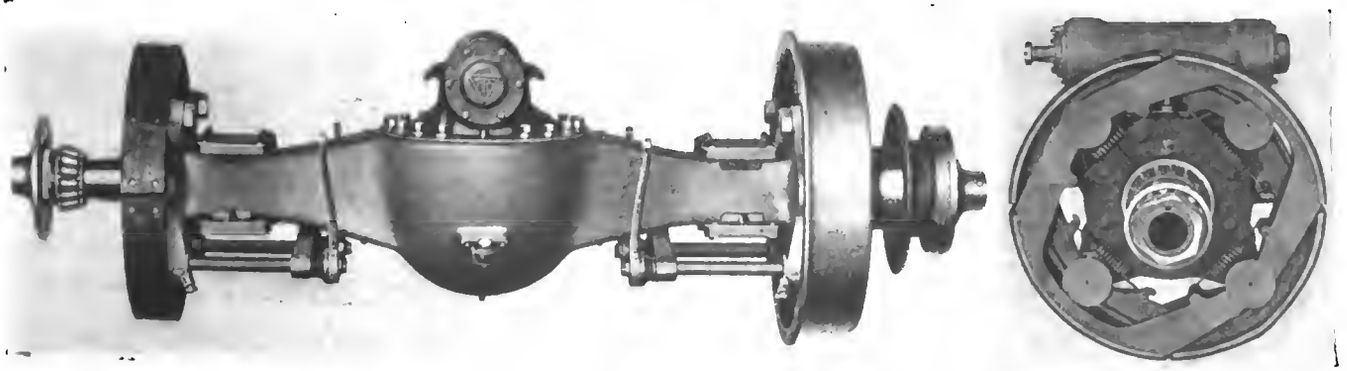
The load-sustaining portion is continuous from spring seat to spring seat, and is a pressing 6 in. square at either end under the spring seats, and enlarges to a spherical shape in the center to provide clearance for worm gear and differential. The square section at the ends has been used in order to give a firm seat for the spring saddles and added strength where it is needed. The center is open at the top for the attachment of the carrier flange which holds the worm shaft and its bearings, the worm gear, differential and bearings being in one complete unit. The ends of the housing are flanged to a large diameter and the brake spider is riveted to this flange substantially.

The axle is designed as a floating unit, and the wheel bearings are mounted on chrome-nickel steel tubes which extend inwardly toward the worm almost to the differential bearings, thus making a sturdy mounting for the shafts, the bearing supports being filler pieces welded and riveted to the housing, and the tubes forced into these filler pieces under great pressure. Thus the axle has a truss or bridge construction, which is the strongest type.

Brakes are 24 in. in diameter and 4 in. wide and are of the internal duplex form. Substantial flanges on the drums provide against distortion.

Some of the dimensions are:

Overall length—89⅞ in.
Centerline to bottom of housing—9 11-16 in.
Centerline to top of carrier—13⅛ in.
Centerline to forward end of worm shaft—13¼ in.
Centerline to centerline of spoke—69½ in.
Diameter of axle shafts—2¼ in.



Left—New 5-ton Timken floating worm-drive axle for trucks. Right—Brake construction and worm mounting

ACCESSORIES

Ryerson Connecting-Rod

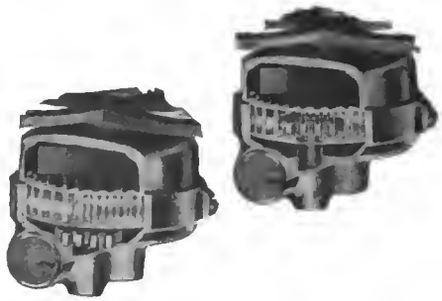
THIS new connecting-rod and bearing enables the owner or repair man to install in a Ford engine a bearing of the same type used in practically all the high-priced cars. The outstanding feature of this product is the fact that it does not require a complete overhauling of the engine but may be installed in a few minutes. When a car has been equipped with these Quick Change rods and bearings, new bearings may be slipped in when necessary without tearing down the entire engine. The bearing is the Glyco patented skeleton construction of reinforced babbitt, consisting of a strong skeleton introduced into a high-grade babbitt and finished with great accuracy. Special laminated shims come with each set of bearings which are inserted one on either side where the halves meet. These are composed of metal leaves 0.002 in. thick and are peeled off at intervals as the bearings gradually wear so that the fit will be as nearly perfect as possible at all times. Individual boxes each contain one complete connecting-rod and bearing.—Joseph T. Ryerson & Son, Sixteenth and Rockwell Streets, Chicago, Ill.

Muller Wash Lamp Stand

A large reflector with four lights is horizontally mounted on a vertical standard with a cast-iron base supported on three casters. The position of the reflector is adjustable. Fifteen ft. of cord are supplied. The device is guaranteed to be waterproof. Price, $10 and up.—Edward Muller, West New York, N. J.

Rex Lock for Fords

The Rex lock replaces the regular Ford steering gear cover, and is attached to the internal gear case just below the steering wheel. The case contains an internal gear and pinions. When the key of the lock is turned, a geared sector is moved down between two of the gears, locking the steering gear so that it cannot be moved. Thus when the lock is set the car can move only as the front wheels are set, which may be straight ahead or at any angle. The maker states that the lock cannot be picked, and that if it were smashed the steering gear would be disabled. No drilling is required to install the device and only ordinary tools are needed. It sells for $4.—De Tamble Mfg. Co., Chicago, Ill.



Rex lock for Ford steering gear

Storm & O'Hair Reboring Tool

Cylinders used on any make of engine and from 2¾ to 5 1/16 in. diameter may be rebored by this adjustable machine which has two thread bars, one left and one right, the former being for Ford engines and the latter for all other makes. The regular machine is furnished with seven lead rings as follows: 3⅝, 3⅞, 4, 4⅛, 4⅜, 4¼ and 4½ in. Price, $60. Small head and attachments for boring cylinders from 2¾ to 3¾ in., four lead rings. Price, $20. Large attachment, working in connection with regular machine, two lead rings, $15.—Storm & O'Hair, Thompson, Iowa.

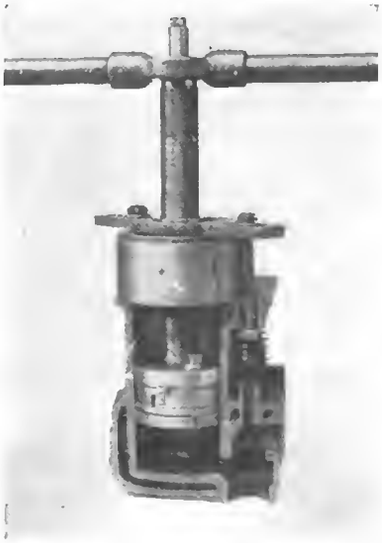
Hand-I-Wash

This is a combination of water, soap and towel put up in a can about 3 in. in diameter and 1 ft. high. By turning the outlet on the top of the can the liquid may be sprinkled on the hands and is just like soap and water. The hands are then dried by tearing off a section of the paper towel which is on a roller in the body of the can. Both liquid and towel may be purchased separately so that when the can is empty, it may be refilled. The liquid will remove all kinds of dirt, grease and oil, is antiseptic and neutral, containing neither acid nor alkali. Price $1; refiller, consisting of towel roll and tube of liquid 50 cents.—Tay-Miller Mfg. Co., 1714 Cherry Street, Philadelphia, Pa.

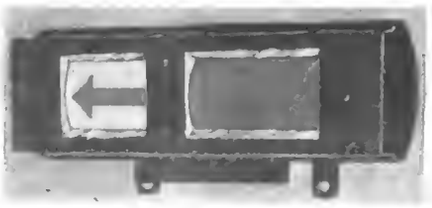
Water, soap and towel in one can

Automatic Signalite

A rear safety signal which operates by day or by night and indicates when a

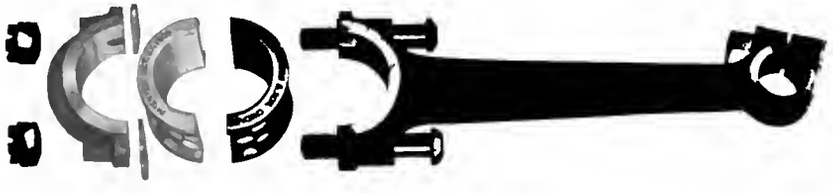


Storm & O'Hair reboring tool outfit

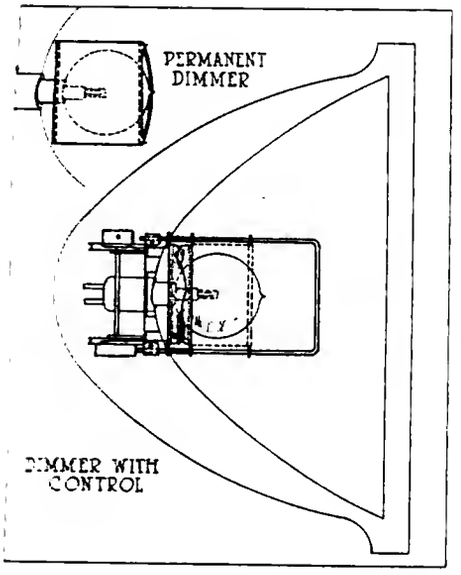


Automatic Signalite

Storm & O'Hair reboring tool outfit



Ryerson Quick Change connecting-rod and bearing assembly for use on Ford cars



O-U-Lite dimmer in which a cylindrical silk sleeve is used to remove the glare

turn to the right or the left is to be made, slowing down, stopping and backing to the right or left. These various functions are performed by the turning the steering wheel, depressing the brake, engage and reverse, etc. A hand lever attachment for indicating turns to the right or left will also be supplied, if desired. It is illuminated with a standard tail light bulb and carries the license plate. It may be attached to any car in 30 min., it is said.—Signalite Mfg. Co., Kansas City, Mo.

O-U-Lite Dimmer

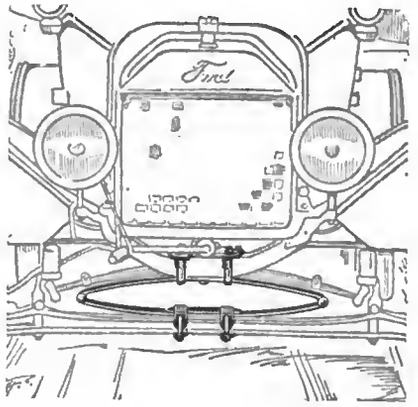
This is a small silk shade and in the permanent type is held by a metal frame and completely incloses the lamp bulb. In the control type the silk shade may be telescoped against the back of the reflector to give full power from the lamps. Price for electric lamps, $1, with control on lamps, $3.50, with control on steering post, $5.—O-U-Lite Co., Racine, Wis.

Twin Safety Spring Check

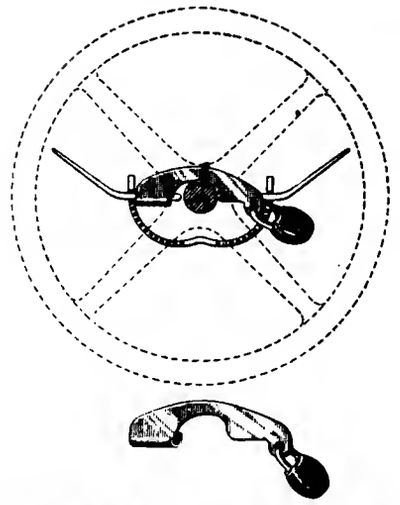
This is a device which is particularly for Ford cars and is designed to prevent side sway and lurching when driving at high speed or over rough roads, consists of a full elliptic single leaf spring which is clamped between the cross frame member and the front axle. Price, $3.—Twin-Rim Co., 103 Massachusetts Avenue, Boston.

National Mix-O-Lock

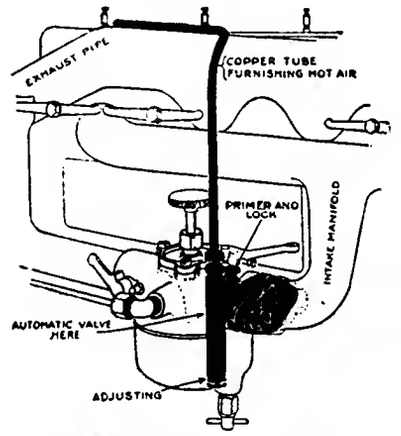
This device combines a gasoline saver, primer, carbon remover and lock for Ford cars, consisting of a flange which bolts between the carbureter and the intake. There are no holes to be drilled or capped; all that is required is a wrench. It contains an automatic valve which admits more air when required and has a plug which may be removed, thus preventing the starting of the motor, as



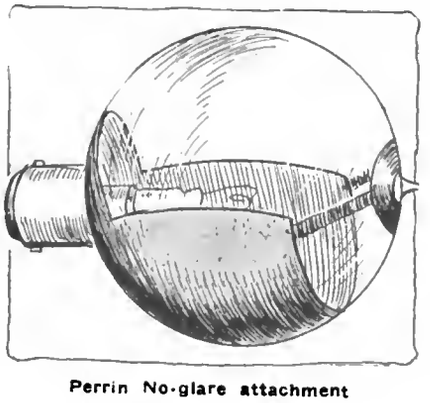
Twin safety check for Fords



Adams spark and throttle lock for use on Ford cars



National Mix-O-Lock for Fords



Perrin No-glare attachment

the absence of the plug renders it impossible for gasoline to be sucked from the spray nozzle. Price, $2.—National Motor Supply Co., 5606 Euclid Avenue, Cleveland, Ohio.

Perrin No-Glare

This device is not a dimmer but an intensifier of the light on the road. The No-Glare is a deflector made of special aluminum which fits snugly around the lower half of the light bulb, without any vibration or danger of breaking the bulb.

The Perrin device complies with the recommendations of the Society of Automobile Engineers, as none of the light rays are over 42 in. above the road at 75 ft. from the car. It gives 10 ft. of side light 10 ft. in front, and objects are clearly lighted 150 ft. in advance of the car.—Perrin Mfg. Co., Detroit, Mich.

Adams Spark and Throttle Lock

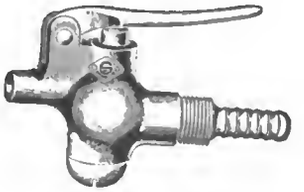
This lock is designed to control both the spark and throttle levers on Ford cars, hooking over one lever and being held to the other by a padlock. The devices are made of sheet steel and nickeled, the lock being a four-tumbler type and furnished with two keys. Price 50 cents.—A. L. Adams, 18 Normond Street, Springfield, Mass.

Stevens Air Cleaner

This device, called the Stevens automatic blow cock and cleaner, is designed for dusting the cars, cleaning motors, removing chips from bench and machine tools, etc., wherever compressed air is available. It is provided with a convenient operating handle and the valve has a tapered metal seat. Price, 75 cents.—Stevens & Co., 375 Broadway, New York City.

Wall Handle for Soldering

This steel handle for soldering coppers is designed to stay in its place indefinitely without breaking, splitting or burning, which wood handles will not do. The handle is of pressed steel, of heavy gage, and a grooved projecting member provides a seat for the iron tang of the soldering copper. Once the handle and tool are put together they are practically permanently attached. The makers state that the handle will not grow too hot for comfort, no matter how hot the copper may be. Made in three sizes: No. 1, for 1 and 1½-lb. coppers; No. 2, for 2 and 3-lb. coppers, and No. 3, for coppers up to 6 lb.—Stewart & Co., New York City.



Stevens air cleaner

Automobile Nomenclature

Complete Report of the Nomenclature Committee of the S. A. E. as Accepted by the Society at Its Summer Meeting—Correct Names for All Car Parts

AFTER a number of meetings held during the past year in conference with engineers and representatives of service departments responsible for the naming of car parts in their own organizations, the following list of names has been prepared and is offered for acceptance by the Society.

An attempt has been made to include in the list the more important parts throughout the whole car, bolts, studs and the like being indicated in general terms. Body parts have not been included generally nor parts of some units such as carbureters, which vary so much in construction as to make anything like uniform nomenclature very difficult.

Definitions of different types of construction have been included for several units in order to encourage uniform terminology in descriptions appearing in the trade press and in catalogs, as well as in the technical discussions of the Society. Definitions of different types of bodies are also included, because it is thought that some authority should take action to make possible the use of names which will be understood generally, rather than those which are meaningless except to persons conversant with the terminology peculiar to individual manufacturers. It is surprising how many distinctly different types of body are being sold under the name "brougham," for instance.

A scheme of classification based entirely on assemblies is impracticable for general use, on account of diverse arrangement of elements of so-called conventional cars. The classification proposed is therefore based largely on function.

In its present form the report can be used as a guide in making up lists of parts, or for any purpose by those familiar with automobile construction. It is probable that at some time in the near future sketches illustrating various of the parts listed in the report will be supplied.

DIVISION I—CYLINDERS

Group
- 1—Cylinders.
- 2—Crankcase.
- 3—Crankshaft.
- 4—Starting-crank.
- 5—Connecting-rods.
- 6—Pistons.

DIVISION II—VALVES

- 1—Camshaft.
- 2—Valves.

DIVISION III—COOLING SYSTEM

- 1—Fan
- 2—Radiator.
- 3—Pump.
- 4—Pipes and Hose.

DIVISION IV—FUEL SYSTEM

- 1—Carbureter and Inlet Pipe.
- 2—Carbureter Control.
- 3—Carbureter Air Heater.
- 4—Fuel Tank.
- 5—Fuel Pipes and Feed System.

DIVISION V—EXHAUST SYSTEM

- 1—Exhaust Manifold.
- 2—Exhaust Pipe and Muffler.

DIVISION VI—LUBRICATION SYSTEM

- 1—Oil Pan or Reservoir.
- 2—Oil Pump.
- 3—Oil Pipes, Strainers, Gages.

DIVISION VII—IGNITION

- 1—Spark-plugs, Cables and Switches.
- 2—Ignition Distributor.
- 3—Magneto.
- 4—Ignition Control.

DIVSION VIII—STARTING AND LIGHTING EQUIPMENT

- 1—Generator.
- 2—Starting Motor.
- 3—Wiring.
- 4—Battery.

DIVISION IX—MISCELLANEOUS ELECTRICAL EQUIPMENT

- 1—Lamps and Wiring.
- 2—Switches and Instruments.
- 3—Horn.
- 4—Miscellaneous.

DIVISION X—CLUTCH

- 1—Clutching Parts:
  - Cone Clutch.
  - Disk Clutch.
  - Plate Clutch.
- 2—Releasing Parts.

DIVISION XI—TRANSMISSION

- 1—Transmission.
- 2—Shifting Mechanism.
- 3—Control.
- 4—Propeller-shaft.

DIVISION XII—REAR AXLE

- 1—Housing.
- 2—Torque Arm and Radius-rod.
- 3—Drive Pinion.
- 4—Differential.
- 5—Axle Shafts.

DIVISION XIII—BRAKES

- 1—Outer Brake.
- 2—Inner Brake.
- 3—Pedal (or outer) Brake Control.
- 4—Hand (or inner) Brake Control.

DIVISION XIV—FRONT AXLE AND STEERING

- 1—Axle Center.
- 2—Steering-knuckles.
- 3—Steering-rods.
- 4—Steering-gear.

DIVISION XV—WHEELS

- 1—Front Wheels.
- 2—Rear Wheels.

DIVISION XVI—FRAME AND SPRINGS

- 1—Frame.
- 2—Frame Brackets and Sockets.
- 3—Front Springs.
- 4—Rear Springs.

DIVISION XVII—HOOD, FENDERS AND SHIELDS

- 1—Hood.
- 2—Engine Shield.
- 3—Fenders and Running-boards.
- 4—Windshield.

DIVISION XVIII—BODY

- 1—Floor-boards and Dash.
- 2—Body
- 3—Upholstering.
- 4—Top.

DIVISION XIX—ACCESSORIES

- 1—Speedometer.
- 2—Tire-pump.

General

Where terms "front" and "rear" are used, "front" should always be toward the front end of the car. These terms are sometimes confused in regard to parts that are mounted on the dash. The front side of the dash is always that next the engine.

Where parts are numbered, No. 1 should be toward the front of the car. For instance, No. 1 cylinder is the one nearest the radiator (in conventional construction).

"Right" and "left" are to the right- and left-hands when sitting in one of the seats of the car.

Studs, screws and bolts shall take names from parts they serve to hold in place, although they are assembled with other parts. For example, the cylinder stud is permanently screwed into the crankcase but holds the cylinder in place.

The name "engine" should be used rather than "motor" to avoid confusion with electric motors and to secure a lower freight rate.

DIVISION I—CYLINDERS

Group 1—Cylinders.
- Cylinder:
  - L-head cylinder (valves on one side of cylinder).
  - T-head cylinder (valves on opposite sides of cylinder).
  - I-head cylinder (valves in cylinder head).
  - F-head cylinder (one valve in head, other on side directly operated).
- (Cast in block, not cast en bloc.)
- (Cylinders of V-type engines should be numbered 1R, 1L, 2R, etc.)
- Inlet-valve cap.
- Exhaust-valve cap.
- Valve-cap gasket.
- Cylinder-head.
- Cylinder-head gasket.
- Cylinder-head plug.
- Water-jacket top cover.
- Water-jacket top cover gasket.
- Water-jacket side (or front or rear) cover.
- Valve-spring cover.
- Valve-spring-cover gasket.
- Valve-spring-cover stud.
- Valve-stem guide.
- Priming-cup.

Group 2—Crankcase:
- Crankcase.
- Barrel-type crankcase.
- Split-type crankcase (split horizontally, at or near center line of crankshaft).
- Crankcase upper half.
- Crankcase lower half (used only when the lower half contains bearings. A crankcase of either barrel or split type, in which all the bearings are mounted directly on the part to which the cylinders are attached, is called a "crankcase," the terms "upper half" and "lower half" not being used).
- Oil pan (used for lower part of split-type or barrel-type crankcase, whether this serves as an oil reservoir or not).
- Oil-pan drain-cock (or -plug).
- Breather.
- Oil-pan gasket.
- "Bushing" instead of "bearing" for removable and renewable lining used in a plain bearing.
- Crankshaft front bearing bushing (upper half and lower half).

Crankshaft front bearing cap.
Crankshaft front bushing support (sometimes used in barrel-type crankcase).
Crankshaft rear bearing bushing.
Crankshaft rear bearing shims (other shims accordingly).
Crankshaft center bearing bushing (if only three bearings or if all except end bearings are alike).
Crankshaft second bearing bushing, etc. (if more than three bearings, for example, front bearing, second bearing, third bearing, fourth bearing, rear bearing).
Hand-hole cover.
Hand-hole-cover gasket.
Timing-gear cover.
Timing-gear-cover gasket.
Flywheel housing.
Generator bracket (other brackets take name of part supported).

Group 3—Crankshaft:
Crankshaft.
Flywheel.
Crankshaft timing-gear (or sprocket).
Crankshaft timing-gear key.
Flywheel starter gear.
Crankshaft starter sprocket.
Flywheel studs.
Clutch-spring stud.
Crankshaft starting jaw (or pin).

Group 4—Starting-crank:
Starting-crank.
Starting-crank jaw.
Starting-crank shaft.
Starting-crank handle.
Starting-crank-handle pin.

Group 5—Connecting-rods:
Connecting-rod.
Straight connecting-rod } V-type engine.
Forked connecting-rod }
Connecting-rod cap.
Connecting-rod bushing (upper half and lower half).
Connecting-rod cap stud (or bolt).
Connecting-rod cap nut.
Connecting-rod bearing shims.
Connecting-rod dipper.
Piston-pin bushing.

Group 6—Pistons:
Piston.
Piston-pin.
Piston-pin lock-screw (in connecting-rod or piston).
Piston-ring.
Piston-ring groove.

DIVISION II—VALVES

Group 1—Camshaft:
Camshaft.
Eccentric shaft (Knight engine).
Camshaft timing-gear.
Camshaft timing-gear key.
Camshaft idler gear.
Camshaft oil-pump gear.
Camshaft ignition-distributor gear.
Exhaust cam.
Inlet cam.
Oil-pump eccentric (or cam).

Group 2—Valves:
Valves should be numbered 1 Ex, 1 In, 2 Ex, 2 In, etc., according to the number of the cylinder. On V-type engines the numbers should be 1 REx, 1 LEx, etc.
Poppet valve.
Inlet valve.
Exhaust valve.
Valve-spring.
Valve-spring retainer.
Valve-spring retainer lock.
Valve-lifter.
Valve-lifter guide.
Valve-lifter-guide clamp.
Valve-lifter roller.
Valve-lifter-roller pin.
Valve adjusting screw.
Valve adjusting screw nut.
Valve-rocker (either at cam or at overhead valve; if both, upper and lower).
Valve push-rod (intermediate between lifter and valve in I-head engine).

DIVISION III—COOLING SYSTEM

Group 1—Fan:
Fan.
Stationary fan support.
Adjustable fan support.
Fan hub.
Fan-blades.
Fan pulley.
Fan-belt.
Fan driving pulley.

Group 2—Radiator:
Radiator core.
Radiator shell.
Radiator upper tank.
Radiator right side.
Radiator left side.
Radiator lower tank.
Radiator filler-cap.
Radiator strainer.
Radiator drain-cock.

Group 3—Pump:
Water-pump.
Water-pump impeller.
Water-pump-impeller key.
Water-pump body (in case of doubt, body is member mounted on engine).
Water-pump cover.
Water-pump shaft.
Water-pump gland (part in contact with packing, whether threaded or not).
Water-pump-gland nut (or screw, or other part used to compress gland).
Water-pump shaft gear.

Group 4—Pipes and Hose:
Engine water outlet.
Engine water inlet.
Radiator hose (upper and lower).
Radiator water fitting (upper and lower).
Water-pump outlet pipe.

DIVISION IV—FUEL SYSTEM

Group 1—Carbureter and Inlet Pipe:
Carbureter.
Inlet manifold (more than one connection to cylinder).
Inlet pipe (only one connection to cylinder).
Inlet manifold or pipe gaskets (at cylinders).
Carbureter gasket.

Group 2—Carbureter Control:
(Throttle control rods will take names from parts they connect, shafts by location or arrangement, and brackets by parts they support).
Accelerator pedal.
Accelerator pedal bracket.
Accelerator pedal pin.
Accelerator pedal rod.
Accelerator pedal rod end pin.
Carbureter mixture hand-regulator.
Carbureter choke.

Group 3—Carbureter Air Heater:
Carbureter air heater.
Carbureter hot-air pipe.

Group 4—Fuel Tank:
Fuel tank.
Fuel reserve tank.
Fuel gage.
Fuel gage float.
Fuel gage glass.
Fuel tank outlet strainer.
Fuel tank outlet (flange, fitting, etc.).
Fuel tank pressure flange (or fitting).

Group 5—Fuel Pipes and Feed Systems:
Main fuel valve.
Reserve fuel valve.
Fuel pipe, main tank to auxiliary tank (or names of other parts connected).
Fuel pressure-pump (power pump).
Fuel hand-pump.
Fuel pressure-gage pipe.
Fuel pressure-gage tee.
Fuel pressure pipe to tank.
Fuel pressure pump pipe.
Fuel hand-pump pipe.
Fuel hand-pump tee.
Fuel pressure gage.

DIVISION V—EXHAUST SYSTEM

Group 1—Exhaust Manifold:
Exhaust manifold.
Exhaust manifold gasket.

Group 2—Exhaust Pipe and Muffler:
Muffler.
Exhaust pipe (extends from exhaust manifold to muffler. If in more than one part name sections front and rear. For V-type engines with two pipes name right and left).
Muffler outlet pipe.

DIVISION VI—LUBRICATION SYSTEM

Group 1—Oil-pan or Reservoir:
Oil-pan.
Oil tank (when separate).
Oil-filler strainer.
Oil-filler cap.

Group 2—Oil-pump:
Oil-pump.
Oil-pump body (any type of pump).
Oil-pump plunger.
Oil-pump plunger spring.
Oil-pump inlet valve.
Oil-pump outlet valve.
Oil-pump shaft.
Oil-pump shaft gear (outside the pump).
Oil-pumping shaft gear (inside the pump).
Oil-pumping follower gear.
Oil-pump cover.

Group 3—Oil Pipes, Strainers, Gages:
(Oil pipes should be named from the parts they connect, as "Oil-pump to pressure-gage pipe.")
Circulating-oil strainer.
Oil-strainer cap.
Sight feed.
Sight-feed glass.
Oil level-gage.
Oil level-gage float.
Oil level-gage glass.
Oil pressure-gage.

DIVISION VII—IGNITION

Group 1—Spark-plugs, Cables and Switches:
Spark-plugs.
Spark-plug cables (numbered according to cylinders).
Coil high-tension cable.
(Low-tension cables should be named from the parts they connect, as: "Storage battery to ignition switch cable." In case of more than one conductor the cable should be designated as double, triple, etc.)
Ignition coil.
Ignition switch.
Dry cell (two or more cells make a dry battery).

Group 2—Ignition Distributor:
Ignition-distributor breaker.
Ignition-distributor breaker-arm.
Ignition-distributor breaker-arm point.
Ignition-distributor fixed breaker-point.
Ignition-distributor brush.
Ignition-distributor shaft.
Ignition-distributor shaft gear.

Group 3—Magneto:
Magneto.
Magneto distributor.
Magneto breaker-box.
Magneto breaker-arm.
Magneto fixed breaker-point.
Magneto breaker-arm point.
Magneto distributor brush.
Magneto-collector-ring brush.
Magneto coupling, pump end.
Magneto coupling, center member.
Magneto coupling, magneto end.

Group 4—Ignition Control:
Spark control rod (name parts connected).
(Other control parts named as explained under throttle control.)

DIVISION VIII—STARTING AND LIGHTING EQUIPMENT

A one-unit system uses a starter-generator.
A two-unit system uses a generator and a starting motor.
A combined unit system uses a duplex starter-generator.

Group 1—Generator:
Generator.
Generator brush.
Generator brush-holder.
Generator gear.
Generator shaft.
Generator coupling (members as indicated under magneto coupling).

Group 2—Starting Motor:
Starting motor.
Starting-motor brush.
Starting-motor brush-holder.
Starting-motor pinion.
Starting-motor intermediate gear.
Starting-motor intermediate-gear shaft.
Starting-motor intermediate pinion.
Overrunning clutch.

Group 3—Wiring:
(Cables and conduits should be named from parts they connect.)
Starting switch.
Starting-switch pedal (or lever).

Group 4—Battery:
Storage battery.
Filler cap.
Terminal post.
Connector strip.

DIVISION IX—MISCELLANEOUS ELECTRICAL EQUIPMENT

Group 1—Lamps and Wiring:
Head-lamp.
Tail-lamp.
Side-lamp.
Instrument lamp.
Tonneau lamp.
Dome lamp.
Pillar lamp.
Inspection lamp.
Inspection-lamp cord.
Inspection-lamp plug.
Inspection-lamp socket.
Head-lamp socket.
Head-lamp support.
Head-lamp support tie-rod.
Tail-lamp support.
(Cables and conduits should be named from the parts they connect.)
Junction-box (wires not attached to box).
Junction-box screw.
Junction-box cover.
Fuse-box.
Fuse-box cover.
Fuse-block.
Fuse-clip.
Fuse (designated by name of part fed by circuit).
Junction panel.

Group 2—Switches and Instruments:
Lighting switch.
Ammeter.
Voltmeter.
Volt-ammeter.
Charging indicator.
Reverse current cut-out.
Current regulator.

Group 3—Horn:
(No names have been selected for horn parts.)

Group 4—Miscellaneous:
(Will include any additional electrical equipment, such as electrical gearshift.)

DIVISION X—CLUTCH

General

Plate clutch (one plate clamped between two others).
Disk clutch (more than three disks).
Dry disk clutch.
Lubricated disk clutch.
Cone clutch (leather faced, asbestos faced).
Expanding clutch.

Group 1—Clutching Parts:

Cone Clutch

Clutch cone.
Clutch facing.
Clutch-facing spring.
Clutch-facing-spring plunger.
Clutch spring.
Clutch thrust-bearing.
Clutch cone hub.
Clutch cone bushing.
Clutch-spring spider (for cone clutch with multiple springs).
Clutch-spring stud.
Clutch-spring retainer.
Clutch-spring nut.
Clutch spindle.
Clutch shaft (not attached to crankshaft).
Clutch shaft bearing (not in transmission case).

Disk Clutch

Clutch case (rotating member).
Clutch housing (non-rotating member).
Clutch cover.
Clutch housing cover.
Clutch driven disk.
Clutch driving disk.
Clutch driving disk stud.
Clutch pressure plate (front and rear, if two—used on both disk and plate clutches).
Clutch driven spider (or drum—driving and driven, if two).
Clutch cork-inserts.
(Facing, spring, thrust-bearing, etc., as under cone clutch.)

Plate Clutch

Clutch driven plate.
Clutch driving plate.
Clutch pressure levers.
(Other parts as under cone and disk clutches.)

Group 2—Releasing Parts:
Clutch release sleeve.
Clutch release shoe or clutch release bearing housing.
Clutch release bearing.
Clutch release fork.
Clutch release fork lever.
Clutch release fork shaft.
Clutch pedal shaft.
Clutch pedal adjusting link.
Clutch pedal.
Clutch pedal pad.
Clutch brake.
Clutch brake facing.

DIVISION XI—TRANSMISSION

Group 1—Transmission:
Transmission case (upper half and lower half, if bearings seat in both).
Transmission case cover.
Clutch gear.
Clutch gear bearing (front and rear, if two).
Clutch gear bearing retainer.
Countershaft.
Countershaft front bearing (if ball or roller).
Countershaft front bearing bushing (if plain bearing).
Countershaft front bearing retainer.
Countershaft rear bearing retainer.
Countershaft drive gear.
Countershaft second-speed gear.
Countershaft low-speed gear.
Countershaft reverse gear.
Reverse idler gear.
Reverse idler gearshaft.
Reverse idler gear bushing.
Transmission shaft.
Transmission shaft pilot bearing.
Transmission shaft pilot bearing bushing (if plain).
Transmission shaft rear bearing.
Transmission shaft rear bearing retainer.
Second and high sliding gear.
Low and reverse sliding gear.

Group 2—Shifting Mechanism:
High-gear shift fork.
Low-gear shift fork.
Reverse shift fork (if three are used).
High-gear shift bar.
Low-gear shift bar.
Reverse shift bar.

Group 3—Control:
Gearshift bar selector.
Gearshift lever shaft.
Low gearshift connecting-rod.
High gearshift connecting-rod.
Gearshift hand lever ("hand" may be omitted).
Gearshift hand lever bracket ("hand" may be omitted).
Gearshift housing (center control).
Gearshift gate.

Group 4—Propeller-shaft:
Propeller-shaft.
Propeller-shaft front universal-joint (assembly—"propeller-shaft" may be omitted).
Propeller-shaft rear universal-joint (assembly—"propeller-shaft" may be omitted).
Propeller-shaft front bearing (with inclosed shaft).
Transmission shaft universal-joint flange (substitute name of any other shaft on which flange is mounted).
Universal-joint flange yoke.
Universal-joint slip yoke.
Universal-joint plain yoke.
Universal-joint center cross (ring or block).
Universal-joint bearing bushing.
Universal-joint pin (may be designated as long and short, straight and shoulder, etc.).
Universal-joint inner casing.
Universal-joint outer casing.
Universal-joint casing packing.
Universal-joint casing nut.
Universal-joint trunnion (for trunnion type joint).
Universal-joint trunnion block.

DIVISION XII—REAR AXLE

General Types

Dead Axle—An axle carrying road wheels with no provision in the axle itself for driving them.

Live Axle—General name for type of axle with concentric driving shaft.

Plain Live Axle—Has shafts supported directly in bearings at center and at ends, carrying differential and road wheels.

(The plain live axle is practically extinct.)

Semi-Floating Axle—Has differential carried on separate bearings, the inner ends of the shaft being carried by the differential side gears and the outer ends supported in bearings.

The semi-floating axle shaft carries torsion, bending moment and shear. It also carries tension and compression if the wheel bearings do not take thrust, and compression if they take thrust in only one direction.

Three-Quarter Floating Axle—Inner ends of shafts carried as in semi-floating axle. Outer ends supported by wheels, which depend on shafts for alignment. Only one bearing is used in each wheel hub.

The three-quarter floating axle shaft carries torsion and the bending moment imposed by the wheel on corners and uneven road surfaces. It also carries tension and compression if the wheel bearings are not arranged to take thrust.

Full-Floating Axle—Same as three-quarter floating axle, except that each wheel has two bearings and does not depend on shaft for alignment. The wheel may be driven by a flange or a jaw clutch.

The full-floating axle shaft is relieved from all strains except torsion, and in one possible construction, tension and compression.

Types of Axle Drive

The different types of live axle can be driven by *Bevel Gear, Spiral Bevel Gear, Worm, Double-Reduction Gear* or *Single Chain.*

In other constructions the rear wheels are driven by *Double Chains, Internal Gears* or *Jointed Cross-shaft.*

Group 1—Housing:
Rear-axle housing (if one piece).
Right and left halves (if two pieces).
Bevel (or worm) gear housing } (if three pieces)
Right rear-axle tube } (if three pieces)
Left rear-axle tube } (if three pieces)
Rear-axle-housing cover.
Differential carrier (bolted to housing).
Rear-axle spring-seat.
Axle brake-shaft bracket (right and left).
Wheel brake-support, right and left ("wheel" may be omitted).
Wheel brake-shield ("wheel" may be omitted).

Group 2—Torque Arm and Radius Rod:
Radius rods.

Group 3—Drive Pinion:
Axle drive bevel pinion (or worm).
Axle drive pinion (or worm) shaft.
Axle drive pinion front bearing.
Axle drive pinion rear bearing.
Axle drive pinion thrust-bearing.
Axle drive pinion front bearing adjuster.
Axle drive pinion front bearing adjuster lock.
Axle drive pinion rear bearing adjuster.
Axle drive pinion rear bearing adjuster lock.
Axle drive pinion adjusting sleeve (containing both bearings).
Axle drive pinion (or worm) carrier.

Group 4—Differential:
Axle drive bevel (or worm) gear.
Differential.
Differential case, right.
Differential case, left.
Differential side gear.
Differential spider pinion ("spider" may be omitted).
Differential spider (or pinion shaft).
Differential bearing.
Differential thrust-bearing.
Differential bearing adjuster.
Differential bearing adjuster lock.

Group 5—Axle Shafts:
Axle shaft (right and left).
Axle shaft wheel-flange (or clutch).

DIVISION XIII—BRAKES

General

In the following list of brake parts the terms "outer" and "inner" are used, being applicable to any case of two sets of brakes on the rear wheels. Where the brakes are external and internal these terms may be substituted for "outer" and "inner." Where one brake is located at the wheels and the other at the transmission the terms "wheel brake" and "transmission brake" should be substituted. With other concentric or side-by-side brakes the terms "outer" and "inner" should be retained, "outer" indicating in the latter case the ones nearer the wheels.

The list is made up for external contracting and internal expanding brakes. If both brakes are of one type the necessary changes will be obvious. The designation of brake parts on the rear axle as foot-brake or hand-brake parts, or by equivalent terms, is too remote to be clear, especially in the case of stock axles whose brakes may be connected either way according to chassis design. Nearly the same condition prevails in regard to designating parts on the chassis according to whether they are connected to the inner or outer brakes at the axle.

The terms "service brake" and "emergency brake" should not be used. Better designations are "foot brake" and "hand brake"; or if both brakes foot-operated, "right foot-brake" and "left foot-brake."

Group 1—Outer Brake:
Outer brake band.
Outer brake band lining.
Outer brake band adjusting nut (yoke, etc.).
Outer brake hand lever.
Outer brake lever shaft.
Outer brake shaft inner end lever.
Outer brake shaft outer end lever.

Group 2—Inner Brake:
Inner brake shoe (or band).
Inner brake shoe (or band) lining.
Inner brake toggle (link, etc.).
Inner brake toggle lever.
Inner brake toggle shaft.
Inner brake cam.
Inner brake camshaft.
Inner brake camshaft (or toggle shaft) lever.

Group 3—Pedal (or outer) Brake Control:
Outer brake rod.
Outer brake rod yoke.
Outer brake intermediate shaft (or tube)—right and left.
Outer brake intermediate shaft (or tube)—right lever.
Outer brake intermediate shaft (or tube)—left lever.
Outer brake intermediate shaft (or tube)—center lever.
Outer brake right equalizer lever.
Outer brake left equalizer lever.
Outer brake equalizer.
Brake pedal.
Brake pedal rod.
Brake pedal rod yoke.
Brake pedal pad.
Brake pedal shaft.

Group 4—Hand (or inner) Brake Control:
Inner brake rod.
Inner brake rod yoke.
Inner brake intermediate shaft (or tube)—right and left.
Inner brake intermediate shaft (or tube)—right lever.
Inner brake intermediate shaft (or tube)—left lever.
Inner brake intermediate shaft (or tube)—center lever.
Inner brake right equalizer lever.
Inner brake left equalizer lever.
Inner brake equalizer.
Brake hand lever rod.
Brake hand lever rod yoke.
Brake hand lever.
Brake lever segment (or sector).
Brake lever pawl.
Brake pawl spring.
Brake pawl button.
Brake pawl finger lever.
Brake pawl rod.

DIVISION XIV—FRONT AXLE AND STEERING

Group 1—Axle Center.
Front axle center.
Front spring seats.
Front axle bushing.

Group 2—Steering Knuckles:
Right steering-knuckle.
Left steering-knuckle.

Steering-knuckle bushing (upper and lower).
Steering-knuckle pivot.
Steering-knuckle pivot nut.
Steering-knuckle thrust-bearing.
Right steering-knuckle arm.
Left steering-knuckle arm.
Steering-knuckle gear rod arm.

Group 3—Steering-rods:
Steering-knuckle tie-rod.
Steering-knuckle tie-rod end.
Steering-knuckle tie-rod clamp bolt.
Steering-knuckle tie-rod pin.
Steering-gear connecting-rod.

Group 4—Steering-gear:
Steering-gear case.
Steering-gear-case cover.
Steering-gear bracket.
Steering-gear arm.
Steering-arm shaft (if separate from sector or other operating member).
Steering-wheel rim.
Steering-wheel spider.
Steering-wheel tube (or shaft).
Spark and throttle sector.
Spark and throttle sector tube.
Spark hand-lever.
Spark hand-lever tube (or rod).
Throttle hand-lever.
Throttle hand-lever tube (or rod).
Steering-column tube (stationary).
Steering-column cowl (or dash or floor) bracket.

The various bushings in the steering-column take names from parts to which they are permanently fitted, being further distinguished as upper and lower, inner and outer, if necessary. Bushings in the steering-gear case take names from the worm and sector or other main operating parts which they support, as steering-gear worm upper bushing, although the steering-wheel tube may be the member which turns inside the bushing.

Steering worm
Steering-worm sector (or gear)
Steering-worm shaft
} (worm and sector gear)

DIVISION XV—WHEELS

Group 1—Front Wheels:
Front wheel felloe.
Front wheel felloe band.
Front wheel rim.
Rim bolts.
Rim clamps.
Front wheel hub.
Front wheel hub flanges.
Front wheel hub-cap.
Front wheel outer bearing.
Front wheel outer bearing inner race.
Front wheel outer bearing outer race.
Front wheel outer bearing balls.
Front wheel outer bearing ball retainer.
Front wheel outer bearing rollers.
Front wheel outer bearing roller cage.
Front wheel inner bearing (parts same as outer bearing).
Front wheel bearing spacer.
Front wheel bearing nut.
Front wheel bearing lock nut.
Front wheel bearing locking washer.

Group 2—Rear Wheels:
Rear wheel hub.
Rear wheel hub-flange.
Rear wheel hub-cap.
Rear wheel outer bearing.
Rear wheel inner bearing.
Wheel brake-drum.
(Other parts named like front wheel parts.)

DIVISION XVI—FRAME AND SPRINGS

Group 1—Frame:
Frame side member (right and left).
Front cross member.
Rear cross member.
Center cross member.
(As above if only three cross members; as below if more than three.)
First cross member.
Second cross member, etc.
Sub-frame side member (right and left).
Sub-frame cross member (front and rear).
Right rear gusset (upper and lower).
(Gussets at other cross members named according to member.)

Group 2—Frame Brackets and Sockets:
Front spring front bracket (right and left).
Front spring rear bracket (right and left).
Rear spring front bracket (right and left).
Rear spring rear bracket (right and left).
Running-board bracket (front, right, etc., if not duplicates).
Running-board bracket brace.
Engine front support bracket.
Engine rear support bracket.
Torque-arm bracket.
Radius-rod bracket.

Group 3—Front Springs:
Front spring (right and left).
Front spring shackle.
Front spring shackle-bolt (upper and lower).
Front spring front bolt.
Front spring rebound-clip.
Front spring seat.
Front spring seat pad.
Front spring clip.
Front spring clip plate.
Front spring center-bolt.

Group 4—Rear Springs:
Rear springs (upper and lower for elliptic and three-quarter elliptic).
Rear spring pivot bolt (or pin)
Rear spring pivot seat
} (for half-elliptic cantilever spring)
Rear spring double shackle
Rear side spring
Cross spring.
} (for platform spring)
(Other parts as for front springs.)

DIVISION XVII—HOOD, FENDERS AND SHIELDS

Group 1—Hood:
Hood.
Hood sill.
Hood handle.
Hood fastener.
Hood fastener bracket (spring, lever, etc.).

Group 2—Engine Shield:
Engine shield.
Engine shield fastener.
Engine shield bracket (spring, etc.).

Group 3—Fenders and Running-boards.
Running-board (right and left).
Running-board linoleum coverings.
Running-board outside binding.
Running-board inside binding.
Running-board front binding.
Running-board rear binding.
Running-board shield (right and left).
Right front fender.
Left front fender.
Right rear fender.
Left rear fender.
Fender support socket.
Right front fender front support.
Right front fender rear support.
(Other fender supports accordingly.)

Group 4—Windshield:
(Names for windshield parts have not been selected.)

DIVISION XVIII—BODY

Types of Bodies

Roadster—An open car seating two or three. It may have additional seats on running-boards or in rear deck.

Coupelet—Seats two or three. It has a folding top and full-height doors with disappearing panels of glass.

Coupe—An inside operated inclosed car seating two or three. A fourth seat facing backward is sometimes added.

Convertible Coupe—A roadster provided with a detachable coupe top.

Clover Leaf—An open car seating three or four. The rear seat is close to the divided front seat and entrance is only through doors in front of the front seat.

Touring Car—An open car seating four or more with direct entrance to tonneau.

Salon Touring Car—A touring car with passage between front seats, with or without separate entrance to front seats.

Convertible Touring Car—A touring car with folding top and disappearing or removable glass sides.

Sedan—A closed car seating four or more all in one compartment.

Convertible Sedan—A salon touring car provided with a detachable sedan top.

Open Sedan—A sedan so constructed that the sides can be removed or stowed so as to leave the space entirely clear from the glass front to the back.

Limousine—A closed car seating three to five inside, with driver's seat outside, covered with a roof.

Open Limousine—A touring car with permanent standing top and disappearing or removable glass sides.

Berline—A limousine having the driver's seat entirely inclosed.

Brougham—A limousine with no roof over the driver's seat.

Landaulet—A closed car with folding top, seats for three or more inside, and driver's seat outside.

Group 1—Floor-boards and Dash:
Floor-boards (horizontal).
Toe-boards (sloping).
Heel-boards (under seats).
Dash (separates engine compartment from driver's compartment).
Instrument board.

Group 2—Body.*

Group 3—Upholstering.*

Group 4—Top.*

DIVISION XIX—ACCESSORIES

Group 1—Speedometer.*

Group 2—Tire-pump:
Tire-pump.
Tire-pump driving gear.
Tire-pump shaft gear.
Tire-pump idler gear.

*Names for parts in these groups have not been selected.

Klaxon Horn Warns of Gas Attacks

AT the left is a reproduction of a photograph of a listening post at the front in France. This photograph was brought to this country by William R. Fay, of the American Ambulance, who explains the listening post as being a point in the first line trenches nearest to the enemy. These posts are manned by volunteers as the work is extremely dangerous, the posts sometimes being only a few feet from the enemy parapet. The duty of the men is to warn the defending forces of impending gas attacks. In this connection an interesting use of automobile horns is made, each post being equipped with a Klaxon as shown in the illustration, the roar and rattle of shell and machine gun fire rendering a sharp, clear-cut warning note necessary, while a man's voice is absolutely lost in the clamor. The piece of sheet steel mounted over the horn is for the purpose of protecting it from shrapnel fire. When the trench defenders hear the horn shriek they throw on their gas masks and are in readiness.

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Fuel Commonsense

OF all proverbs the most true is that which says "a little knowledge is a dangerous thing." In this age when everyone has a smattering of scientific knowledge the public at large is a ready prey for the charlatan who can reel off a quasi-scientific tale. Even now in the twentieth century there are thousands of well educated people who are not aware of the impossibility of perpetual motion. The patent office has not yet ceased to have applications for thousands of machines that cannot ever operate. Thus when the claim is made that some liquid has been discovered of which a few drops will render water combustible there are plenty of persons to be found who fail to grasp the absolute scientific impossibility of the feat.

To do this would be the exact equivalent of turning ashes back into the coal from which they were formed, the equivalent of making bodies fall upward instead of downward.

Might Act as Carrier

There is only one way in which a water mixture could possibly serve as fuel and it is a way that is highly improbable to say the least. It is just conceivable that some high explosive, containing an immense amount of potential chemical energy might be dissolved in water and then burned while in suspension in a mist of spray, converting the water into steam. That such a solution would be capable of ignition by an ordinary sparking plug, or that it could be carbureted in the conventional way is almost as improbable as that such a solution could be made in the first place. Incidentally, it may be added, science has never yet discovered a cheap explosive, and that a few drops of liquid containing as much energy as a corresponding number of gallons of gasoline would be an explosive so powerful that its manufacture would be both difficult and dangerous.

The Laws of Energy

Scientific progress has taught us that what seems highly improbable to-day may be simple enough to-morrow, but the laws of energy remain the same as they have always been. Scientists know every substance from which the earth is made and they know the exact amount of energy which is available by burning those substances in the atmosphere. Science also knows how to make many other substances which will burn with much greater liberation of energy, but the making of the latter necessitates the expenditure of energy. In other words science has never discovered how to get more energy out of a substance than was put into it originally and the common fuels used by man contain the greatest amounts of natural or inherent energy. All our fuels are vegetable products containing the energy of the sunlight which shone upon them millions of years ago.

Thus while few things are utterly impossible, many are so improbable that they approach impossibility. Any liquid which would do what is claimed for the water energizer would not only solve the gasoline problem, it would revolutionize the entire artificial heat and power system of the world.

Important Trade News

IN this, and future issues of THE AUTOMOBILE the leading events of the week will be dealt with on the first few pages instead of in the center of the paper as hitherto. Trade news of lesser importance will conclude the editorial section, while all the articles and the regular features will form the center. We believe that very many of our readers turn to the news pages first of all and the latter will now be more readily accessible.

Better Work Wanted

WHILE there is no doubt that some of the cheapest of automobiles are well and carefully made, there is no doubt that a good many thousands of machines have been sold in the last few months which were really unfit to go into the hands of the user. Throughout the country there has been considerable complaint regarding the accuracy of fitting and assembling and, though the owner or dealer does not expect perfection of workmanship in an admittedly cheap car, he does not expect to have to overhaul the engine bearings after 500 miles of running. Some reputations are suffering.

$16,213,387 in Fees for Roads

This Is 90% of Total Collected in United States in 1915

WASHINGTON, D. C., July 3—Ninety per cent of the registration and license fees paid in 1915 by automobilists to the States, or $16,213,387, was spent for the building and maintenance of county and State roads, according to a compilation just published by the Office of Public Roads, U. S. Department of Agriculture. In all, 2,445,664 motor vehicles were registered in that year and their owners paid a total of $18,245,713 for registrations and drivers' and dealers' licenses. This is an increase of $5,863,760 over 1914, and an increase of 734,325 in the number of vehicles registered. Automobile fees now defray nearly 7 per cent of the total amount spent on rural road and bridge building, whereas in 1906 the income from this source was less than three-tenths of 1 per cent of the total expenditure.

Rapid Growth in Registration

The growth of the volume of fees and registrations is noted by the fact that in 1901 New York, the first State to require fees, collected only $954. In 1906 only 48,000 cars were registered throughout the entire United States. By 1915, however, the number had jumped to the figure given, so that there is slightly more than one motor car registered for each of the 2,375,000 miles of road outside of the incorporated towns and cities.

The relation between cars and road mileage varies widely in different sections. There is only one car for every 6 miles of rural road in Nevada, but nearly six cars for every mile of such road in New Jersey. There is an average of one car registration for every forty-four persons in the United States. Iowa apparently leads, however, with one car for every sixteen persons, while only one for every 200 persons is registered for Alabama.

It must be understood, however, that the figures of registration do not necessarily represent a total number of cars, as some of the States do not require annual registration, others group pleasure and commercial cars and motor cycles in their accounts, while still other States do not require registration of motorcycles.

There is great inequality in the registration fees charged by the different States. The average for the United States was $7.46. The State of Vermont, however, secured in 1915 a gross revenue of $18.10 for each car, while Minnesota received only about 50 cents annually for each car. In Texas and South Carolina no annual registration fees are collected, the only requirement being a county fee of 50 cents and $1 respectively for perennial registration. Most of the States, however, also levy annual taxes on motor vehicles and this adds importantly to the public revenue contributed by the owners of motor-propelled vehicles.

In the use of fees, however, there seems to be a general policy of applying the major part of the money collected from automobilists directly to road betterment. In forty-two of the States of the Union all or the major portion of the motor-vehicle revenue must be expended for the construction, improvement, or maintenance of the public roads, or for the maintenance of the State highway department. In twenty States, all or the major portion of the net motor vehicle revenues are expended by or under the supervision or direction of the State highway department. In seven States one-half to one-fourth of the State motor vehicle revenues are expended through the State highway department, and the remainder by the local authorities. Many States, in addition to applying license fees to road construction expend for this purpose a large part of the fines and penalties collected from owners.

California Leads in Fees

In the number of registrations New York State led in 1915 with 255,242; Illinois was second with 180,832; California third with 163,797; and Pennsylvania fourth with 160,137. In gross revenues received from this source, however, California led with $2,027,432; New York was second with $1,991,181; Pennsylvania third with $1,665,276; while Iowa, with 145,000 cars registered, came fourth in point of revenue with $1,533,054.

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Cole Adds All-Weather Body

INDIANAPOLIS, IND., July 1—The Cole Motor Car Co., this city, has mounted an all-weather body on its eight-cylinder chassis. The Cole-Springfield body, as it is known, sells at $2,195. The car is called the Cole-Springfield Toursedan.

There are two other Cole models equipped with the new body. One is known as the Tourcoupé, selling for $2,195, and the other is the Towncar listed at $2,495.

The body is finished in American flag blue with dull block trimming and mouse gray upholstering. It has automatic electric door lights, which switch on and off as the doors are opened and electric light switches are located both at the driver's seat and in the tonneau.

The company will continue its standard eight, seven-passenger touring car and four-passenger Tuxedo roadster, which continue to sell for $1,595.

British Bar U. S. Cars July 16

Importation of American-Built Trucks Is Also More Closely Restricted

LONDON, ENGLAND, June 30—*Special Marconigram* to THE AUTOMOBILE:—The British Government has further restricted the importation into the United Kingdom of automobiles and commercial vehicles, which is to go into effect on July 16. Provision is made for the importation under licenses issued by the Government of such articles as may be approved by the authorities.

After July 16 the importation into the United Kingdom of such automobiles, trucks, chassis, parts and accessories, except tires, as were exempted from previous prohibition will be prohibited. Licenses to import such goods will be granted where goods were en route or were paid for on the date of the proclamation. Licenses for the importation of automobiles will be issued where the national interest is apparent or where trucks are required for fire departments, conveyances for wounded or sick, for police or local government authorities, agricultural purposes, or the conveyance of essential goods. Spare automobile parts may be imported under license when intended for imported commercial vehicles already in the United Kingdom.

A general license has been issued permitting the unrestricted importation of steel ball bearings and tool handles.

Fighting American Competition

This action, presumably by the Chancellor of the Exchequer, Reginald McKenna, culminates a long series of efforts on the part of the British trade to prevent further American competition. Tied up with government orders to such extent that they could not supply private users and later released to some extent for private trade with government contractors, British factories have been unable to supply British business men with motor delivery and haulage equipment. There are now some thirty lines of American trucks represented in England. Recently a number of releases of product for private sale were granted some of the truck firms which have since been withdrawn, so that with the demand for trucks greater than ever before and the home-manufactured product still largely taken up by the government, British business is to be forced by the government to put up with inferior equipment or no equipment at all lest American trucks secure too firm a foothold in the British market.

This action on the part of England tallies closely with that of France, which

has put a ban on all motor vehicles not ordered before May 8. An attempt is being made to exempt trucks from this drastic measure, as was successfully done at the time of the passage of the prohibitive tariff on motor vehicles in England; but the French effort is not apt to prove effective since the government is willing to rent trucks to government contractors as they may be required. They will be able to provide all of the vehicles that will be needed, since they can be purchased from America by the government. This will give the government of France complete control of the situation, so that the number of American trucks required to carry on the war will be sufficient and yet American enterprise will be prevented from securing a place in the French market.

—

Republic Truck Co. Adds $1,000,000 to Its Capital

ALMA, MICH., June 30—The Republic Motor Truck Co., has increased its capital $1,000,000, the former capital being $250,000. The company recently bought a large tract of land in this city and the cash increase will be used to improve this tract and triple the capacity of the plant. It has contracted for materials to build 18,000 trucks for 1917.

—

Cummins Monitor Capital $100,000

COLUMBUS, OHIO, July 1—The Cummins Monitor Co., this city, has increased its capital to $100,000.

—

Few Market Changes

NEW YORK CITY, July 3—The automobile materials market last week remained steady, with few price changes. Aluminum went down 3 cents a lb. to 60.

With the War Department taking bids on over 5000 trucks for immediate delivery to the Mexican border, the manufacturers in the West are urgently seeking to cover their requirements against prospective contracts. Several of the companies have sounded mills on steel for frames, taking material out of stock. One Western automobile plant has already secured a contract for 1500 trucks from the U. S. Government and placed a rush order for 4 and 6-in. channels.

Day and Warner on G. M. Board

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General Managers of G. M. Truck Co. and Oakland Complete Directorate

DETROIT, MICH., July 3—Following a policy of having the various units of its organization as representative as possible on the board of directors, the General Motors Co., at a meeting in New York on June 27, elected W. L. Day, general manager of the General Motors Truck Co., and Fred W. Warner, general manager of the Oakland Motor Car Co., both at Pontiac, Mich., to the board of directors. These elections filled vacancies occasioned by the resignations on June 1 of three members of the banking interests that had aided in tiding the organization over its period of depression some years ago.

Fill Vacancies

Those resigning at the time of the election of W. C. Durant to the presidency to succeed C. W. Nash, were Albert Strauss of J. & W. Seligman & Co., J. J. Storrow of Lee, Higginson & Co., both of New York, and Emory W. Clark, head of the First and Old Detroit National Bank of Detroit. To fill one of these vacancies on the board, W. C. Leland, vice-president and general manager of the Cadillac Motor Car Co., was elected at the June 1 meeting, and Day and Warner have now completed the directorate.

Both Implement Men

Both Day and Warner are old farm implement men, who, like many others in the industry, graduated to the automobile business after long years of experience in the other line. Day came to the truck unit in 1912, leaving the Mitchell-Lewis Motor Co., where he was general manager. Before his connection with the latter concern he had been for 27 years general manager of the Parlin & Orrendorff Plow Co. at Kansas City. Warner 2 years ago took up the Oakland management, coming from Chicago, where he had managed the Buick branch. Prior to his connection with Buick he had long been connected with the John Deere Plow Co., also at Kansas City. Both men have made a striking success of the General Motors units they are now managing.

—

Willys-Overland Earns $4,377,799 in 4 Months

NEW YORK CITY, June 30—The Willys-Overland Co. reports to the local stock exchange for the 4 months ended April 30, 1916, net earnings all companies, $4,377,799; interest on floating debt, $184,655; surplus, $4,193,144.

The $1,500,000 Willys-Overland common stock which has just been listed on the Stock Exchange is the stock which was specifically reserved for that purpose when the authorized capitalization was increased by action of the stockholders last January.

Practically all of this $1,500,000 common stock has been allotted to employees, and is to be paid for in monthly instalments over a period of 10 years. No stock is to be delivered to the employees until all payments are completed, thus requiring 10 years before this stock is to be delivered.

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Diamond 300% Cash Dividend

DETROIT, MICH., July 1—The Diamond Mfg. Co., one of the Detroit concerns that was recently taken over by the Motor Products Corp., of which W. H. Rands is president, is now paying its stockholders a 300 per cent cash dividend as a result of the change of control. In a letter to the stockholders it is explained that additional cash dividends will be forthcoming and that each will receive pro rata stock in the Motor Products Corp. The Diamond company had a capital stock of $300,000, of which two-thirds was outstanding.

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Continental Pays 5 per Cent on Common

DETROIT, MICH., June 29—At a meeting of the directors here to-day the Continental Motors Co. declared an initial cash dividend of 5 per cent, payable July 15 to common stock of record July 5.

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Autocar Co. Increases Capital to $1,800,000

ARDMORE, PA., June 30—The Autocar Co., this city, has declared a cash dividend of 5 per cent., payable to-day, and has also increased its paid-in capital from $300,000 to $1,800,000.

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Stutz Stock All Purchased

NEW YORK CITY, June 30—The Stutz Motor Car Co. of America, which was recently organized by A. A. Ryan and associates, has completed the purchase of

Daily Market Reports of the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Week's Ch'ge
Aluminum, lb.	.63	.63	.63	.60	.60	— .03
Antimony, lb.	.18½	.17½	.17¼	.17	.17	— .01½
Beams & Channels, 100 lb	2.67	2.67	2.67	2.67	2.67	...
Bessemer Steel, ton	42.00	42.00	42.00	42.00	42.00	...
Copper, Elec., lb	.26½	.26½	.26½	.26½	.26½	...
Copper, Lake, lb	.26¼	.26¼	.26½	.26½	.26½	...
Cottonseed Oil, bbl	10.80	10.80	10.87	10.80	10.75	— .05
Fish Oil, Menhaden, Brown	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl	.24	.24	.24	.24	.24	...
Lard Oil, prime, gal	1.05	1.05	1.05	1.05	1.05	...
Lead, 100 lb	6.85	6.85	6.85	6.85	6.85	...
Linseed Oil, gal	.64	.64	.64	.64	.64	...
Open-Hearth Steel, ton	42.00	42.00	42.00	42.00	42.00	...
Petroleum, bbl., Kans., crude	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal	.92	.92	.92	.92	.92	...
Rubber, Fine Up-River, Para, lb	.62	.67	.65	.65	.65	+ .03
Rubber, Ceylon, First Latex, lb	.60½	.60½	.60	.60	.60	— .00½
Sulphuric Acid, 60 Baume, 100 lb	3.00	3.00	3.00	3.00	3.00	...
Tin, 100 lb	38.75	39.00	39.50	39.63	39.63	+ .88
Tire Scrap, lb	.05¾	.05¾	.05¾	.05¾	.05¾	...

all the stock of the Stutz Motor Car Co. of Indiana.

The company is planning a larger output. In 1912 it produced 266 cars; in 1915, 1079, while for the 5½ months ended June 15 the output was 874 cars.

Within 4 or 5 weeks the new plant, which is as large as the existing factory, will be in operation. At the present rate, it is estimated that the company will earn in 1916 at least $750,000, which will be available for dividends, amounting to $10 a share on its 75,000 shares of stock, no par value.

H. C. Stutz remains president. The refinancing has brought in new blood, including, A. A. Ryan, G. H. Saylor, S. A. Fletcher and others.

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Hare, Packard New York Sales Manager

NEW YORK CITY, June 29—E. S. Hare has been appointed manager of sales of the Packard Motor Car Co. in this city, under E. B. Jackson, president of the company. Mr. Hare comes from Philadelphia. From 1909 to 1916 he was vice-president of the Commercial Truck Co. of America, Philadelphia, and joined the Packard organization Jan. 1, 1916, as a special representative of the motor truck department.

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Dividends Declared

White Motor Car Co., initial quarterly of 87½ cents a share, par value $50, payable July 15 to stock of record July 6. This places the stock on 7 per cent basis.

Swinehart Tire & Rubber Co., quarterly 1½ per cent, payable July 1. Books closed June 26.

Automobile Issues Are Active

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Willys-Overland on $25 Par Basis—Stutz Reaches New High of 60⅞

NEW YORK CITY, July 3—Automobile issues last week were fairly active with few important changes. The stock of the Stutz company advanced to the new high price of 60⅞ on Friday. At this figure it was nearly 6 points above the figure at which subscriptions were received about 2 weeks ago.

United Motors went up 3 points on reports that interests identified with the property declared current earnings are at the rate of $12 a share on the outstanding stock, and that the management has in mind the payment of quarterly dividends at the rate of $6 a share early in October.

Overland Common High

Trading in Overland common began last week with the stock on a $25 par basis. It opened around 69 and later sold above 72.

Several of the issues on Saturday saw declines. Studebaker sold below 133 as against 137¼ for Friday; Maxwell common dropped to 79½, off 2⅝ points.

Peerless came into prominence after a long period of inactivity, and sold at 26 and 27, a gain of 2 points.

Studebaker common was one of the weak issues last week with a drop of 24¼ points. No reason is given for the drop as the company has just made a very favorable report as to the sales during the first 6 months this year, which amounted to 36,700 cars against 20,400 for the same period of 1915, a gain of 16,300 cars, or 80 per cent.

One more issue has been put on the Stock Exchange. The Ajax Rubber Co. stock has had admittance to the Exchange to the value of $4,000,000.

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Harry Newman Appointed Chalmers Distributor in Chicago

CHICAGO, ILL., July 3—*Special Telegram.*—Harry Newman, Inc., distributor of Chalmers cars in Wisconsin, northern Michigan and southeastern Minnesota since Dec. 1, 1915, has been appointed Chicago distributor. Distributing stations will be established in Springfield and Chicago. Contracts have been made with the Chalmers company to supply the new distributor with 5000 cars during the fiscal year ending July 1, 1917, which represents a season's business in excess of $6,000,000.

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Ford Holds Sales Conference

DETROIT, MICH., July 1—The annual sales conference of the Ford Motor Co. has been in progress here this week, managers and assistant managers of the twenty-eight branches of the company in the United States, and of the fifty-one sales and service branches throughout the country being in attendance. These men are responsible to a large extent for the marketing of 500,000 Ford cars for the present fiscal year which ends July 31, and on them will depend a great deal

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Net Ch'ge
Ajax Rubber Co. (new)	..	..	64	66	..
J. I. Case pfd	70	79	86	90	—2
Chalmers Motor Co. com	91	92¾	..	180	..
Chalmers Motor Co. pfd	95	98	100	102	+1
Chandler Motor Car Co.	..	..	108½	109	+ ½
Chevrolet Motor Co.	..	..	215	220	+1
Fisk Rubber Co. com	..	..	..	150	..
Fisk Rubber Co. 1st pfd	..	..	114	120	..
Fisk Rubber Co. 2d pfd	..	..	120	..	..
Firestone Tire & Rubber Co. com	500	506	870	..	—10
Firestone Tire & Rubber Co. pfd	109	111	112	114	..
General Motors Co. com	156	157	470	541	..
General Motors Co. pfd	101	102	100	113	—2½
B. F. Goodrich com	53	54½	74½	75	+1½
B. F. Goodrich pfd	103	105	113⅜	113½	— ⅛
Goodyear Tire & Rubber com	269	272	230	240	..
Goodyear Tire & Rubber pfd	106	107	105	107	+1½
Grant Motor Car Co.	..	..	12	13	..
Hupp Motor Co. com	..	..	8	84	..
Hupp Motor Co. pfd	..	..	90	110	—9
International Motor Co. com	13	14	9	12	..
International Motor Co. pfd	32	36	20	28	+2
Kelly-Springfield Tire & Rubber Co. com	159	152	70	72	+1
Kelly-Springfield Tire & Rub. 1st pfd.	85½	86½	95	97	..
Lee Rubber & Tire Corp.	..	..	47½	48½	—1
Maxwell Motor Co. com	35	35½	79	79½	—1⅜
Maxwell Motor Co. 1st pfd	82	83	85½	86	+ ½
Maxwell Motor Co. 2d pfd	31½	33	54½	55½	+ ½
Miller Rubber Co. com	190	192	350	357	..
Miller Rubber Co. pfd	103	105	105	106	..
Packard Motor Car Co. com	109	..	..	190	..
Packard Motor Car Co. pfd	96½	101	100	104	..
Paige-Detroit Motor Car	..	..	..	52	..
Peerless Truck & Motor Corp.	..	..	26	27	+2
Perlman Rim Corp.	..	..	..	120	..
Portage Rubber Co. com	35	38	119	120	..
Portage Rubber Co. pfd	92	95	120	122	..
Regal Motor Car Co. pfd	..	..	17	22	..
*Reo Motor Truck Co.	15	16	38½	39½	+1¼
*Reo Motor Car Co.	29¼	30	40	40¼	— ½
Saxon Motor Car Co.	..	..	79	83	—1
Standard Motor Co.	..	..	7	8	..
Stewart-Warner Speed. com	67½	68¼	98	99	+1½
Stewart-Warner Speed. pfd	104	107	..	..	..
Studebaker Corp. com	76	78	113¼	133¾	—24⅛
Studebaker Corp. pfd	100	100½	107¼	110	+ ¼
Stutz M. C. Co. of America	..	..	58	60	..
Swinehart Tire & Rubber Co.	77	78	88	91	..
United Motor Corp.	..	..	65½	66	+3
U. S. Rubber Co. com	45½	47	53¾	54½	+ ¾
U. S. Rubber Co. pfd	105	106	109¼	110	+ ¼
White Motor Co. (new)	..	..	57¾	58¼	+4¾
Willys-Overland Co. com	126	128	73	74	..
Willys-Overland Co. pfd	102	103½	106½	107½	+ ¼

Quotations furnished by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co.	..	..	..	..	..
Chalmers Motor Co. com	..	95	176	185	+6
Chalmers Motor Co. pfd	96	99	96	..	..
Continental Motor Co. com	185	..	35	37	—2
Continental Motor Co. pfd	82	86	9½	10½	..
Ford Motor Co. of Canada	1275	..	395	375	..
General Motors Co. com	153	156	470	545	—5
General Motors Co. pfd	101½	103½	..	116	..
Maxwell Motor Co. com	38	41	79½	82½	—1
Maxwell Motor Co. 1st pfd	83½	86	84½	87½	—1½
Maxwell Motor Co. 2d pfd	34	37	55	57½	— ½
Packard Motor Car Co. com	..	112½	..	185	..
Packard Motor Car Co. pfd	96¼	100	102	104	..
Paige-Detroit Motor Car Co.	..	..	..	50	..
*W. K. Prudden Co.	19½	21	40	44	..
*Reo Motor Car Co.	30	31	40	41	—1
*Reo Motor Truck Co.	15⅜	16⅛	37½	39	—2¾
Studebaker Corp. com	76	78	134½	137½	—1½
Studebaker Corp. pfd	98½	100½	105	..	..
C. M. Hall Lamp Co.	..	..	..	33	..

INACTIVE STOCKS

*Atlas Drop Forge Co.	..	26	..	40	..
Kelsey Wheel Co.	205	..	..	350	..
Regal Motor Car Co. pfd	..	25	17	..	..

¼

*Par value $10; others $100.

of the success of the contemplated marketing of 1,000,000 Fords for the next fiscal year. Somewhat over 500,000 cars will have been built when the present year ends, probably being in the neighborhood of 560,000.

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New Record of 28,500 Goodyear Tires in 1 Day

AKRON, OHIO, June 30—The Goodyear Tire & Rubber Co., this city, on June 22 established a new production record of 28,500 tires, the best previous known record being 18,000 tires in a single day.

The company has 13,000 employees working in three shifts of 8 hr. To achieve the record run the company for 1 day put on a 12-hr. shift so as to utilize 6700 employees on each shift.

A year ago the company was producing about 12,000 tires on the daily average. Last month the gross sales were in excess of $6,000,000 and the total for the month will exceed $7,000,000.

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Gearless Differential Reduces Prices

DETROIT, MICH., July 3—The Gearless Differential Co., this city, has reduced the price of its replacement differential on Ford and Chevrolet 490 models from $20 to $15; and on its Overland model from $25 to $20.

The company has reduced the cost of manufacturing on account of a much larger manufacturing schedule and the fact that it has been able to standardize many of the parts for the above models for the car and axle makers.

Overland Buys Out Leavitt

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Deal with Pacific Coast Distributor of Co.'s Products Involves $1,000,000

LOS ANGELES, CAL., June 30—The J. W. Leavitt & Co. organization is no more. The entire holdings of the company, which has distributed Willys-Overland products on the Pacific Coast, have been purchased by Willys-Overland, Inc., of Toledo. The deal involves practically $1,000,000 cash and is one of the most talked of changes in the automobile industry on the Pacific Coast in years. It is the first time that a factory has purchased an agency from a Pacific Coast dealer or distributor.

The new organization will operate in the form of two companies. The interests in California are to be known as the Willys-Overland of California and those in the Northwest as the Overland-Pacific, Inc.

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Stutz Features Newark Race

NEWARK, N. J., July 4—J. W. Dickinson in his Stutz Special again carried off the honors at the ½-mile dirt track meet held to-day at Olympic Park, this city. The ½-mile record of 37 2/5 sec., made by him on June 17 last, was shattered when both he and I. C. Barber of Washington, D. C., in an Eye See Bee Special, made the distance in 35 2/5 sec.

To-day's races were featured by closely contested events, the entry list including such cars as Jessop's Chevrolet, Gouirand and Moore's Mercers; and an Adams Special. The last named car, which had raced during the early part of the afternoon at the Sheepshead track, arrived near the closing of the local meet, and managed to participate in a special 3-mile race with Dickinson's Special and the Eye See Bee. The Stutz was put out on account of a punctured tire and the Adams Special just managed to beat the Eye See Bee.

A new 3-mile mark was hung up by Dickinson when he beat the old mark of 3:54 2/5 sec. by 15 sec., his time being 3:39 2/5.

—

Commercial Preparedness Keynote of Studebaker Dealers' Convention

DETROIT, MICH., July 1—Practically every eastern Studebaker dealer in the territory of the New York, Boston, Philadelphia and Norfolk, Va., branches attended the series of conventions held at these branches last week and part of the week before. The conventions were conducted by L. J. Ollier, vice-president and director of sales of the Studebaker Corp.; R. T. Hodgkins, general sales manager; H. A. Biggs, of Frank Seaman, Inc., advertising counsel, and C. F. O'Meara, efficiency expert.

Realizing that it would work a hardship on dealers to ask them to visit the factory at this time of the year, the

De Palma Wins Twin City 150-Mile Race

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(*Continued from page* 1)

Fourteen cars rolled across the tape for the start. Chevrolet had the pole, and his neighbors were Aitken, De Palma and Christiaens. In the second batallion were Rickenbacher, O'Donnell, Anderson and Galvin. The third row included Milton, Buzane, Henderson and Osteweg, and Sorenson and Muller brought up the rear. Cooper broke a connecting-rod in the trials and did not start.

The real fight for first money was between the first four until Chevrolet dropped out with a broken rocker arm at the end of the fifty-second mile. Christiaens, who led at the start, finished third. De Palma, who started second, ended first. Aitken, who was third, finished second. Milton, a local celebrity, gathered in fourth money and made a strong run. O'Donnell was fifth; Sorenson, local entrant, was sixth, and Muller seventh. Christiaens made a good race with De Palma. They were neck and neck at the end of the third lap and at 10 miles crossed the wire together. De Palma led in the sixth lap; up to the eighteenth Christiaens led by a good margin; then De Palma took the lead. Rickenbacher, who ran third, after the second lap had worked up to second place by steady driving and in the twenty-sixth lap jumped to the lead. This was notwithstanding a blow-out as Rickenbacher rounded the first quarter at 20 miles.

De Palma resumed the lead in the thirtieth lap, after a record of 93.30 miles average for the first 60 miles. Aitken made his way to the front in the thirty-eighth and held it for the next 6 miles, when he was nosed out by De Palma. Christiaens jumped back to the lead for two laps, and then Rickenbacher took the van for 22 miles. The lead then seesawed between Aitken and De Palma, Aitken dropping out in the sixty-ninth lap from tire trouble. Milton ran along about tenth place until he had covered nearly 50 miles, when he began to spurt up to third place. He ran steadily third and fourth until he had tire trouble in the fifty-third round. After 10 miles he dropped out again. For 6 miles he had a neck-and-neck brush with De Palma.

Rickenbacher dropped out at the end of 116 miles, leaving the fast field to De Palma, Aitken and Christiaens. Osteweg withdrew at the end of 30 miles, Galvin at the end of 42 miles. Henderson had 118 miles to his credit when the flag fell and Buzane ran only 138 miles.

De Palma used Mercedes carbureted and shock absorbers, Eisemann plugs, Bosch magneto and Monogram oil. Aitken used Miller carbureter, K. L. G. plugs, Oilzum and castor oil, Rudge-Whitworth wheels and Bosch magneto. Christiaens used Miller carbureter, K. L. G. plugs, Rudge-Whitworth wheels and Bosch magneto. Milton used Zenith carbureter, Rajah plugs, Oilzum, Rudge-Whitworth wheels and Bosch magneto. All the cars in the race used Bosch magnetoes except Muller's Dans L'Argent, which used Delco ignition. All but De Palma's Mercedes used Dixon's graphite and Hartford shock absorbers. All used Motometers except Milton, O'Donnell and Muller.

factory officials came from Detroit to tell them of the company's plans for the year.

Commercial preparedness was the keynote of the gatherings at the eastern cities. A warning was sounded to dealers against any tendency to treat the immediate future as a period of easy sailing simply because the demand for automobiles at this time exceeds anything experienced in the past. It was pointed out that increased production will demand increased selling activity.

100,000 Cars Planned

Announcement was made to the dealers by Vice-president Ollier that the Studebaker Corp. plans a production of 100,000 cars beginning July 1. Sales for the past 12 months have been double those in any similar period, and practically another doubling of sales for the coming 12 months over the period just closing is provided to take care of the greater output. Information was given to the dealers regarding the factory's plans for selling the increased production of cars.

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Perfection Spring in U. S. Service

CLEVELAND, OHIO, July 5—The Perfection Spring Co. has been appointed by Secretary of War Baker responsible for the maintenance of the spring equipment on all United States government trucks in use in the Mexican campaign. E. O. Blanchard, president of the Perfection service station in this city, has left for the front in charge of the work for the local company.

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Rain Postpones Sioux City Race

SIOUX CITY, IOWA, July 4—*Special Telegram.*—A 3-hour cloudburst which visited this city early this morning transformed the local speedway into a pasty mass of mud and made necessary postponement of the Independence Day race meet until Saturday of this week. A number of the drivers disagreed on the time of postponement and the result was that several entrants withdrew their cars Dissatisfaction has been expressed among the drivers concerning the method of prize distribution without a stipulated guarantee. The arrangement here this year calls for a percentage division of the gate receipts among the winners. Several drivers have stated that they would refuse to appear again under similar conditions.

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Tacoma Races Cancelled

TACOMA, WASH., July 4—*Special Telegram*—The match race for the Northwest Championship at this city to-day was cancelled in the third lap, when Parsons went out with a broken connecting-rod.

1916 Gasoline Output Is Record

140,000,000 Bbl. Marketed in First 6 Months, It Is Estimated

WASHINGTON, D. C., July 1—Some illuminating figures regarding the quantity of petroleum marketed in the United States during the first half of 1916 have been prepared by John D. Northrop, of the United States Geological Survey. He estimates that 140,000,000 bbl. were marketed during that period, his apportionment of the output among the major fields being as follows:

Appalachian, 11,400,000; Lima-Indiana, 1,800,000; Illinois, 7,900,000; Kansas and Oklahoma, 50,500,000; Northern and Central Texas, 4,200,000; Northwest Louisiana, 6,800,000; Gulf Coast, 11,400,000; Wyoming and Montana, 3,400,000; California, 43,500,000; miscellaneous, 100,000.

This quantity, which includes a little oil actually produced in 1915 but marketed during 1916, is appreciably less than the output during the first half of 1915, though it is greater by about 5,000,000 bbl. than one-half the entire quantity marketed last year. When it is considered that the first half of 1915 includes the period of maximum production of the Cushing pool in Oklahoma and the Crichton pool in northwestern Louisiana the disparity in output between the corresponding periods is not especially significant. The magnitude of this quantity, the fact that is is greater than one-half the total petroleum marketed in the United States in 1915, and the further fact that it reflects the results of general activity throughout all oil-producing areas rather than flush production in restricted areas is, however, significant and leads to no other conclusion than that the final satistics of oil marketed in 1916 are destined to establish a new record.

The outstanding feature of the petroleum industry during the half-year just closed was the high level reached in the prices of crude oil in March and maintained firmly to the end of the period. This level involves prices ranging from 90 to 350 per cent higher than those of a year ago for high-grade Eastern and Mid-Continent grades and reflects less strongly the decreased capacity of Cushing than it does the increased demand for crude oil.

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K. C. Speedway Nears Completion

KANSAS CITY, Mo., July 3.—The new 1⅛-mile speedway south of Kansas City, being built by the Kansas City Speedway and Exposition Co., will be finished by July 10, and the first event will be staged July 22. Several drivers have signed up for the races, including Ralph De Palma, Hudson; Eddie O'Donnell, Duesenberg; Eddie Rickenbacher, Peugeot; Ralph Mulford, Hudson; Earl Cooper, Burman Special; Jack Gabel, Sunbeam; Art Klein, Miles Special; and there is an entry of H. J. Rahe's Hudson with racing body, Mr. Rahe making the entry from the K. C. Automobile Training School.

The track is a triple radius track, built of the black gumbo that people of this territory known to be pasty and to pack like glue—there will be no holes dug in it by the tires.

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Uniontown Hill Climb July 20

UNIONTOWN, PA., July 1—The fourth annual Summit Hill Climb under the auspices of the Uniontown Motoring Association will be held July 20 on the mountain course between Hopwood and Summit. There will be three automobile races, consisting of a free-for-all and two races for cars of limited piston displacement. Flying starts of 100 yd. will be given in each event. Entries will close July 17. More than forty cars are already entered, including De Palma. The management expects the entry of Mulford and the Christiaens brothers in their two Sunbeams.

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More Firms to Protect Soldiers

JACKSON, MICH., July 1—The Briscoe Motor Corp., this city, will place the families of its soldier employees on its payroll during the guardsmen's service to their country in Mexico. Their positions will also be held open for them until they return. It is reported that more than 1 per cent of the employees of the concern are guardsmen in the army.

Several of the automobile concerns in Long Island City will also protect their workmen. The Pierce-Arrow company will hold the men's jobs open until they return and give them full pay all the time they are away.

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New Miller Tire

AKRON, OHIO, June 29—The Miller Rubber Co., this city, announces its new Millermolded black tread geared-to-the-road tire to be sold at a popular price. The company has been experimenting with this model for over a year.

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Peugeot Co. to Sell Premier

NEW YORK CITY, July 1—The Premier and the Peugeot cars will be sold together by the Peugeot Import Co., Broadway and Fifty-ninth Street.

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Oakland Branch in Dallas

DALLAS, TEX., July 1—C. L. Zutavern and others will open a factory branch of the Oakland Motor Co. here to distribute in Texas.

Factory Miscellany

To Make Vulcanizing Machinery—A new factory for the manufacture of vulcanizing machines was opened this week on West Chestnut Street, Canton, Ill. The company is in charge of F. A. Whitten, Charles Palmer and Abe Lewis. The machine produced is a timely invention. By a simple chemical process owners are enabled to repair a break in a tire within 5 minutes and without danger of burning the rubber. The operations of the company will be upon a small scale at the outset, but it is planned to expand as business warrants.

Gillette Tire Plant Progresses—Excellent progress is being made by the Gillette Safety Tire Co., Eau Claire, Wis., on the construction of its new plant and it is expected that the first tires will be coming through before Aug. 15. The main building, the first unit of the proposed group, is 60 x 250 ft. in size. It will be equipped with $30,000 worth of tire and rubber working machinery purchased from the Adamson Machinery Co., Akron, Ohio, and the total investment at this time will exceed $75,000. R. B. Gillette is general manager and J. S. Wilson is secretary. The initial output will be 150 tires daily and between eighty-five and 100 skilled workmen will be employed.

Wis. Factory Items—The Wald Mfg. Co., Eighteenth and Martin Avenue, Sheboygan, manufacturing accessories and parts, will erect an additional machine shop, 80 by 100 ft., one story high, made necessary by the rapid growth of its business.

The Four Wheel Drive Automobile Co., Clintonville, which has more than doubled the size of its works during the last year, is planning to erect a large new gray iron and malleable foundry during the late summer and early fall. A new machine shop, 100 by 200 ft., is now being completed. The company is working on large orders for army commercial vehicles for the American and European governments.

The Kurz & Root Co., Appleton, manufacturing electrical devices, has booked a large order from the United States government for the military electrical generating units which it has built for the last 18 months or more for foreign governments. The unit is designed for military camp service, in connection with the portable machine shops on motor trucks used generally for army service in this and foreign countries. The generator takes the place of the flywheel on a small four-cylinder, four-cycle gasoline engine and produced current for lighting camps as well as for wireless apparatus. The overall length of engine and generator is only 42 in.

The Pan-American Rubber Co., Milwaukee, has been organized with a capital stock of $200,000 to manufacture a patented inner tire, known as the cellular pneumatic inner tire. The concern takes over the business of the Sporub Tire Co., which has been manufacturing inner tires for about 10 months. Factory quarters have been leased in the Kopmeier Building, Third and Prairie Streets, and a large production is planned. At this time about fifty tires are being manufactured daily, but within a short time the number will be increased to 100, and within 60 days to 200. F. J. Ramler, H. C. Clauson and J. Kopmeier appear as incorporators of the new company. F. J. Ramler is president and general manager. He is half owner of the Standard Racine Rubber Co., Milwaukee, and a large stockholder in the Racine Rubber Co., Racine, Wis. He has been engaged in the rubber and tire business for more than 16 years. The cellular pneumatic tire is distinct from so-called tire fillers, in that it is virtually a pneumatic tube without the disadvantages of the ordinary tube and does not require inflation, and may be transferred from one casing to another.

Start Perfex Radiator Plant—Ground has been broken for the new plant of the Perfex Radiator Co., Racine, Wis., which established a factory in leased quarters about 4 years ago for the production of radiators for pleasure and commercial cars, trucks, tractors, etc. The main building will be 85 by 250 ft.

The Automobile Calendar

ASSOCIATIONS

July 9 - 13 — Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.

Sept.—Indianapolis, Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.

Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.

Dec. 2-9—Electricians' Country-wide Celebration.

CONTESTS

July—La Grande, Ore., Track Race, LaGrande Motor Club.

July — Burlington, Iowa, 100-Mile Track Race, Tri-State Fair.

July 8—Grand Rapids, Mich., 100-Mile Track Race, Auto. Business Assn.

July 14-15—Los Angeles to San Diego, Commercial Vehicle Endurance and Reliability Demonstration.

July 15 — Portland, Ore., Track Race, Northwest Auto Assn.

July 15—Omaha, Neb., Speedway Race.

July 15—North Yakima, Wash., Track Race, Hiller-Riegel Co.

July 20—Uniontown (Pa.) Hillclimb, Uniontown Motoring Assn.

July 22—Kansas City, West Speedway Race, Kansas City Speedway Co.

July 22—Oriskany Falls, N. Y., Hillclimb, Auto Club of Utica.

Aug. 5—Tacoma Speedway Race, Tacoma Speedway Association.

Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.

Aug. 12—Portland, Ore., Track Race, Hiller-Riegel Co.

Aug. 18-19—Elgin Road Race, Chicago Auto Club.

Aug. 26—Kalamazoo, Mich., 100-Mile Track Race.

Sept. 1-2—New York, N. Y., Sheepshead Bay Speedway, 24-Hour Race, Trade Racing Assn.

Sept. 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.

Sept. 4—Cincinnati, Ohio, Speedway, Cincinnati Speedway Co.

Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.

Sept. 4—Indianapolis Speedway Race.

Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.

Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.

Sept. 16—Providence Speedway Race.

Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.

Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.

Sept. 30 — New York City, Sheepshead Bay Speedway Race.

Oct. 7 — Philadelphia Speedway Race.

Oct 7—Omaha Speedway Race.

Oct. 14 — Chicago Speedway Race.

Oct. 19—Indianapolis, Ind., Race Indianapolis Motor Speedway.

Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

SHOWS

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.

Sept. 10-16 — Milwaukee, Wis., Show, Wisconsin State Fair, Machinery Bldg.

Aug. 2-9—Hollywood and West End, N. J., Show, Atlantic Exhibition Co.

Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

TRACTOR

July 17-21—Dallas, Tex., Tractor Demonstration.

July 24-28—Hutchinson, Kan., Tractor Demonstration.

July 31-Aug. 4—St. Louis, Mo., Tractor Demonstration.

Aug. 7-11—Fremont, Neb., Tractor Demonstration.

Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.

Aug. 21-25—Bloomington, Ill., Tractor Demonstration.

Aug. 28-Sept. 1—Indiana Tractor Demonstration.

Sept. 4-8—Madison, Wis., Tractor Demonstration.

Sept. 11-16 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, JULY 13, 1916—CHICAGO No. 2

U. S. Places Orders for Trucks Worth $3,500,000

Nine Makes of Vehicles, the Majority Being of 3-Ton Capacity, Included in Order—Two 5-Ton Types Are Ordered

WASHINGTON, D. C., July 8—Nine makes of vehicles are included in the motor truck order placed by the quartermaster general of the army during the past week—an order amounting to almost $3,500,000. Most of these nine makes are of 3-ton capacity, although two makes are of 5-ton capacity. In the purchase of these trucks the War Department has been largely governed by the recommendation of Gen. Frederick Funston, who has learned, through his subordinate officers, of the real needs of the army along motor truck lines, particularly the needs of the present service. Government officials here also are giving some consideration to the type of vehicles purchased to better regulate the models for military use.

To Simplify Purchases

By this means it will be possible, officers say, to eliminate the purchase of too many types, which would require the keeping of manifold parts and greatly add to the repair problem. It is entirely out of the question, experts declare, to adopt a single standard type, owing to the refusal of motor truck manufacturers to depart from their own distinctive designs, which are of commercial value. The order recently given was divided as follows:

Ninety-seven Riker, with bodies, 3-ton capacity; two Riker tank trucks; 8 Riker, with platform bodies, 3-ton capacity; 224 Peerless, with bodies, 3-ton; seventy-three Peerless chassis, 3-ton; two Peerless, platform bodies, 5-ton; twelve Peerless, platform bodies, 3-ton; six Reos, with bodies, ¾-ton; 264 Packards, with bodies, 1½-ton; 132 Packards, 3-ton; 528 Whites, with bodies, 1½-ton; thirty-three Whites, with bodies, 3-ton; ninety-nine Four Wheel Drive chassis, 3-ton; fifty-eight Kelly-Springfield, with bodies, 1½-ton; sixty-six Kelly-Springfield, with bodies, 3½-ton; ninety-nine Kelly-Springfield chassis, 3-ton; thirty-three Velie chassis, 1½-ton; thirty-three Velie chasis, 3-ton; 163 Packard chassis, 1½-ton; thirty-three Packard chassis, 3-ton.

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France Lowers Truck Duty

PARIS, June 28—*Received in New York July* 12—By the repeal of the import prohibition law, American trucks are now admitted to the French market on the pre-war tariff, which is roughly equivalent to 12 per cent of value. All passenger cars, however, are met by a 70 per cent import duty. This duty applies virtually to all vehicles weighing less than 2½ tons. The adoption of a weight limit instead of an attempt to define a commercial vehicle is a very intelligent move.

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Congress To Pass Trade-Mark Registration Law

NEW YORK CITY, July 1—Those manufacturers who are interested in export conditions will find it to their advantage by having their trade-marks registered. The United Export Bureau of THE AUTOMOBILE has received information from its agent in Chile, that Congress is about to pass a law in regard to the registration of trade-marks. Up to the present time, this has been a very simple procedure, but the Bureau is informed that in the future it will not be so easy, and above all, the expense for registering the trade-mark will be considerably higher than it is at present.

The United Export Bureau, which is thoroughly conversant with conditions in South America, is taking charge of this trade-mark work, charging a nominal fee to cover its expenses. Those makers wishing to procure the registration certificate may do so by sending the Bureau three copies of the trade-mark, also three photographs of the car which is to be registered.

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Gaston, Williams & Wigmore Profits $10,000 a Day

NEW YORK CITY, July 7—Gaston, Williams & Wigmore, exporters of trucks and automobiles, this week declared an initial dividend of $1 a share. Earnings thus far this year have increased steadily. For the period from date of organization, April 19, to May 31, profits were $400,000, or $10,000 a day. From Jan. 1 to April 19 they were $1,073,851, or at the annual rate of over $3,500,000, or approximately $10,000 a day.

For the current month, profits will run between $350,000 and $400,000, bringing the total for the first half year up to $1,800,000, or equivalent to $6 a share.

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S. A. E. Aeronautic Division to Meet

NEW YORK CITY, July 12—The aeronautic engine division of the S. A. E. standards committee will meet in Washington, Tuesday, July 18. Henry Souther will be chairman of the division and the first meeting will be attended by representatives of the aeroplane industry, government officials and officers of the army and navy.

7992 Cars and Trucks Valued at $8,426,928 Exported in May

Parts, Not Including Engines and Tires, Valued at $789,826—Total for 11 Months Period Is 71,175 Machines Worth $91,594,466—Parts, $20,649,739

WASHINGTON, D. C., July 8.—During May 1717 commercial cars, valued at $4,357,238, and 6275 passenger cars, valued at $4,069,690, and parts, not including engines and tires, worth $789,826, were exported to various countries. During the 11 months ended May the exports were as follows: Commercial cars, 19,849, valued at $53,254,400; passenger cars, 51,326, valued at $38,340,066; parts, not including engines and tires, $20,649,739.

In May a year ago 2426 commercial cars, valued at $6,583,912, together with 4821 passenger cars, valued at $3,971,483, and parts, not including engines and tires, to the value of $789,829, were shipped abroad. For the 11 months' period the exports were 11,006 commercial cars, valued at $30,561,880; 19,462 passenger cars, valued at $16,327,955, and parts, not including engines and tires, to the value of $6,714,001.

Europe Takes Most

As has been the case ever since the European war began, the bulk of our automobile shipments continue to find their way into Europe. A total of 877 cars, valued at $1,764,489, was exported to France in May last, as against 521 cars, valued at $1,106,572, shipped there in May a year ago. During the 11 months' period these shipments increased from 4472 cars, valued at $11,142,414, in 1915 to 7080 cars, valued at $18,054,753, in 1916.

The United Kingdom bought 975 machines, valued at $1,745,415, in May, a considerable falling off as compared to the purchases in May a year ago, which amounted to 4036 cars, valued at $5,895,856. However, this decline was nothing as compared with the big increase in the purchases for the 11 months' period, which in 1916 totaled 17,795 machines, valued at $24,705,017, as against 11,688 cars, valued at $16,736,165, exported in 1915.

Russia, which did not figure in the export tables last year, bought 359 cars, valued at $660,620, in May last, and that country's purchases of American cars during the 11 months' period of this year amounted to 5133 cars, valued at $15,528,974.

Denmark Becomes a Factor

Denmark is another country whose car imports from this country were not separately reported last year, but in May last we shipped there 210 machines, valued at $144,737, while during the 11 months' period the shipments totaled 807 cars, valued at $556,445.

There were no car shipments to Germany during any of the periods under consideration, but Italy took fifty-one cars, valued at $19,376, in May last and 307 cars, valued at $192,107, during the 11 months of this year. Twenty-three cars, valued at $17,004, were exported there in May a year ago. while during the 11 months' period the number was 111 and the value $75,372.

There was a big drop in our exports of cars to "other Europe," the shipments declining from 699 cars, valued at $1,638,709, in May, 1915, to 404 cars, valued at $392,189, in May last, and from 2817 cars, valued at $7,768,101, during the 11 months of last year to 2149 cars, valued at $2,651,331, during the same period of this year.

Shipments to Canada show a big increase from 838 cars, valued at $630,990, in May a year ago to 1779 cars, valued at $1,212,260, in May last and from 3606 cars, valued at $3,796,729, during 1915 to 9212 cars, valued at $6,368,633, in 1916.

Even war-ridden Mexico shows a healthy growth in its imports of automobiles from this country, fifty-eight cars, valued at $53,500, being shipped there in May last, as against three cars, valued at $4,407, exported in May a year ago, while during the 11 months' period the exports increased from sixty-seven cars, valued at $68,067, in 1915 to 396 cars, valued at $381,818, in 1916.

Another section of the world that is showing a fondness for American cars is the West Indies and Bermuda, which took 495 cars, valued at $296,798, in May last and 4355 cars, valued at $2,642,466, during the 11 months of this year. Last year the shipments there amounted to 262 cars, valued at $131,779, during May and 1383 cars, valued at $827,989, during the 11 months.

Under the heading "South American countries," we shipped 165 cars, valued at $88,631, in May a year ago, while during the 11 months of 1915 the exports there amounted to 1071 cars, valued at $583,119. This year the shipments have increased to such an extent that the various countries of South America are listed separately in the export tables and the figures are as follows: Argentina, 578 cars, valued at $279,736, in May and 4075 cars, valued at $1,910,679, during the 11 months of 1916; Brazil, thirty-two cars, valued at $14,944, and 236 cars, valued at $142,191; Chile, sixty-nine cars, valued at $62,736, and 773 cars, valued at $527,291.

Exports of Automobiles, Trucks and Parts for May and 11 Previous Months

	May				11 Months Ending May			
	1915		1916		1915		1916	
	Number	Value	Number	Value	Number	Value	Number	Value
Passenger Cars	4,821	$3,971,483	6,275	$4,069,690	19,462	$16,327,955	51,326	$38,340,066
Commercial cars	2,426	6,583,912	1,717	4,357,238	11,006	30,561,880	19,849	53,254,400
Parts, not including engines and tires	....	789,826	....	2,426,206	.....	6,714,001	.....	20,649,739
	7,247	$11,345,221	7,992	$10,853,134	30,468	$53,603,836	71,175	$112,244,205
By Countries								
Denmark	....	.....	210	$144,737	.....	.....	807	$556,445
France	521	$1,106,572	877	1,764,489	4,472	$11,142,414	7,080	18,054,753
Germany	....	.....	....	.....	20	20,164	....	.....
Italy	23	17,004	51	19,376	111	75,372	307	192,107
Russia	....	.....	359	660,620	.....	.....	5,133	15,528,974
United Kingdom	4,036	5,895,856	975	1,745,415	11,688	16,736,165	17,795	24,705,017
Other Europe	699	1,638,709	404	392,189	2,817	7,768,101	2,149	2,651,331
Canada	838	630,990	1,779	1,212,260	3,606	3,796,729	9,212	6,368,633
Mexico	3	4,407	58	53,500	67	68,067	396	381,818
West Indies and Bermuda	262	131,779	495	296,798	1,383	827,989	4,355	2,642,466
South America	165	88,631	....	.....	1,071	583,119	.....	.....
Argentina	....	.....	578	279,736	.....	.....	4,075	1,910,679
Brazil	....	.....	32	14,944	.....	.....	236	142,191
Chile	....	.....	69	62,736	.....	.....	773	527,291
Venezuela	....	.....	16	12,025	.....	.....	432	276,495
Other South America	....	.....	94	63,355	.....	.....	547	319,643
British East Indies	....	.....	367	270,432	.....	.....	2,834	2,145,615
British Oceania	256	212,316	934	660,862	2,727	2,271,349	7,043	5,661,675
Asia and Other Oceania	241	588,116	558	687,468	1,581	2,708,004	4,736	6,148,853
Other countries	203	241,015	136	85,986	925	892,362	3,265	3,380,480
	7,247	$10,555,395	7,992	$8,426,928	30,468	$46,889,835	71,175	$91,594,466

Hupp Business Gains 47.3 Per Cent

Floorspace Increased 93.9%—Will Produce 18,000 Cars in Next 12 Months

DETROIT, MICH., July 10—With the close of the 1916 selling season, July 1, the Hupp Motor Car Corp. announced an increase in business over the 1915 season of 47.3 per cent. The gain in the Hupp corporation's business was made notable by the fact that for practically 8 months the main Detroit plant has been in the hands of builders. During the past season, the floorspace in the Hupmobile factories has been increased 93.9 per cent, practically doubling the space of 1 year ago.

With the buildings now being completed, the plants will have a capacity more than double that of 1 year ago. The company is installing approximately $500,000 worth of cost-reducing machinery and efficiency equipment in its Detroit and Jackson plants. In preparation for a steadily growing business, the company's investments in enlarging and improving the plants have in the past year aggregated approximately $1,000,000.

The number of factory employees has been increased 74.6 per cent, and an additional increase of nearly 1000 men will be made within the next 90 days, when the final factory additions are completed. A production of 18,000 to 20,000 cars is planned for the next 12 months.

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General Motors Directorate Includes Chrysler

DETROIT, MICH., July 10—Further revision of the directorate of the General Motors Co. was made at the quarterly meeting, when Walter P. Chrysler, the newly elected general manager of the Buick company, was made a director, following the resignation of S. F. Prior, who is prominent in the Union Metallic Cartridge Co. and the Remington Arms Co.

Thomas Neal, former president of the organization and chairman of the board, is again an officer by his election as vice-president at this meeting. He will share the duties of the vice-presidency with A. G. Bishop, the Flint banker, who was elected a vice-president last fall.

In placing Chrysler on the directorate, another of the General Motors subsidiaries was given representation on the board. Not long ago W. C. Leland, of the Cadillac company, was elected to the board, and with the placing of W. L. Day of the General Motors Truck Co., and F. W. Warner of the Oakland Motor Car Co. also on the directorate, there are four of the subsidiaries directly represented.

These recent director changes followed the resignations of J. J. Storrow, Albert Strauss, Emory W. Clark and S. F. Prior. The revised board as it now stands follows:

Pierre du Pont, chairman; J. H. McClement; C. S. Mott; C. W. Nash, Lammont Belin, A. H. Wiggin, C. S. Sabin, J. A. Haskell, J. J. Roskob, F. W. Warner, W. L. Day, W. C. Leland, W. P. Chrysler, Thomas Neal, W. C. Durant, L. G. Kaufman, and A. G. Bishop.

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New Thomas Truck Ready for Market

NEW YORK CITY, July 10—The Thomas Auto Truck Co., Inc., which was organized early this year by C. K. Thomas, formerly vice-president and general manager of the Federal Motor Truck Co. of New York, now has its 2-ton model ready for the market. Eventually there will be three other models rated at ¾-ton, 1-ton and 1½-ton. The 2-ton model is built entirely of standard units the principal specifications including a 4-cylinder, 4⅛ by 5½ Buda motor, selective three-speed gearset, dry-plate clutch in unit with the motor, worm drive, with Timken-David Brown worm and propulsion and torque taken through the spring. Frame is pressed steel with a total overall length of 214 or 232 in. Wood wheels are fitted with 34 by 4 front and 34 by 4 dual or 34 by 6 single rear tires. The steering wheel is at the left with control levers in the center. The standard wheelbase is 150 in. with 168 in. optional and the tread is 58 in. The loading space is 112 in. with 130 in. optional. Regular equipment includes Bosch lighting generator, electric lamps, 6-volt 110 amp.-hr. battery, electric horn, bumper, windshield, front fenders, tools, etc. The company does not manufacture bodies but will furnish conventional designs on orders. Special designs will also be produced.

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Reo Buys Out National Coil

LANSING, MICH., July 10—The Reo Motor Car Co. has bought out the National Coil Co., which employs about 100 men. The building will be used to extend the manufacturing facilities of the Reo company. Although no figures are given out, it was stated by an official of the Reo Motor Car Co. that it has been decided to build 50 per cent more Reo passenger cars for the season 1917. This will probably mean a total production of from 38,000 to 40,000 cars. A proportionate schedule has been adopted by the Reo Motor Truck Co.

Signal-Commerce Merger

To Be Known as Signal-Commerce Motor Truck Co.—Neal and Parker Heads

DETROIT, MICH., July 8—Merging of the Signal Motor Truck Co., maker of the Signal line of trucks, and the Commerce Motor Car Co., manufacturer of the Commerce trucks, has been effected here. The new organization taking over these two properties is to be known as the Signal-Commerce Motor Truck Co., and it is incorporated under the laws of New York State with a capital stock of 600,000 shares of no par value. The proposition is to be underwritten by fourteen members of the Detroit Stock Exchange, and active in its management will be Thomas Neal, head of the present Signal concern, and W. E. Parker, who is the head of the Commerce company

To Concentrate Production

The capital of the Signal company was increased from $85,000 to $450,000 in January of this year, and by a stock dividend the Commerce company was also raised some time ago to $250,000 capital. It is planned to concentrate the production of a very complete line of trucks, ranging from light delivery types to heavy-duty vehicles, in the new plant of the Signal company, located on Commonwealth Avenue, this city, removing the Commerce manufacturing business from its present location on Mackie and Solvay Avenues.

These two truck manufacturers are strictly Detroit companies, their stock being largely held here. Each makes a range of models of different capacities, and their merger will eliminate a competition between them that was keen. Mr. Neal, at one time president of General Motors Co., later chairman of the board of directors of that organization, and now one of its vice-presidents, is to direct the policies of the Signal-Commerce concern as chairman of the board. Among the directors will be W. E. Parker, who is also connected with the Mexican Crude Rubber Co.; Myron Neal of the Acme White Lead & Color Works, A. H. Buhl, T. J. Bosquette and W. K. Hoagland. There are also several other prominent automobile men interested whose names have not been disclosed.

Stock at $6

To give some idea of the amount of money involved, it is understood that the stock will be offered for subscripton at about $6 per share.

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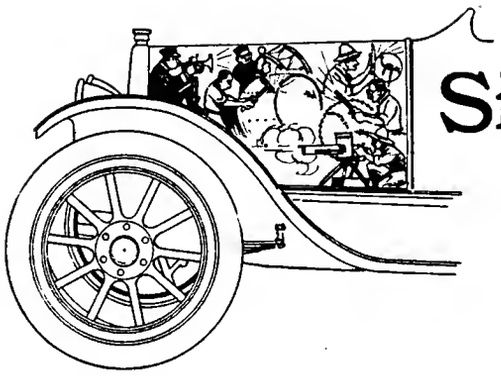
(*Trade News continued on pages* 77-84)



Silence=Continuous Noise

Over 200,000 Sounds Each Minute in a Twelve-Cylinder Car at 20 M.P.H.—Careful Design and Exquisite Workmanship Blend These Into a Pleasant Hum

By A. Ludlow Clayden

FOR the quietness of the modern automobile engineers have hardly received the credit that is properly their due; the immense difficulties with which they have had to contend only appear on a close examination. Some interesting figures can be obtained by calculating the number of opportunities for noise production that exist in a chassis, and the comparative frequency of each gives an opportunity for some "noise analyses" which are instructive.

Just to take a few striking cases, in order to show the idea. Suppose a twelve-cylinder chassis geared between four and five to one on high and running at twenty miles an hour with 34-in. tires. Using round figures we know that the engine fires six times in each crankshaft revolution, that the road wheel revolves 247 times per minute and if the gear is 4 5/11 to 1 the crankshaft revolutions per minute will be just about 1100. To simplify the argument, suppose it is 1000 r.p.m. Then the number of explosions per minute will be 6000 or no less than 100 per second.

400 Valve Shocks per Second

Taking a further step, each valve is opened and closed once to each explosion; so at a rate of 100 explosions per second there are 200 valve-lifting motions performed and 200 valve closings. The crankshaft revolves twice to each explosion and the piston makes four complete strokes, hence the 100 explosions per second represent 400 piston strokes in the different cylinders. Meanwhile the breaker mechanism must operate the contacts in the ignition device 100 times. If a chain front end is used the crankshaft sprocket will have about twenty teeth and will revolve 1000 times in the minute, so there will be 20,000 engagements of chain link with sprocket tooth on the crankshaft pinion; on the camshaft sprocket, and on any other intermediate pinion an equal number of contacts must take place.

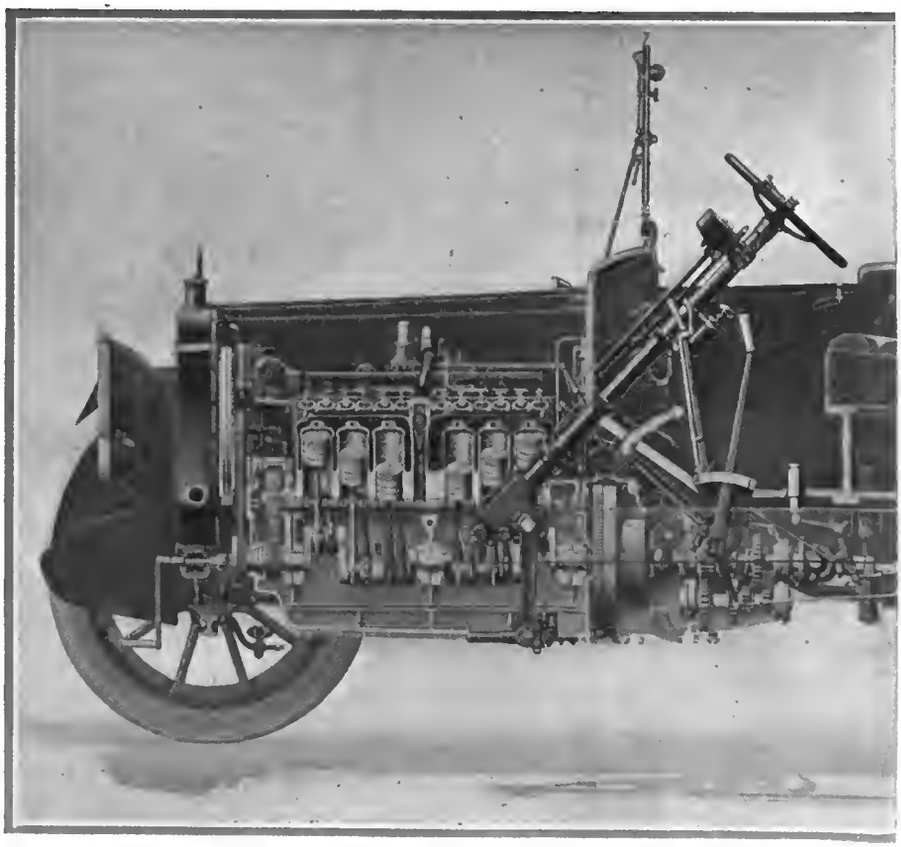
Thus, neglecting any other parts in addition to those mentioned, with a twelve-cylinder car running at 20 m.p.h. there are 2000 things happening every second which have possibilities for noise production; and each minute there will be 120,000.

Engine Makes 150,000 Sounds per Minute

Of course, what happens is that each minute sound blends with the others, so that the resulting sound is practically continuous and capable of being described as a low hum. Even today the predominant sound is almost always that of the escaping exhaust gases and, at certain speeds, the hiss of the air entering the carbureter.

There are many other small joints and connections on the engine which might be included. The generator brushes make and break contact on the commutator bars, the gears in the oil pump can be heard if you run the pump alone in a quiet room, there is probably a bevel geared head for the ignition which runs at a fairly high speed and so on. Altogether it is not too much to say that a twelve-cylinder engine at 20 m.p.h. performs 150,000 operations per minute, each of which could make an audible noise if it were not for the care taken to prevent it. And that engine is comparable with a water tank with 150,000 holes in the bottom, each closed by a cork of clever design and fine workmanship. Any falling off in quality of work means a loose cork and a leaking noise. As for instance a single loose lifter in the valve gear is instantly noticeable as a steady tap, tap, tap.

But, though the engine perhaps contains the greatest possibilities for noise making it is by no means all. In the gearset, in the rear axle, in the universals and in every bearing there is opportunity for sound production. To do a little more rough calculation let us consider the constant mesh gears in the gearset, one of the most troublesome parts from



This section of a twelve-cylinder Packard chassis shows most of the parts men
However, sufficient appear to emphasize the immense amount of engineering
ness of this and other

a noise viewpoint, though one which the average user never thinks about. Suppose there are twenty teeth on the pinion of the constant mesh gear pair, which is about the normal number. Then, since our engine is running at 1000 r.p.m. there will be 20,000 tooth contacts per minute.

Next, take the countershaft. This runs more slowly, say half the speed of the main shaft, and it drives the reverse pinion. Suppose there are sixteen teeth in the reverse pinion which is about as small as it could well be, then there will be 500 times sixteen or 8000 tooth contacts at this point.

Following the gear train through, the next step is the bevel drive of the rear axle. About as small a number of teeth as the pinion is likely to have is thirteen, twelve being the irreducible minimum. Thirteen teeth at 1000 r.p.m. means 13,000 contacts a minute and adding the contacts of teeth in the gearset we get a total of gear tooth contacts per minute of 41,000.

SOUNDS PER MINUTE MADE BY ALL PARTS OF TWELVE-CYLINDER CAR AT 20 M.P.H.

Explosions	6,000
Valves and tappets	24,000
Reversing piston direction	24,000
Breaker mechanism	6,000
Timing gear	60,000
Gearset and bevel drive	41,000
Bearings throughout car	56,000
Total	217,000

Bearings Create Noise

Another fruitful source of an audible, though quite a pleasant sound, is ball bearings. Each bearing contains a number of balls that carry the load when they are on one side of the shaft and have no load on them when on the opposite side. As each ball runs into the half where it is carrying the load it is compressed slightly; in other words it suffers a minute shock. Again, as it runs out of the loaded side into the half of the race where there is no pressure on it, it expands and thus creates another slight shock. Taking a very low estimate, this means that each ball bearing in the chassis, on the average, creates eight or ten tiny vibrations every revolution, roller bearings doing exactly the same thing, of course.

In the gearset there are two bearings at least on the mainshaft which make 1000 r.p.m. or a total of 16,000 shocks per minute. On the countershaft there will be another pair of bearings which run at half speed and so cause half the number of shocks or 8000, giving a total of 24,000 per minute for the gearset. In the rear axle there will be two races making 1000 a minute on the bevel pinion shaft, giving another 16,000 and the two bearings supporting the differential together with the two at the outer ends of the axle driveshafts will account for another 8000 shocks. This is figuring on a semi-floating axle, if it is floating another 4000 is to be added.

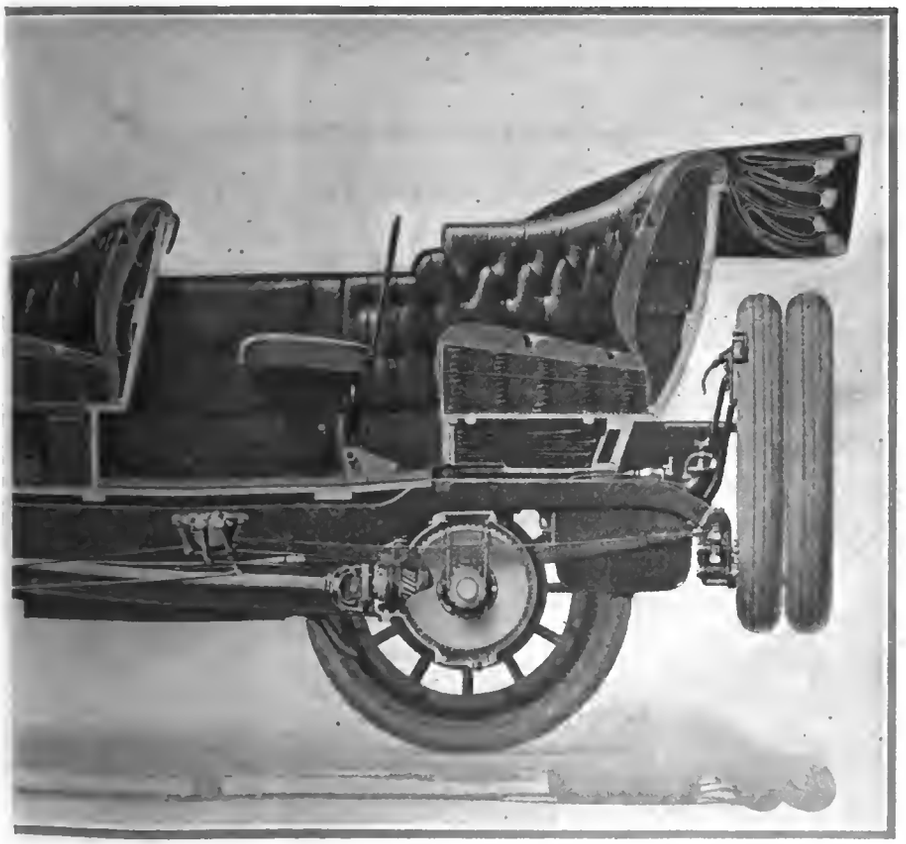
In the front wheels there will be at least four races of ball or roller bearings and these will cause another 8000 shocks between them. This completes the consideration of the principal parts of the chassis, with the exception of the universal joints, but as the stress on these is steady and does not vary in direction there is no reason why they should produce any sound, however small.

In the foregoing many other possible sources of sound have been neglected. For example there are probably gears to drive the speedometer, there may be ball bearings in the generator, there are ball thrust bearings which can make a sound if they are not perfect in manufacture and there are the engine auxiliaries already mentioned. One other thing which ought to be considered is the cooling fan which makes a hum by the action of its blades and also has to stand for at least 24,000 vibrations in the ball bearings which carry it, although, of course, like all other bearing variations, the amount of each is practically molecular in smallness.

Adding up all the sources of sound itemized we get the surprising total of 217,000 things which happen every minute, each of which taken individually is able to cause a sound. In an automobile running at 20 m.p.h. the hum which one hears is composed of *nearly a quarter of a million individual sounds.*

An experiment which may serve to illustrate what happens is to hold down the loud pedal of a piano and then to strike every note simultaneously. After the first crash has died away all the strings will be vibrating and a low sound will be heard that is a blend of all the chords and dischords of the keyboard. With the standard piano this is only a blend of eighty-four notes as compared with the 217,000 of the car.

Another rather interesting thought is that each of the 217,000 sounds taken alone, if they could be isolated, would produce a recognizable note. The smallest number of vibrations per second that is distinguishable as a steady note is sixteen, and this is said to be the pitch of the note made by a big bee. The middle C of a piano should give 512 vibrations per second, and the high C 1024 vibrations, while the highest pitch which any human ear can catch as a sound at all is 40,000 vibrations per second. In an automobile a definite note is to be avoided, and



tioned in the anaylsis of sound production. It does not show quite all of them. knowledge and of manufacturing skill which makes possible the extreme quiet high-grade chassis.

the reason that gears are such a particularly troublesome part to quiet is because they readily produce a note which is within the scale to which the ear is accustomed. For instance, as the middle C has 512 vibrations per second, this corresponds to a gear with twenty teeth running at 1536 r.p.m. Accuracy in workmanship can minimize the shock which occurs as each pair of teeth engage, and the use of large pitch, so as to reduce the number of vibrations per second by cutting down the number of teeth lowers the pitch of the note. A lower pitch not only is less irritating to the ear, but it blends more readily with the other sounds, hence the reason why coarse pitch gears often operate with such desirable quietness.

In the days when motoring was new S. F. Edge, of Napier fame, once said that there is in this world no such thing as silence, there is only continuity of noise. It is a succinct phrase and its truth is perhaps enhanced by the figures itemized above.

Determining Center of Gravity and Moment of Inertia

By Harry B. Wrigley

THE center of gravity and moment of inertia are properties well-known for common sections of beams, shafts, etc., but for other sections, as automobile axles, machine frames, rails, crane-hooks, etc., where the outline is such that the integration in the expressions for center of gravity and moment of inertia is difficult, the following graphic method will be found convenient.

Let it be required to locate an axis passing through the center of gravity of the axle shown in the figure.

Draw axes 1-1 and 2-2 at a convenient distance h apart, parallel to the required axis.

Draw any line as 3-3 parallel to 2-2 and project the points b-b on 2-2; from O and through the intersections on 2-2 draw straight lines intersecting 3-3 at b'-b'; continue this process by determining other points b'-b' and connect them to produce a transformed section.

The statical moment, M, of a plane surface with respect to an axis in the plane is equal to the sum of the products of the elementary areas and their distance from the axis considered, or, it is the product of the area of the plane surface and the distance of its center of gravity from the axis.

Measure the area of the original section and let A denote this area; also let d be the distance from 1-1 to the gravity axis; then by definition $M = Ad$. Measure the area of the transformed section $b' \ldots b'$ and let A_1 denote this area; then M, for the original section $= hA_1$, therefore $d = \frac{hA_1}{A}$, which will now be proved.

Let e denote the distance from axis O-Y to b;
e' the distance from axis O-Y to b';
ew an elementary area;
S the distance of ew from axis 1-1.

It will be noticed that $\frac{e}{h} = \frac{e'}{S}$,

hence $e = \frac{e'h}{S}$

By definition $M = ew.S \ldots\ldots + ew.S$
$= h(e'w \ldots\ldots + e'w)$
$= hA_1$

but $M = Ad$, therefore $d = \frac{hA_1}{A}$

To determine the moment of inertia of the section with respect to its gravity axis.

Project the points b'-b' on 2-2; from O and through the intersections on 2-2 draw straight lines intersecting 3-3 at b''-b'' and through these points construct a second transformed section.

The moment of inertia I of a plane surface with respect to any axis as 1-1 is the sum of the products obtained by multiplying the area of each element of the surface by the square of its distance from the axis.

The moment of inertia I of a plane surface with respect to any axis as 1-1 is equal to the moment of inertia I_g with respect to a parallel axis passing through the center of gravity of the surface plus the product of the area of the surface by the square of the distance between the axes; then $I = I_g + Ad^2$.

Measure the area of the transformed section $b'' \ldots b''$ and let A_2 denote this area, then for the original section $I = h^2A_2$, therefore $I_g = h^2A_2 - Ad^2$, the required moment of inertia.

Let e'' denote the distance from axis O-Y to b''.

Then $\frac{e'}{h} = \frac{e''}{S}$ and $e' = \frac{he''}{S}$; but $e' = \frac{es}{h}$ as before, hence

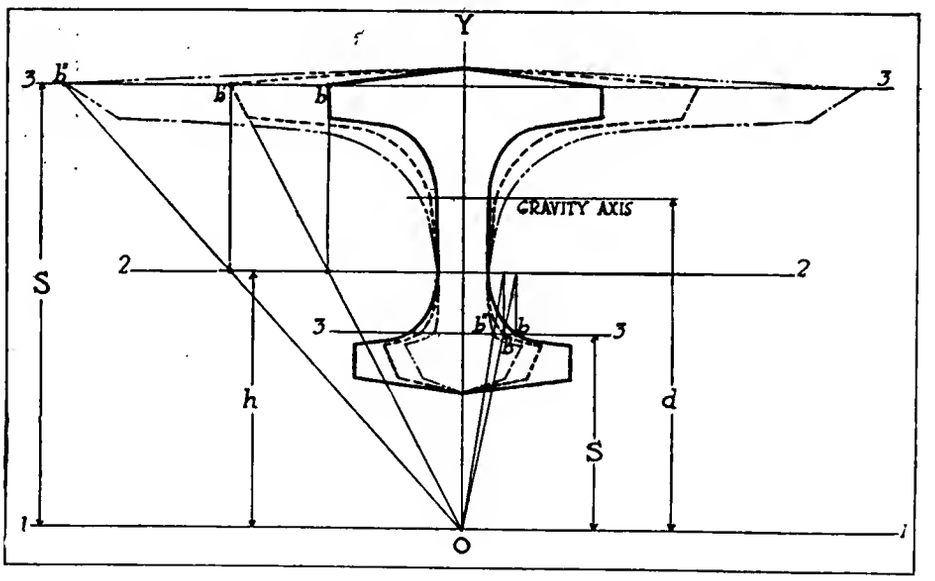
$S^2 = \frac{h^2e''}{e}$

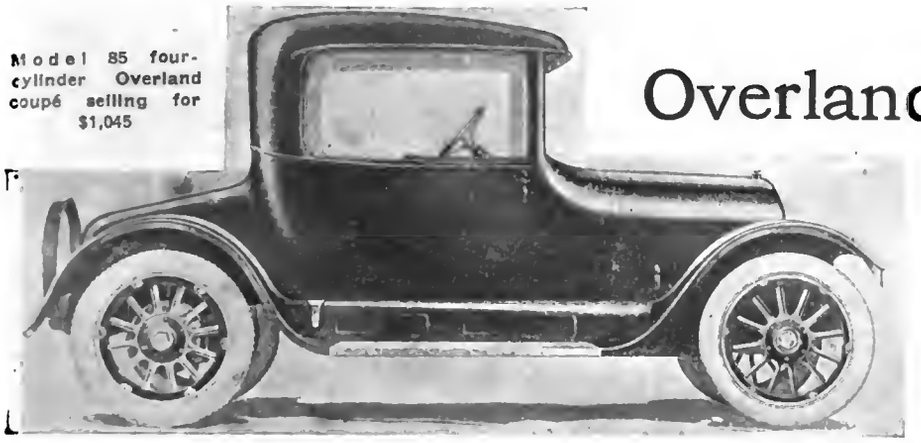
By definition $I = ew.S^2 \ldots\ldots + ew.S^2$
$= h^2(e''w \ldots\ldots + e''w)$
$= h^2A_2$

Armored Cars for U. S. Warships

Armored automobiles cradeled on the decks of warships, in seagoing rafts, for the use of detachments of the United States marine corps in short operations, may soon be added to the regular equipment of naval vessels.

Experiments at the Boston navy yard have demonstrated that these cars can be stowed aboard by the means of electric cranes on war vessels in a few minutes.





Model 85 four-cylinder Overland coupé selling for $1,045

Overland Fits Battery Ignition

Small Four Little Changed—Model 83 Discontinued—New Model 85 as Four and Six

IN the 1917 models of Overland cars made by Willys-Overland company, Toledo, Ohio, it is easy to see that many of the features of the little four which appeared last November have proved so good that they are now seen on the whole range of models. For example, the pressed steel rear axle case used for the small car is now found on the larger one, and the same is true of the cantilever springs. Sizes, of course are different, but the designs are almost identical.

Present models are series 75-B, the little four, and series 85, either four or six. Model 83 is discontinued altogether. The small car sells for $635 as a touring car and $620 as a roadster, while the model 85 touring car is $795 as a four and $925 as a six.

Will Use Battery Ignition

For the first time the Overland company will abandon magneto ignition for all its models. The new ignition incorporates a thermostatic throw-off arrangement, by means of which it is impossible to drain the battery through neglect to pull out the switch button. The current passing through the switch causes the temperature to rise in the thermostat, allowing it to bend and close an electric circuit, permitting the current to flow through a coil somewhat like a buzzer. This buzzer arrangement hammers on the switch button until it is thrown out, thus breaking the ignition circuit and preventing exhaustion of the battery.

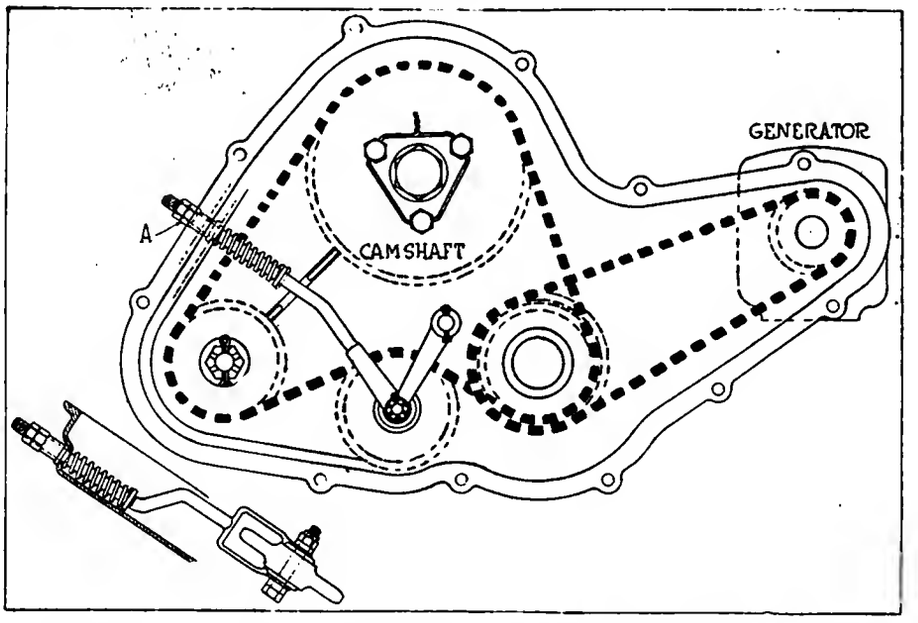
Among other changes it will be observed that the gasoline tank has been moved to the rear and a new form of rigid tire support has been incorporated. On the six-cylinder car, spiral bevel gears are used for the rear axle, while on the four-cylinder model the rear axle gears have straight teeth. The use of a leather universal joint is another innovation.

Probably the most outstanding feature of the model 85 Overland is the particular attention which has been paid to riding comfort. In relation to price both cars are quite long, the wheelbase of the four being 112 in. and of the six, 116 in. Both have large, comfortable bodies, with ample seating room for five persons. In addition to the improvements mentioned above, the seats in these new models have been built lower and deeper with a slight backward tilt to allow the passengers to relax slightly in the seats, and the seat cushions are built on deep coil springs which bear their share in the easy riding qualities of the car.

In the four-cylinder car, the power plant is a development of the four-cylinder engine which has now been used on over 300,000 Overland cars. It is of block design with a bore of 3¼ in. and a stroke of 4½ in. The manufacturers claim that it will readily develop 40 hp. The cylinders are iron castings and the pistons are also of cast iron. The piston length is 4 in., and the number of rings is two on this model. Connecting-rods are 8½ in. long and are of drop forged I-beam section. The crankshaft is carried on five main bearings and has a diameter of 1½ in. The engine is cooled on the thermo-syphon system, and one of the features of the engine is the large waterjacket space surrounding each cylinder.

The capacity of the radiator is increased by fitting of an auxiliary tank at the top, and the radiating surface is also augmented by corrugations in the thin vertical tubes of which it is com-

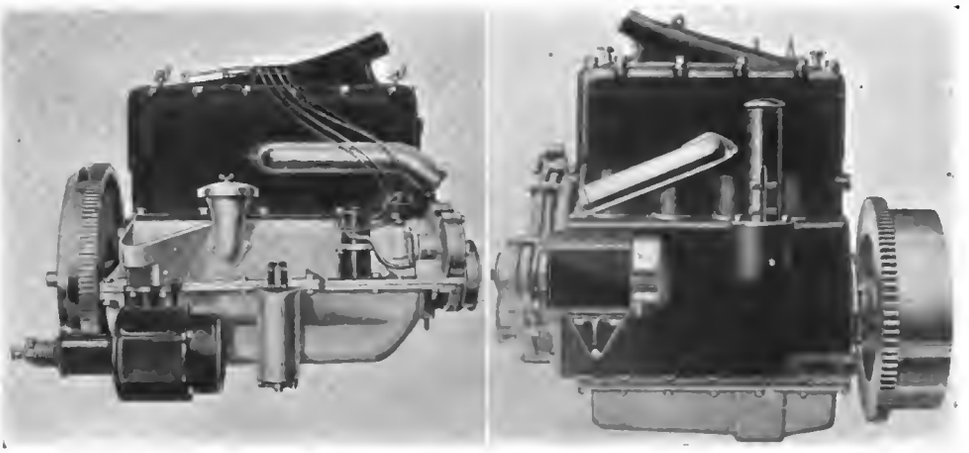
New universal used on model 85 Overland



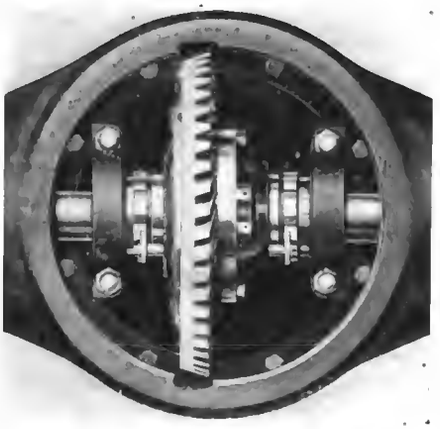
In the Overland camshaft drive by silent chain the idler design has been changed. Formerly the idler was pulled against the chain by a spring, now the nut and lock nut A outside the timing case give a positive adjustment, the spring inside having only a limited cushioning effect

posed. A shell of pressed steel acts as a protective housing for the radiator tubes and this is made from a single piece of steel having no joints in the metal. The shell is supported in swivel seats which relieves the radiator from any stresses which would be due to racking of the frame.

Splash-feed lubrication is used on the constant-level system in which the oil is continuously drained. A small gear oil pump located within the crankcase in a well at the rear end provides a steady flow of lubricant and also sends the oil through a revolving sight feed on the dash. The oil passes through the sight feed and returns to a lead which runs the length of the crankcase, supplying each of the troughs with a quantity of lubricant and keeping them constantly full. The overflow from the trough escapes back to the well in the crankcase, after which it is strained before again being circulated. The sight-feed indicator on the cowl dash clearly shows the flow of oil, for the oil in passing through it revolves a small fan-bladed wheel close to the glass face. There is also a float gage on the crankcase which indicates the amount of oil in the reservoir and the breather tube is widened at the top so as to also act as a filler opening.



Left—Engine of Overland 85-4, showing mounting of ignition distributer, starter and oil gage. Right—Engine of model 75-B, showing generator mounting and oil gage



Bevel gear assembly on model 85-6. Note the strong yet neat and efficient design without superfluous weight

New top fastening on the model 85. This simple and positive device greatly simplifies top manipulation

Six and Four Alike

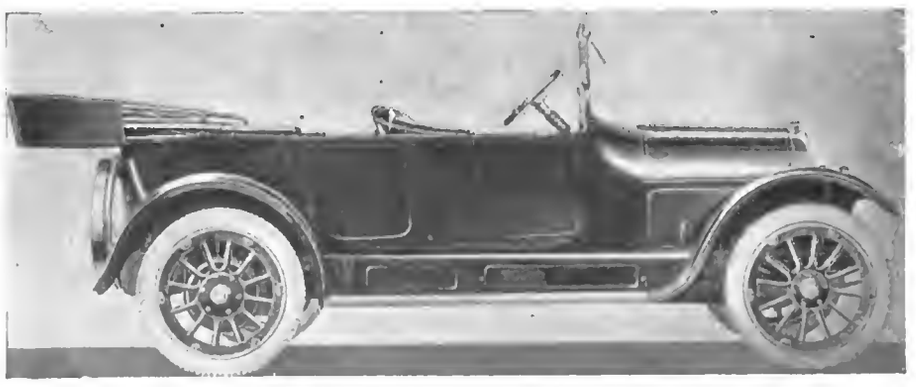
Other than in the power plant, the six-cylinder car is exactly the same as the four, except that the longer engine necessitates a longer hood and consequently a slightly longer wheelbase, the exact difference being 4 in. All this difference in length is made up at the front end of the car, necessitating, of course, a longer frame on the six than on the four. The six-cylinder engine is also a block design and is characterized by an extremely clean exterior. It has a bore of 3¼ in. and a stroke of 3½ in. It develops from 35 to 40 hp., according to the manufacturer's figures. The cylinder heads are removable and are cast in one piece, this construction giving great accessibility and also permitting accuracy in manufacture, particularly as regards the ability to machine all cylinders to a uniform size, thus having the effect of giving uniform compression in all cylinders. Throughout the engine is of conventional L-head design, with both the intake and exhaust manifolds on the right side, together with all the auxiliary apparatus, such as the water pump, ignition distributer, generator, starting motor, etc. The only parts mounted on the left side are the carbureter, the oil filler and the oil level gage.

The clutch is a leather-faced cone with three tension springs spaced evenly around, close to the rim. In releasing the clutch, six small spring studs press outward against the leather, raising it in spots, and when the clutch is engaged these raised spots touch first, providing a gradually increasing contract until the springs are fully depressed and the whole surface engaged. There is also a small fiber-faced clutch brake which stops the spinning clutch member and allows of easy gear shifting.

One Leather Universal

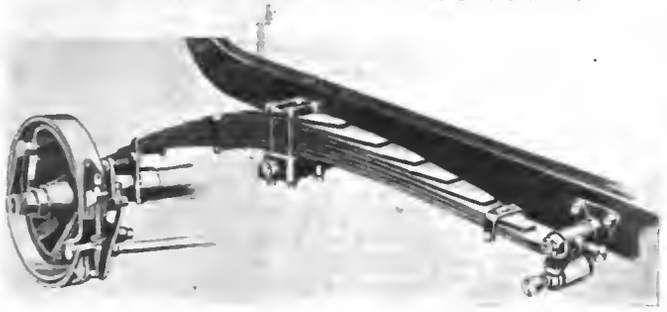
There is only one universal, this being the new leather design, since the gearbox is mounted in a unit with the rear axle. This gearbox provides three forward speeds and is made up of double heat-treated nickel steel gears of stub-tooth type. The shafts are carried on both roller and annular ball bearings. The rear axle is a floating type and as stated, on the four has straight teeth, while on the six it has spiral bevel teeth. There are four differential gears and the shafts are removable. The differential is carried on adjustable taper roller bearings, while the wheels are on annular ball bearings.

Two sets of brakes are used, the service set being contracting type, 13⅜ by 2¼ in. The emergency are expanding 13 by 2¼ in. Both sets



Overland 85-4 five-passenger touring car, which sells for $795

The cantilever springs used on model 75-B Overland are slung under the axle and the side members of the frame



On the 85 Overland, the rear cantilevers are mounted over the axle and at the sides of the frame members

operate on the rear wheel drums and are lined with asbestos fabric on woven brass wire core. The springs are semi-elliptic front, 36 by 1¾ in. and cantilever rear, 48 by 2¼ in. The wheels are wood, and the tires, 32 by 4 in., fitted with straight side tires and non-skids in the rear. On the touring sedan, mounted on the 85 chassis, the tires are 33 by 4½ in.; demountable rims are used throughout.

Bodies Last Word in Modernity

In the body work, the up-to-date conception of streamline design has been carried out through the entire line. The touring body is built with one-piece cowl and high-backed seat. The doors are hinged in front so that in case they are accidentally left open and strike an object they will be slammed shut instead of broken off. The doors are U-shaped, fitted with disappearing hinges and provided with large pockets, while the tool compartment is located under the front seat. Fenders are of heavy shaped steel and are crowned. The finish is Brewster green with ivory striping and the fittings are nickel and polished aluminum, while the fenders and other trimmings are black enamel.

Equipment Is Complete

The price of $925 for the six-cylinder and $795 for the four-cylinder touring car includes full equipment with Auto-Lite two-unit, 6-volt electric lighting and starting system; a complete set of lamps, dimmers and ammeter. There is also a speedometer and an oil pressure gage, complete tool equipment and an extra demountable rim. The top is a one-man mohair and the curtains are fastened from inside. The windshield is built in and incorporates both the rain vision and ventilating features. On this same chassis there is a touring sedan at $1,195 in four-cylinder, and $1,325 as a six, and a touring coupé at $1,045 and $1,175.

More Power in Small Four

The model 75-B is a new series which has taken the place of the previous small four-cylinder car. It is characterized particularly by a more powerful engine which is claimed to develop 31½ hp. at 1950 r.p.m., and to have a speed range of from 2½ to 53 m.p.h. on high. Another feature of the car is that it is equipped with 4-in. tires. It has cantilever suspension, two-unit, 6-volt lighting and starting and complete equipment. The body is new and is fitted with a one-piece cowl which slopes back in a graceful curve, preserving the characteristic Overland outlines.

Intake Manifold Cored in Casting

All four cylinders are cast in a block, having a bore of 3⅜ in. and a stroke of 5 in. and the combination of block casting with thermo-syphon cooling gives a very clean motor. The only auxiliary drive is that of the ignition distributer which is now used in place of a magneto and is mounted on the right side of the engine, back of the timing gear case. The valve mechanism drive is by silent chain and this drive also takes care of the distributer. The intake manifold is cored in the cylinder casting and delivers a warm mixture to the cylinders which is one of the factors in increasing the economy of the car.

Constant Level Splash Oiling

Lubrication is by constant level splash, the oil being circulated by a small pump which constantly maintains a supply of lubricant in the troughs beneath each cylinder. The clutch is the Overland type similar to that described for the model 85, having the three engaging springs with the auxiliary springs beneath the surface of the leather cone facing. The gearset is on the rear axle and is similar in design to that of the larger model, with three speeds and with nickel steel gears carried on shafts that are mounted on roller and annular ball bearings. The axle is floating and an unusual feature for such a low-priced car is that the differential is made up of four bevel gears. The axle shafts are removable and the bearing equipment is annular ball.

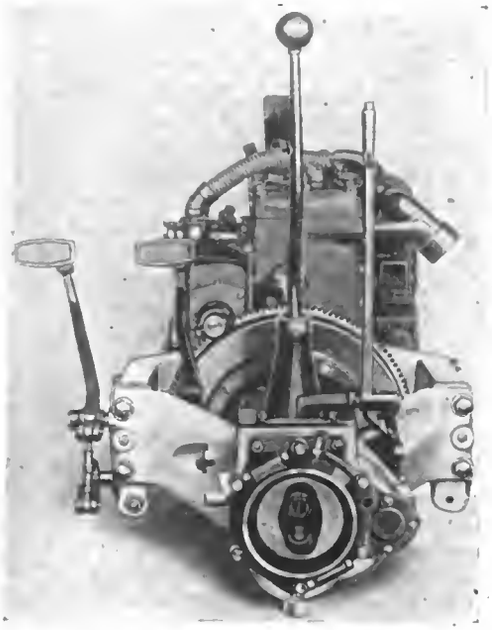
Fabrikoid Upholstery a Feature

Two sets of brakes are used, the surface being contracting 12⅜ by 1¾ in. and emergency 12 by 1¾ in. The springs are semi-elliptic, 36 by 1¾ in. with cantilever rear, 42 by 2 in. The tires are 31 by 4 in. mounted on artillery type twelvespoke wheels with demountable clincher rims. The bodies are streamline provided with Fabrikoid upholstery, front-hinged U-doors with large pockets and tool compartment beneath the rear seat. Heavy sheet steel crown fenders are fitted, and the finish is black and nickel and polished aluminum trimmings. The equipment is complete, including Auto-Lite starting and lighting, full set of lamps, ammeter, one-man Mohair top, inside fastening curtain, electric horn, combination tail light and license bracket, hinged robe rail, foot rest, tire carrier and extra demountable rim. There is also a full set of tools.

Instrument board of the 75-B Overland is compact and neat

Paige Makes Few Changes

Continues Models Seen at National Shows —Bodywork Has Been Improved, Giving More Room and Better Finish for 1917



Rear view of unit power plant used on Paige 6-38, showing control levers

AT the New York show last January a new model Paige known as the Fleetwood 6-38 appeared, this being an addition to the Fairfield model 6-46, which is a larger car. The 6-38 will be continued without any changes, but there have been a few alterations in the Fairfield model, mainly in connection with the body. The Paige-Detroit Motor Car Co., Detroit, Mich., has, like so many other manufacturers, found it necessary to raise its prices slightly, the smaller car now costing $1,090 as against $1,050 and the larger $1,375 as compared with $1,295. These prices are for five-passenger or roadster on the small chassis and seven-passenger or roadster on the larger six.

The changes in the 6-46 are not radical, but incorporate a few body alterations of importance and one mechanical difference. The body changes are a sloping windshield, instead of the vertical type formerly employed; a new form of upholstering in which the leather is arranged in piping, giving a long, tufted effect. Better springs are also used in the upholstery and these tend to make the car easier riding. Leather door flaps have been added and, in addition, there have been some improvements in the equipment in the form of a Boyce Moto-Meter, a vertical tire carrier in place of the slanting one on the previous car and a mahogany instrument board. A feature is made of the oversize tire equipment on this car and the color has been changed to Brewster green with ivory white wheels and black bonnet.

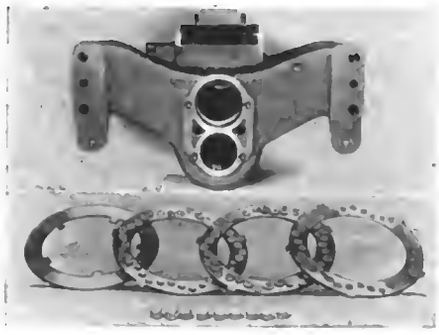
Has Gearbox Tire Pump

The only mechanical change is the addition of a single cylinder tire pump which is mounted on the gearbox and driven from the reverse idler pinion. This pump is a Stewart design and is arranged so that it is easily thrown into mesh by a lever projecting through the floorboard, and is of sufficient size to pump one of the 35 by 4½-in. tires the car uses in less than 5 min.

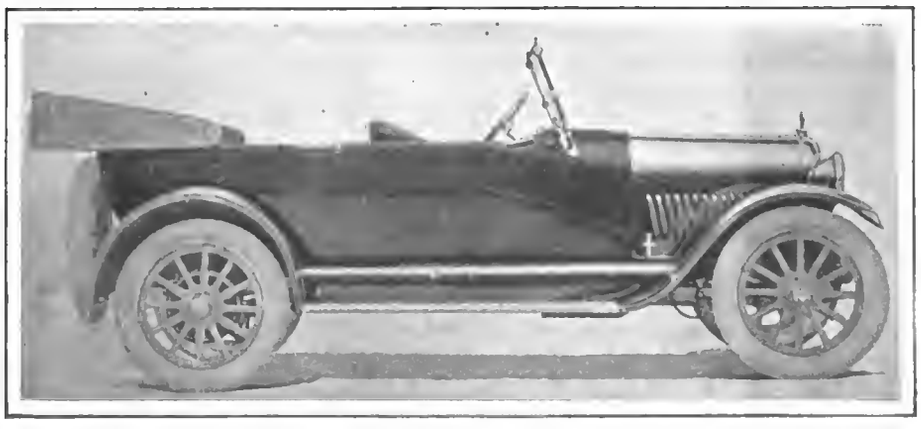
The Paige 6-46 chassis carries the Fairfield touring body and the Meadowbrook roadster. It is the larger of the two sixes and has a 124-in. wheelbase with a standard tread of 56 in. The engine is a block-cast 3½ by 5¼-in. unit power plant, having the clutch and gearset integral. The cylinder casting is of gray iron, while the crankcase proper is aluminum, the lower half of the crankcase which incorporates the oil pan being pressed steel. Valves are on the right and are composite, having nickel steel heads welded to 0.20-0.30 carbon steel stems. The entire valve mechanism is inclosed by aluminum cover plates, and the working parts are submerged in oil. With the aluminum covers and the block casting, a very simple exterior appearance is given the engine while, at the same time, the plates are removable and give easy access to the valve adjustments.

The crankshaft is a drop forging of alloy steel and every shaft is balanced individually for both running and static balance. The shaft diameter is 2¼ in. and three bearings are used for its support. The camshaft is also a carbon steel drop forging, having the cams integral with the wearing surfaces hardened and ground. The camshaft is carried in three die-cast bearings. In both the crankshaft and camshaft the bearing diameters are liberal, as are also the lengths. The crankshaft main bearings have the following dimensions: front, 2 3/16 in. diameter, 3 5/32 in. length; center, 2 7/32 in. by 2⅛ in.; rear, 2¼ in. by 3 9/32 in. The camshaft bearings measure: front, 2 17/64 in. diameter by 1 11/16 in. length; center, 2¼ in. by 1⅛ in., and rear, 2 7/32 in. by 1¾ in.

Drop forged, heat treated, I-beam connecting-rods are used of 0.35 carbon steel. The wristpin bearing has a diameter of 1 3/32 in. and a length of 1½ in., and the lower connecting-rod bearing has a 2 in. diameter and a 2 3/16 in. length. These rods, together with the pistons and the entire



Above—Massive aluminum gearbox. Below—Clutch disks in various stages



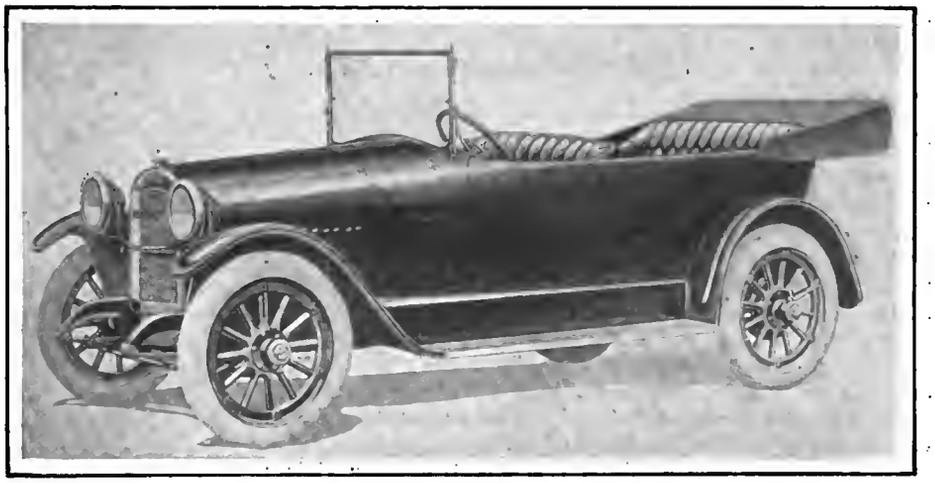
The Paige Fairfield model 6-46 seven-passenger touring car, which now sells for $1,375

reciprocating assembly, are balanced in sets, so that each complete assembly for a given engine must have a proper balance within very narrow limits.

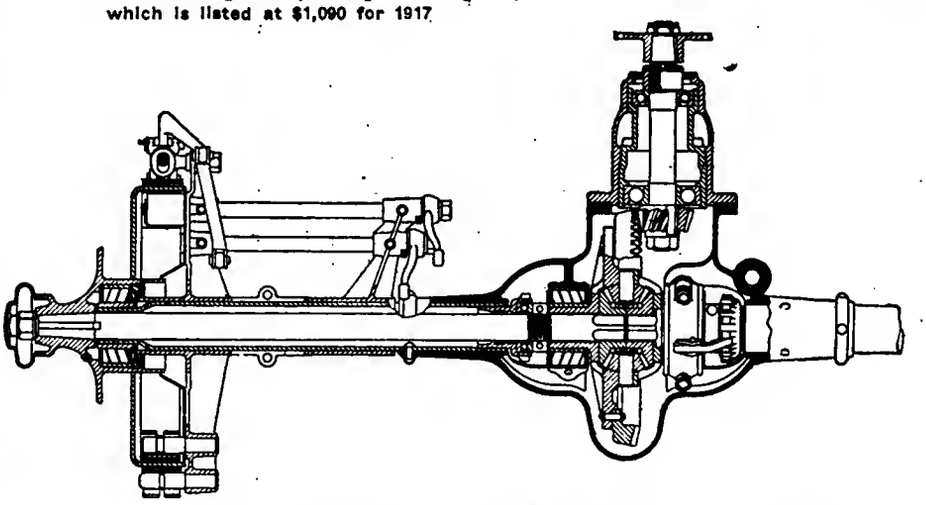
High Efficiency Sought

In carrying out the valve design particular attention has been paid to securing good volumetric efficiency at high speed. The diameter of the valve head is 1 11/16 in. and the opening of the port in the clear is 1 17/32 in. The valve lift is 5/16 in. The design of the valve is conventional with the 45 deg. seat, and the stem diameter is ⅜ in. The valve timing is also conventional, having the inlet opening at 10 deg. after top dead center with inlet closing at 28 deg. after bottom dead center. The exhaust valve opens 40 deg. before bottom center and closes 2½ deg. after top center. This leaves a 7½ deg. negative lap, during which time the piston descends a short distance on the suction stroke, allowing a vacuum to be created sufficient to overcome the inertia of the intake gases.

Lubrication is by a combined pressure and splash system. Oil is carried in the lower half of the crankcase, which has a capacity of 8 qt. A plunger pump operated from the camshaft forces the oil directly to each of the main bearings and to the helical timing gears. This gives four leads from the oil pumps as there are three main bearings and there is an independent lead to timing gears. Oil is forced through these leads in much greater quantity than is consumed by the main bearings, and the resulting overflow is allowed to pass into a series of splash troughs which are arranged one below each crank throw. The dip of the revolving cranks splashes enough oil to lubricate the remaining bearing surfaces, including pistons, cylinders, camshaft and cams.



Fleetwood model Paige five-passenger touring car, which is listed at $1,090 for 1917



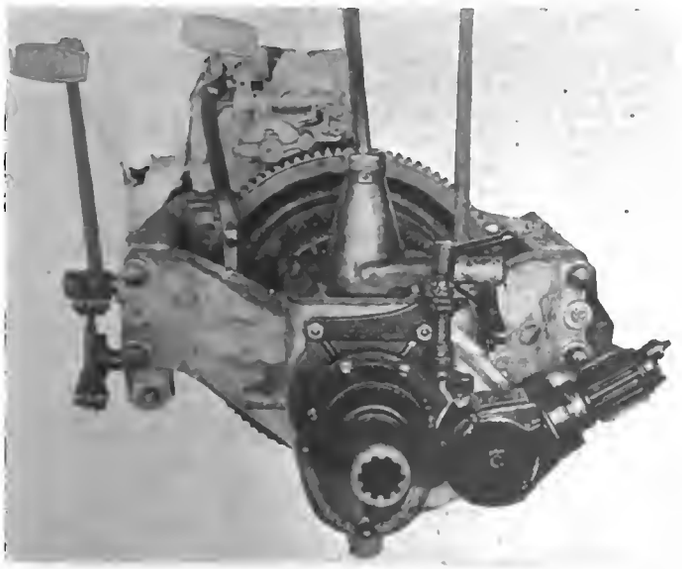
Section through the rear axle used on the Paige Fairfield six model for 1917

Cooling is by centrifugal pump which forces water to a zig-zag cellular radiator having a capacity of 7½ gal. Cooling is assisted by a ball-bearing four-bladed aeroplane type fan, which is hung from a casting directly on the front of the engine.

Gravity Gasoline Feed

The gasoline feed system is by gravity, the tank being located beneath the cowl and having a capacity of 14.7 gal. The carbureter is a Rayfield, supplied with both hot water jacket and hot air intake pipe. The exhaust manifold is located on the opposite side of the cylinder box from the carbureter and hence, in order to get the supply of hot air to the carbureter, it is necessary to carry it across the engine. This is done by fitting the hot air stove around the exhaust pipe and then carrying the hot air lead through the cylinder block between the third and fourth cylinders. Connection is made to the carbureter by a flexible tube on the opposite end of the passage. The hot air is thus provided directly from the exhaust manifold and is maintained at a high temperature by having it pass through the cylinder block where it comes in contact with the hot walls of the cylinder and also with the waterjacketing.

Electrically, the car is Gray & Davis as far as starting and lighting are concerned, while ignition is taken care of by the Remy high-tension distributer and Willard 6-volt storage battery. The starting and lighting system is a two-unit design with a series wound motor, meshing with the flywheel ring gear by means of a Bendix drive and a shunt wound generator on the right side of the engine, driven directly off



Mounting of the new power tire pump on the gearbox of the Paige Fairfield model for 1917

the water pump shaft through a flexible coupling. The automatic cut-out, which is a magnetic design, is mounted directly on the top of the generator, where it is easily reached.

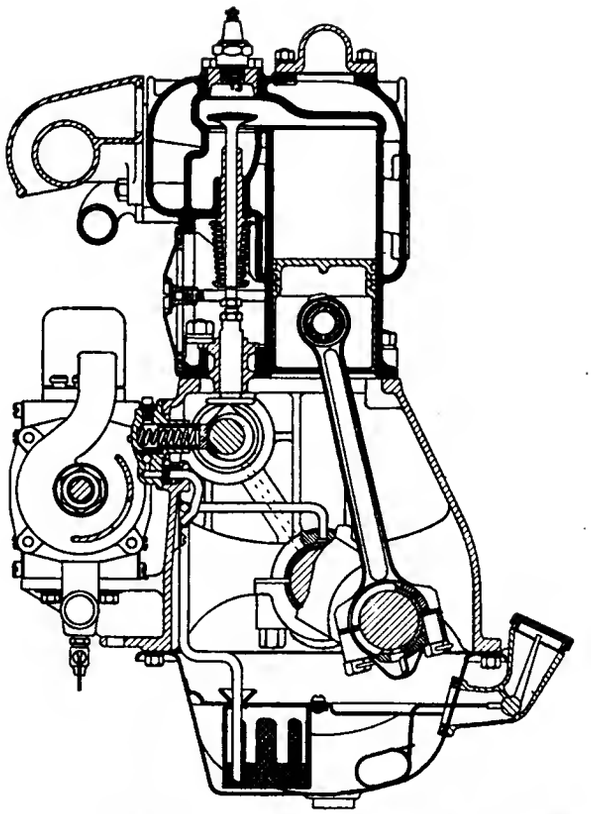
Clutch Runs in Oil

Power is transmitted through a multiple disk clutch, fitted with cork inserts, the entire clutch being inclosed within the flywheel and running in oil. The drive is carried back through a three-speed gearbox having an aluminum case which is a unit with the crankcase. The gears are of chrome nickel steel, hardened and ground, and the shafts are carried on both annular and Hyatt roller bearings. The main shaft is mounted on two annular ball bearings, while the countershaft is carried on two Hyatt high duty roller bearings. Lubrication for the gearbox is taken care of by transmission oil and the capacity of the box is 2 qt.

From the gearbox the drive is taken through a Spicer universal joint to the rear axle. This is a floating type having both the axle shafts and differential on Hyatt high duty roller bearings; the torque on this model is taken through a torque arm. The rear axle is geared 4.357 to 1, having a fourteen-tooth pinion and a sixty-one-tooth ring gear. This gives a reduction on low speed of 14.157 to 1, on second of 7.189 to 1, and reverse, 18.876 to 1. Two sets of brakes are used, working on 14-in. steel drums. The face width of the brake tooth is 2 in., one set of brakes being expanding and the other set contracting.

The front axle is a one-piece drop forged I-beam, heat-treated and provided with ball bearing spindles. The frame is of high carbon steel, channel section, having a 4-in. web and a 3-in. flange: the thickness of the material is 5/32 in., and it is narrowed in front to permit of a small turning radius, while at the rear there is a kick-up over the axle to reduce the height of the body. Springs are semi-elliptic front with cantilever rear, the fronts being 36 in. long and 2 in. wide, and the rears 48 in. in length and 2½ in. wide. The tires are Goodyear or Firestone, with non-skid tread on the rear. The steering gear is the Jacox irreversible screw and split sleeve type, adjustable for wear in any direction, with a steering wheel 18 in. in diameter in one piece, and made with a corrugated inner edge. The horn button is in the center of the steering wheel.

In bodywork, as noted, the cars have been very much improved, especially as regards fitting. The touring bodies are particularly roomy and easily carry a seven-passenger load. Some of the body measurements which are pertinent are as follows: front compartment from back of seat to toe board, 40 in.; height of cushion from floor, 13 in.; depth of seat cushion, 17 in.; width of seat, 47 in. and length of front compartment, 42 in.



Transverse section through the engine of the new Paige

The rear compartment measures from the back of the seat to the back of the auxiliary seat, 26 in., height of cushion from floor, 16 in.; depth of seat cushion, 19 in.; width of seat cushions, 48 in.

A Deferred Payment Difficulty

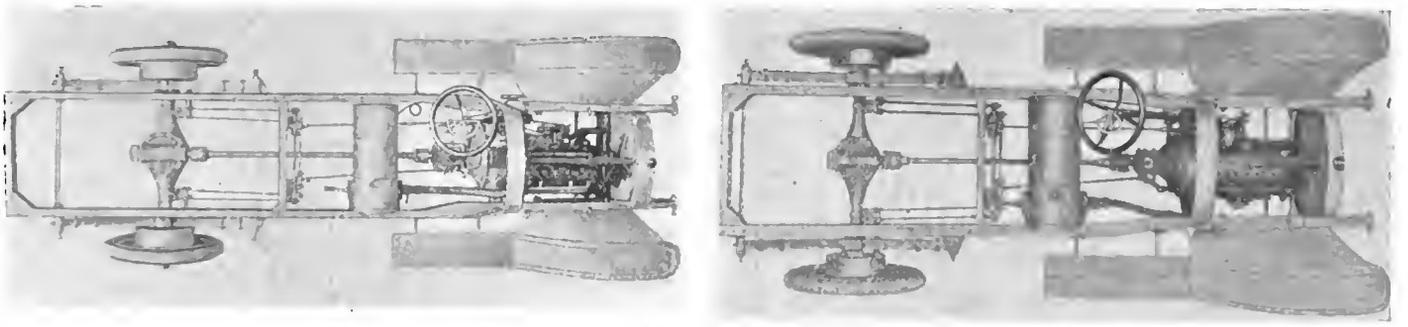
THAT an automobile manufacturer may retain title in an automobile even though he has received the whole amount under a sale contract, is the decision in a recent New York case.

The manufacturer had an agreement in writing with its agent in the city of Elmira, which contract was styled a "Limited Agency Contract." Under it the agent agreed not to sell automobiles for less than their list price; that he would advance in cash the sum of 85 per cent of the full advertised list price of each automobile at the time of its consignment to him; that his commission should be 15 per cent of the full advertised list price, to be paid by the company after payment of the full purchase price by the purchaser, and many other stipulations were contained in the contract.

In 1913 the agent sold a car and took from the buyer what was styled a "buyer's order and agreement." This was approved by the company and it was agreed that the car was to be paid for in monthly payments of $50 each. Thereafter the car was levied upon by a sheriff, who sold it under an execution issued on a judgment obtained against the purchaser. As the agent had forbade the sale of the car, he sued the sheriff to recover the sum of $195.70 which he claimed as his interest in the automobile.

The court held that the motor company, even after it had been paid the 85 per cent of the list price of the car, could have taken the car from its agent, as it held the title to it until the agent and the person to whom he sold it had fully performed their agreements.

It was further held that the cars were not sold to the agent at 85 per cent of the list price under the agreement, as the company restricted the sale of its cars at less than the list price and that such a contract was not against public policy under the decision of Ford Motor Co. vs. International Automobile League, 209 Federal 235, as that case did not hold that the company could not enforce its contract with its agents and fix a price at which its cars should be sold by them to users, but only held that the company cannot control the price of a car after it has passed into the hands of a user who has bought it from an agent and paid the full price for it. The agent was therefore allowed judgment against the sheriff on the ground that the title to the car was in the company until it assigned it to the agent. (Whitney vs. Biggs, 155 N. Y. S. (New York) 1107.)



The two Day-Elder chassis in plain view. The Senior model appears at the left and the Junior at the right

Two Worm-Drive Day-Elder Trucks

Junior and Senior of Conventional Design—No Governor

PRACTICALLY the same structural features characterize two truck models which the Day-Elder Motors Co., Newark, N. J., is now producing. They are rated at 1250 and 2000 lb. capacity, known respectively as the D-E Junior and Senior trucks. Both are conventional designs, with rather low, rakish lines, Hotchkiss drive through worm gears and unit power plant assembly.

An outstanding feature is that both models are without governors, the smaller one being mounted on pneumatic tires and especially designed for fast delivery work, and the larger with solid tires. Both have small, high-speed motors, which should show economy in ordinary work, and yet, being of the high-speed type, they are able to develop higher power than if they were governed. In each model the engine is incorporated with the clutch and gearbox and suspended on three points, final drive being by single shafts with two universals each.

On the Junior model the Le Roi motor is used and on the Senior, a Continental. Both are block-cast with valves to the right and both have thermo-syphon cooling through square-tube vertical radiators in sheet-metal cases. Single high-tension ignition with hand spark advance is used on each model, both having Dixie magnetos. A Schebler carbureter is used on the Junior model and a Zenith on the Senior.

Left Steer and Center Control

Brakes are all on the rear wheels, consisting of side-by-side internal types, with rocking equalizers. Left steer and central levers are common to both models, Gemmer steering gears being used. Jones wheels are employed, the pneumatic-tired ones on the smaller model having demountable rims.

The Stewart vacuum system of gasoline feed is used, fed from cylindrical tank beneath the seat on each model.

Clutches and gearsets on both models are the products of the Detroit Gear & Machine Co., and comprise dry-disk clutches and three-speed selective gearsets. The shafts and universals are of Hartford make, driving Sheldon worm-driven axles. Both torque and propulsion are taken by the springs.

Prices as quoted in the specification table below apply to the stripped chasis only, including the driver's cab. Electric starting and lighting will be installed for an additional charge of $85, including the lamps. Standard bodies are carried in stock and will be applied at extra cost or the chassis will be sold without bodies.

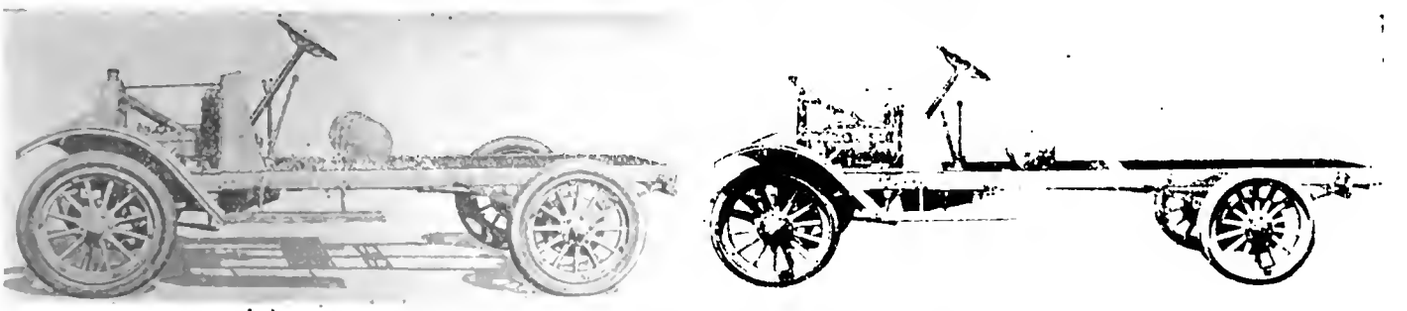
In appearance the trucks are pleasing, the radiators being located well back on the frame in both models, behind the front axle in each case.

	Junior	Senior
Capacity, lb.	1250	2000
Price	$875	$1,450
Wheelbase	108	128
Tires, front	33 x 4	34 x 3½
Rear	33 x 4	34 x 4
Bore	3⅛	3⅛
Stroke	4½	5
Formula, hp.	15.64	19.61
Speed, r.p.m.		
M.p.h.	42	35
Gear-ratio in high gear	6.5–1	7.8
Final drive	Worm	Worm

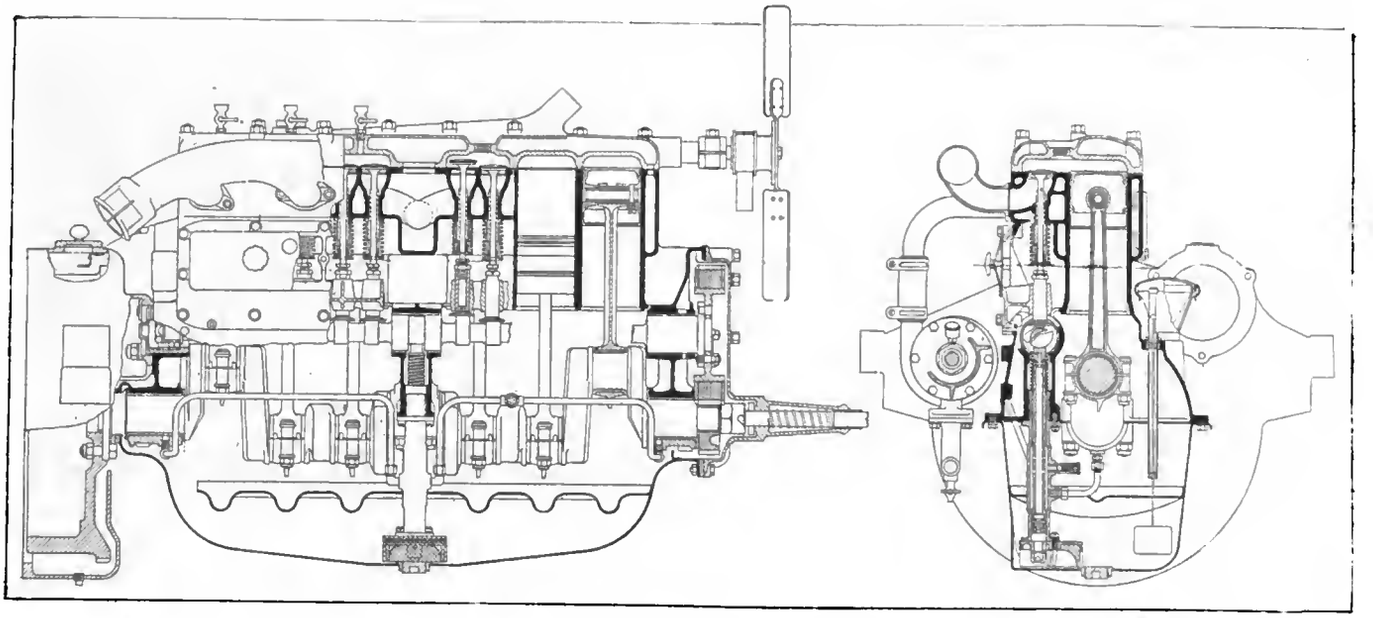
Some Simple Air Bag Precautions

A SUCCESSFUL western vulcanizer has found that he can save a great deal of money in the course of a year simply by being careful with his air bags.

The shape and inside dimensions of a Q. D. clincher tire are different from a straight side tire, so this vulcanizer has two sets of air bags, one for each type of tire. Tires of the same type but of different makes also vary in their dimensions but of course it would not be practical to have a different set of air bags for every brand of tires. To get around this difficulty the vulcanizer has pads of various sizes. —*Goodyear Tire News.*



Similarity of design marks the Day-Elder models. The Junior is at the left and Senior at the right



Longitudinal and transverse sections through the six-cylinder model 25 Rutenber engine. It has a bore of 3⅛ and a stroke of 5 in.

Rutenber Engines Made in Four Models

Two Are for Passenger Cars and Two for Trucks

RUTENBER engines, made by the Rutenber Motor Co., Marion, Ind., are made in four models. Two of these are for passenger cars and two for commercial vehicles. The bulk of manufacture in the plant is, however, given over to the model 25, which is used in the Paige, Auburn, Marion, Glide, Madison, Halliday, Roamer and Jones cars for the coming year.

This motor is a successor to the model 22 of last year and has been refined and rendered more powerful by an increase in the bore. In general design, however, it is very little different from its predecessor, what changes there are being due to the enlarged cylinder dimensions and in detail refinements. It is a six-cylinder L-head 3⅛ by 5 in.

The other passenger car engine is known as the model T. It is used in the Inter-State cars and is a four-cylinder, valve-in-the-head job, the dimensions being 3½ by 5 in.

Production on the truck models is limited by the fact that nearly all the facilities of the plant are required for the model twenty-five passenger car engines. The two truck models are fours and the entire consumption is taken by the Indiana Truck Co. The motors are known as the 38 and the 20 with dimensions respectively of 4⅛ by 5½ and 3½ by 5. They are standard L-head designs.

Crankshaft Is Larger

Regarding the improvements on the model 25, which is the focal point of Rutenber manufacture, there will be little fundamental change noted outside of what has been made necessary by the larger cylinders. The crankshaft has been strengthened and is now 2 in. in diameter in place of 1¾. The timing gears have been changed and are now Fabroid, or compressed Sea Island cotton, whereas in the former unit they were cast iron.

The oil pump is different and the drive for this unit has also been rearranged. While formerly a vein pump was used, the pump is now a plunger type, and while the drive was formerly off the front end of the camshaft, an eccentric has now been placed at the center camshaft bearing and the drive is taken from that. Another pump change is in the instrument for circulating the cooling water. This was formerly a separate casting bolted on to the crankcase. It is now contained directly in the case and a timing drive is fitted to it, to take the standard Remy units.

The fan pulley unit has been brought forward, allowing of a stiffer and thicker timing case. In the matter of motor fittings the engine is adapted to take any of the standard products. The flanges are so arranged that they can handle both vertical and horizontal installations.

All the makers who have previously been using the Rutenber model 22 and are continuing with the Rutenber product have shifted to the 25 without rendering necessary any important chassis changes. This makes the third successive year, practically, for this type of motor with the Rutenber concern. It is a six-cylinder four-cycle L-head design with the cylinders and the upper half of the crankcase cast together. Following up-to-date practice, the valves are inclosed and the cylinder heads are detachable. It is for unit or separate power plant construction designed for three-point suspension and having the flywheel bell housing as a detachable unit from the remainder of the engine.

The pistons are cast iron and are fitted with three rings. Two of these are close to the top and the third is located just beneath the wristpin boss, giving wide separation between the rings and reducing to a minimum the tendency toward slap. The wristpin is locked securely in the boss by a through set screw. I-beam connecting-rods are used and the crankshaft is a drop forging from 0.40 carbon steel made by the open hearth process. These shafts are all balanced in the Norton running balance machine and are passed on for balance before assembly.

For the camshaft 0.20 carbon steel is used. This is also a drop forging having a diameter of 1⅛ in. and the cams integral. The shafts are hardened and ground and are carried in plain bearings at the center and front and in an S. K. F. double-row, self-aligning bearing at the rear end.

The valves are actuated by mushroom type flat followers which are offset 1/16 in., allowing them to rotate while in operation and to distribute the wear around the peripheral

bearing surface. The valves are made in two parts with alloy steel stems and carbon steel heads. The diameter of the valves is 1 5/16 in. in the clear and the lift is 5/16 in. A feature of the valve construction is that the valve brackets, together with the entire lifter mechanism, can be lifted from the engine without disturbing the camshaft. This is done by removing the coverplate and stud nuts and then turning the starting crank until the valves are at their lowest level.

Standard Timing Used

Standard valve timing is used, and is in accordance with the practice on many of the latest American engines. The intake valve opens at 15 deg. after top center and closes 50 deg. after bottom center. The exhaust valve opens at 45 deg. before bottom center and closes 10 deg. after top center. Compression in 75 lb. absolute.

Provisions for Standard Electric Systems

Any standard starting and lighting unit can be employed with this engine. The flywheel ring gear as standard is cut with 126 teeth on an 8-10 pitch. The flywheel will fit any standard size clutch and the entire design is one which will fit in with the standardized chassis parts furnished by makers of clutches, gearsets, etc. An ignition distributer drive is mounted on the engine and can be used when desired.

Pressure and Splash Oiling

Combination pressure and splash feed is used for lubrication. The oil reservoir is in the bottom pan and has a capacity for 1½ gal. It is taken from the crankcase reservoir by the plunger pump, which, as has been explained, is driven by an eccentric off the camshaft. There are direct leads from the pump to the main bearings which thus receive a supply of oil under pressure. The other leads go direct to the crankcase where the oil is led to splash troughs placed beneath each connecting-rod throw. Provision is made for the mounting of an oil pressure gage and the pressure may be regulated by means of an adjustable relief valve. Some of the specifications of the model 25 engine follow:

Cylinders	Six
Bore	3½ in.
Stroke	5 in.
Valve diameter	1 5/16 in.
Piston length	3⅛ in.
Piston pin bearing	¾ by 1½ in.
Connecting-rod length	9½ in. center to center
Connecting-rod bearings	Front, 2 by 2¾ in.
Connecting-rod bearings	Center, 2 by 2¾ in.
Connecting-rod bearings	Rear, 2 by 3⅛ in.
Camshaft diameter	1⅛ in.
Camshaft bearings	Front, 1 15/16 by 2¾
Camshaft bearings	Center, 1 29/32 by 2⅞
Camshaft bearings	Rear, S.K.F. No. 1265
Length, front of fan to rear of cylinder	32¾ in.

Jeffery Quads with Wrecking Equipment for Mexico

A POWER winch, with 300 ft. of steel wire cable and two capstan heads, is the feature of a new type of wrecking truck that will aid the motor truck trains in Mexico when they get into difficulties. Several of these are now on their way south, and others are being turned out by the Thomas B. Jeffery Co., Kenosha, Wis., as fast as possible, in anticipation of the rainy season in Mexico. The chassis employed is the Jeffery Quad, which drives, brakes and steers on all four wheels. About 200 Quads for various purposes are already in Mexico.

Body Is of Steel

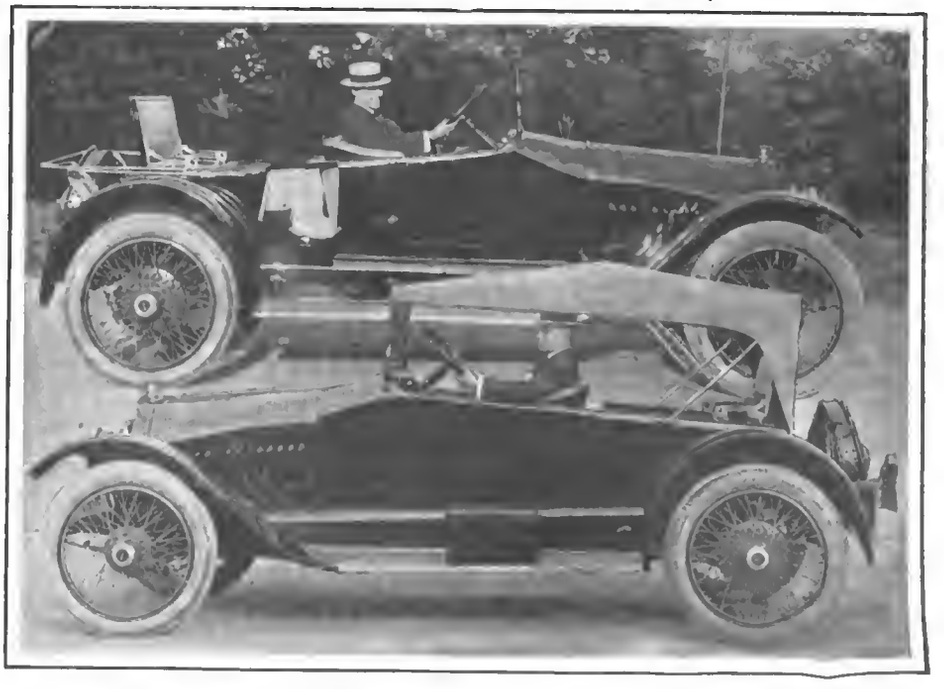
The body of this truck is made of steel. It is 10 ft. long, 40 in. wide and 32 in. deep, and has wide running boards on both sides, strong enough to hold a considerable outside load. Besides the power winch and capstan heads, the truck carries 300 ft. of 9/16-in. wire cable, 100 ft. of 1¼-in. manila rope, an oxy-acetylene welding outfit complete with acetylene and oxygen tanks, flux rods and wire. There is also a hand-operated derrick for lifting heavy objects into and out of the truck, besides a workman's bench with vice and tools. The auxiliary equipment includes shovels, axes, crowbars, pick-axe, sledge hammers, gin pole, tow chain, wheel and flange pullers, clamps, files, and a Pyrene fire extinguisher.

A Special Five-Passenger Design On Mitchell Chassis

AT the right is illustrated a five-passenger roadster specially designed and built by the Carl H. Page Motors Co., New York City, agent for the Mitchell on which chassis the body is mounted. The rear portion can be closed entirely, thus converting the car into a two-passenger roadster while when opened it has ample room for five, the seats being large and comfortable, the fifth seat being formed by the door on the right-hand side which also serves as an entrance to the rear seats.

Top Disappears

As shown in the illustration the top is of distinctive construction, the top material being removable so that when the top is not in use the nickel-plated bows are folded down around the rear of the body, the material being compactly stowed away in a receptacle especially provided for it at the back of the body.



The Search for the Army Truck Wheel

(*Continued from July 6, pages 24-26*)

By Marius C. Krarup

SINCE the normal driving wheels of automobiles and motor trucks are the only working elements in them whose operation depends on friction, and particularly on friction with a road surface of uncertain and variable suitability for acting as the corresponding friction element, the examination of other types of wheel, with the idea of arriving at a preliminary idea of their properties in advance of actual tests or to decide if practical trial would be advisable, should be liable to save costly experiments sooner or later. In the case of the composite type of wheel—which might also be termed the "squirrel cage" or "treadmill" type, to suggest its mechanical nature more graphically—no such preliminary examination has appeared in public, while it is known that the type has been used in practice and has shown some very desirable qualities (especially in negotiating sandhills and ravines with heavy loads), but also that it has not survived and that probably, therefore, some sharp limitations of its utility have cropped out. The nature of these has not come to light, however, and they may have arisen from faulty application or design rather than from unavoidable defects in the principle.

In so much more as the cursory examination of the same type for front wheels and trailer wheels in THE AUTOMOBILE of June 22 indicated considerable merit for this mode of using it, the more intricate examination of its possibilities for driving wheels seems to be in line with the many efforts now being made, partly in connection with the European war and partly in the development of farm tractors, at finding a wheel type which will operate where normal wheels are unreliable. An examination of this kind may lead to practical trials or to rejection of the type. It can scarcely be sufficiently decisive and explicit to compel acceptance of its purely theoretical conclusions, as the subject is probably still more complicated in practice, but these should of course be as nearly correct as possible in the essentials.

Correction of Errors

As intimated in a note at the end of last week's instalment of this article, however, an error in the premises for the equations in it was scented by the writer too late for correction in that issue, which was then going to press. Subsequently another error was discovered, consisting in applying the gravitation formula for the time of the free fall, $t = \sqrt{2h:g}$ or, approximately, $t = \frac{1}{4}\sqrt{h}$, in connection with measurements expressed in inches, and this slip affected the figures materially. The safe maxim of not doing new work hurriedly was thus unfortunately vindicated, and the writer must ask readers to replace the matter from the first equation near the top on page 25 to the end on page 26 with a more correct version, as given in the following, the passages in small type being substantially repetitions explaining the method of reasoning and not materially affected by the errors in the details.

It was erroneously supposed that the factor p was needed to indicate the nature of the road, but more deliberate examination of the work of propulsion shows that, if traction resistance is uniform, p does not stand for anything that is not fully expressed in coefficient f. The equations should therefore be remodeled by eliminating p, or else giving it the value 1 unless the physical conditions under consideration include an unyielding obstruction imbedded in a soft road and it is the special object to determine how such an obstruction affects the propulsion. It is simpler to eliminate p in considering a uniform traction resistance and introduce it again only where it belongs.

In restating the case, Fig. 3 is reproduced for renewed reference herewith. For completeness, front wheel resistance is also included in the subject and the equations, while previously it was made an after-consideration.

Angle α represents the minimum advancement of Q necessary for producing vehicle movement through the turning of Y. The pressure of L at b balances under this supposition against the traction resistance. The latter is expressed by coefficient f as a percentage of the weight to be moved. When the application of power to Q holds this component of the wheel forward and in contact with the other component, Y, at b, the load L, acting vertically at this point tends to turn Y around the point of ground contact, A, the resistance being primarily $(L + W)\,f$; where W is the weight of Y. But, if the resistance to the simultaneous turning of the front wheel is included, and the load thereon is L_2 (including the weight of the wheel itself), the total resistance to be balanced by L acting at b is $(L + W + L_2)\,f$. As the movement to be effected is the (continuously repeated) turning of Y around A, the required action is analogous to that of a pair of scales with arms of unequal and variable length. The power acts with pressure L and the leverage $R \sin \alpha$. The weight to be moved may be considered as acting with an opposite leverage just sufficient to balance against this pressure, any increase of angle α causing movement. One has then

$$L\,R \sin \alpha = (L + W + L_2)\,f.$$

Whether the road is hard and smooth, in which case f becomes small, or it is soft, so that the wheel is imbedded in it to some depth, the value for f in each case expresses the degree of resistance caused by the road condition, and no additional factor is needed to express a road condition under which the wheel's contact with the ground extends more or less on both sides of A. A remains the pivot around which Y must turn progressively, so long as the traction resistance is not rendered irregular by unyielding, imbedded or projecting, substance.

To determine how large α must be, one has therefore

$$f = \frac{L\,R \sin \alpha}{L + W + L_2} \text{ and } R \sin \alpha = \frac{f\,(L + W + L_2)}{L}$$

As L_2 is rarely more than one fourth of L, and W is small, say 5 per cent of L, one has then, even if f is taken as high as 20 per cent and with $R = 15$ in.,

$$\sin \alpha = \frac{20 \times 1.30}{1500} = \frac{26}{1500} = 0.0173$$

making α a very small angle. Movement of the vehicle therefore begins on a level road, even if it is so sandy or soft as to raise f to 0.20, at a very small advancement of Q.

In the case of a steam vehicle or a gasoline motor truck with hydraulic transmission, these relations should be decisive to show that the composite driving wheel system will permit starting and operation at one speed or another. But for ordinary gasoline motor trucks the practical question relates to starting and running at the speed giving maximum torque for driving wheel Q, and this is the speed obtained on low gear with the motor running at normal speed. It may be 3 or 4 m.p.h. Let it be given as m m.p.h. vehicle speed. The question is then: At m m.p.h. what are the limit values for β and f? (β being the angle, larger than α, at which a desired vehicle speed is produced.)

To avoid considering the initial acceleration of the vehicle at the

sion is indicated by the line X, this is given as 38 in., which will accommodate the average person, the distance of 4 in. from back of the wheel to the back line of the door will allow a 10½-in. opening between wheel and body, but as the majority of people enter from the curb side, this is not so vital on a left-drive car, and on Fig. 1 this distance is less, the door being 19 in. in width.

Trimming Should Be Leather

These bodies are trimmed in leather, the seats and backs being of generous thickness and very comfortable. No trimming appears above the body or seat line, the doors have the customary flap pockets and the floor is linoleum covered. Locker space is provided under the seats if possible and the rear compartment has a cover on the top as shown.

The present tendency in color design is about equally divided between the somber shades and gay color. Of the first blue predominates and of the light colors, yellow or yellow and black, white and black, various shades of gray from light to dark and a few reds. If wire wheels are used, they are frequently made to show the contrast in color, black wheels being used with all shades of light colored bodies and the wheels are the only contrast, the guards being of the body color.

The great popularity of the clover leaf style of body, predicted in the summer of 1915 and emphasized by the shows of the early 1916 season, is certainly being upheld, at least in the large cities. The clover leaf is essentially the body for a man who likes a smart appearing car and its chief attraction is that it can have the lines of a racy roadster and yet have a greater capacity. If the rear compartment is not used for passenger accommodation it is often extremely useful for baggage and for carrying golf clubs or other sportsmen's impedimenta. The long aisle provided by the passage between the two front seats is more convenient than even the whole tonneau of a five-passenger car of conventional design.

Type Likely to Persist

Thus there is good reason to expect that the clover leaf or something very much like it should be regarded as a permanent addition to automobile body styles. If its appearance should go out of fashion, if its lines should cease to seem to be as smart as they now appear, still the convenience of the seating plan should hold that part of the design unchanged. Almost any kind of an outer shell can be arranged around a pair of seats of the clover leaf type, in fact the body lends itself to more variation, almost, than any other. That this is true is shown by a study of the very large number of quite different styles produced within the past twelve months.

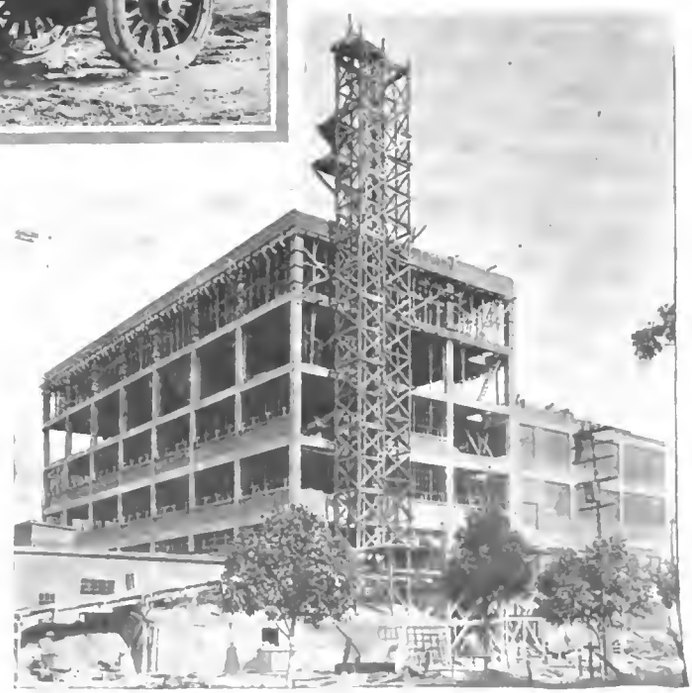
F. W. D. Repair Truck for U. S. Army

ABOVE is illustrated one of the repair trucks built by the Four Wheel Drive Auto Co., Clintonville, Wis., for use by the United States Army. These trucks are fitted for repair work on the road and are expected to prove extremely valuable in keeping the trains of supply trucks in good mechanical condition. Each truck is equipped with a 13-in. lathe with a 5-ft. bed; a drill press; grinder; portable drill; cabinet bench; three vises; a forge; three anvils; oxygen-acetylene welding outfit; a complete set of blacksmith's tools and also complete sets of machine bench tools and carpenter's tools.

A 9-hp. four-cylinder gasoline engine drives the dynamo which furnishes power to the motors which operate the various machines and also supplies the current for the electric light. Oxygen and acetylene tanks are carried under the frame of the truck where they are accessible but do not take up valuable space.

Champion Adds Again

THE Champion Spark Plug Co., Toledo, Ohio, has again been obliged to expand its factory facilities by the addition of the six story building illustrated in course of construction below. In this new structure the company can turn out from 75,000 to 100,000 spark plugs a day and from 1400 to 1500 employees will be engaged in their manufacture, from this time onward.



Pneumatic Tire and Rim Situation

Early Development of the Various Types of Demountable and Detachable Rims—Comparing the Three Types of Tires—Cost of Operation, Reliability—Future Possibilities

By J. E. Hale
Experimental Engineer, Goodyear Tire & Rubber Co.

BY 1907 the detachable rim with a straight-side tire had become so much appreciated by the public that the clincher-tire manufacturers were obliged to furnish some sort of a detachable tire. The result was the quick-detachable clincher tire called the Q. D. clincher. The introduction of this tire was facilitated by the simultaneous introduction of the universal rim, which would take either a straight-side or a clincher tire by simply reversing the side rings.

While the quick-detachable clincher was a half-way compromise between the clincher and straight-side types, its introduction at that time was justified because the tire-building art was in a stage of development, not having progressed to a point where everybody was producing a successful straight-side tire. Up to the present time the straight-side, clincher and quick-detachable clincher tires have been exploited by their respective backers, and competition has stimulated development of each type. The basic structure of the pneumatic tire has not changed (except by the developments in cord tires) since 1907. The rim details have, however, been undergoing constant progressive development.

Rim Development

In 1911 the demountable rim began to receive commercial attention. In 1912 several manufacturers put them on cars as original equipment. The demountable rims were soon widely demanded by the public, which of course stimulated their further development. The early demountable rims were heavy. Competition has brought many new light-weight designs, some of which have been carried to such extremes that tire troubles result.

The preceding refers to American practice. In Europe the detachable rim and tire did not succeed in getting a foothold, so that as the industry expanded the use of the soft-bead clincher and one-piece clincher rims became firmly established. In Europe four circumstances saved the clincher from the competition of the detachable tire. First, rim-cutting, the worst trouble of the clincher tire, was mastered early. Second, the majority of car owners in Europe have chauffeurs who change the tires, which amounts to saying that a little saving in tire-applying effort does not interest them. Third, it is rather difficult, especially in England, to introduce new contrivances in competition with those firmly established. Fourth, the demountable wire wheel was one of the early developments in European automobile practice. Its use has been extended widely, so that if the quick tire-change idea had to be met, it was considered that the demountable wheel was satisfactory. There were no champions of the detachable type in Europe similar to those in America.

Need for European Sizes

In South America, Australia and South Africa European cars have predominated; naturally the use of millimeter-size (European) tires and rims is firmly established. However, during the recent period of trade activity by American manufacturers many inch-size clincher tires and rims have been introduced in these fields. This is most unfortunate because inch-size tires will be used on millimeter rims if the proper millimeter-size tires are not in stock, with certainty of rim trouble. The same thing is true of the application of inch-size tires on millimeter rims. This foreign business is expanding to such volume that the dimensional clincher-tire complication will, unless checked, ultimately react severely against American prospects. American car makers must discontinue the use of inch-clincher (except Ford sizes) and adopt either the millimeter clincher or inch-size straight-side types.

The straight-side tires are the logical solution. Why should car manufacturers continue to complicate their production processes by equipping some of their cars with millimeter clincher tires and others with straight-side tires, when by proper co-operation between the tire and car makers, the straight-side type, fully perfected and standardized, can be introduced quietly into these markets?

The refinements accompanying the intensive development of the motor car have reached a point where even the weight of the light demountable rim is regarded with disfavor. A return to the simple light-weight detachable rim fitted directly to the felloe of the wheel seems likely. The car designers want to eliminate weight, particularly unsprung weight, at the periphery of the wheel, and to reduce the cost; the car owner desires a maximum of tire service with a minimum of tire trouble. Thus the situation boils down to a case of the survival of the fittest with the demountable rim, the demountable wheel and the simple rim mounted on a permanent wheel on the one side; and the straight-side tire, the clincher tire and the quick-detachable clincher tire on the other.

Three Types of Tires Compared

The purpose of this paper is to point out the trend of the time in the tire world, and to venture a prediction concerning the future. In order to lay proper stress on the points to be brought out, it seems wise to discuss the merits of the three types of tires under the following headings: Energy consumption; traction; total mileage; cost per tire-mile; cushioning effect; reliability; ease of applying; and service.

Figs. 2, 4 and 8 show the straight-side, quick-detachable clincher and soft-bead clincher tires that will be compared. These are drawn to scale. The straight-side tire is shown on the wide standard rim. All three tires will be identical in every particular above the line *H-K;* consequently the energy consumption and traction would be the same for each type.

Factors Affecting Total Mileage

The total mileage would be influenced by the structure of the tire below the line *H-K*. While the schemes of attachment to the rims have been largely perfected, the life of the tire is sometimes shortened by a form of trouble com-

monly called rim-cutting. In a well designed and properly built tire the chances of rim-cutting troubles from causes inherent in the tires themselves are remote. Imperfect rims and various forms of abuse are the actual causes. If a tire is punctured and ridden flat, the clincher casings and tubes will soon be ruined beyond repair. The clinch of the rim simply gouges into the carcass of the tire and cuts through the plies. At the same time, the tube gets under the toes of the bead, which mutilates it beyond repair. The structure of the straight-side tire, on the other hand, is such that the carcass is simply crushed against a comparatively wide rounding surface. Of course, the straight-side tire and tubes can easily be ruined by this form of abuse, but the chances are three to one in its favor, compared with the other type. The effect of the quick-detachable clincher is about half way between that on the clincher and straight-side tires. In this case the toes of the bead do not lift to catch the tube, but the clinch of the rim gouges into the fabric of the casing to some extent.

Under-Inflation and Overloading

These are similar in their effects on the structure of the tire, being forms of abuse that aggravate any tendency to rim-cut. The effect is more pronounced on the clincher type than on the straight-side, because the flexing of piles is localized at the edge of the clinch with the former, while with the latter the flexing is distributed with less intensity over the gradual curvature of the rim.

Tire-Mile Cost of Operation

The cost per tire mile is of course a function of the mileage and of the original cost of the tire. Inasmuch as the three types cost the same, the tire-mile cost is directly proportional to the mileage. Since the tires of the different types are alike above the line *H-K*, the service will average the same for all so far as the upper part of the tires is concerned. Any variation in the tire-mile cost will be dependent on the complications introduced by tire-base troubles. While no specific cost figures can be presented, there is no doubt that the tire-mile cost of the straight-side tire is the lowest. This is strongly emphasized by the domination of the straight-side over the quick-detachable clincher tires as shown in the percentages given in Table I.

TABLE I—TIRE EQUIPMENT (IN PER CENT) ON CARS PRODUCED 1913-1916

Type of Tire	1913	1914	1915	1916
Straight-Side Equip.	32	72	84	96
Quick-Detachable Clincher Equip.	40	28	16	4
Universal Rim	28	.....	.....	.....
Total	100	100	100	100

Cushioning Effect

For a given tire section the cushioning effect is largely dependent on the relation between the load and inflation pressure. Lowering the inflation pressure gives the greater cushioning effect, but on the other hand fabric troubles are greatly increased by excessive flexing of the carcass. In practice it has been found that the best inflation pressure will permit the tread to be depressed 11 to 12 per cent of the tire section. Since all three types are alike above the line *H-K*, the cushioning qualities are the same if the tires are operated under similar conditions.

Scope of Reliability

The difference in the rim-attachment structure of the two types has an effect on the cushioning properties. A straight-side and a quick-detachable clincher tire of the same size and design to require the same quantity of raw materials, are superimposed in Fig. 1. This shows that the straight-side tire has the advantage due to the beads of the tire being more widely separated, resulting in a slightly larger diameter of tire section.

Reliability covers such features as freedom from instantaneous failures and safety considerations. Punctures, blowouts and fabric breaks occurring in the tread and side-wall portion of the carcass (above the line *H-K*) are on a par in all three types. Fabric failures at the point of contact with the rim are apt to be more in the nature of a concealed distress followed by sudden failure (blowout in effect) in the clincher and quick-detachable, while the corresponding troubles with the straight-side tires are easier to detect and provide against.

Blowing Off the Rim

Blowing off the rim is one of the troubles of bygone days. The early straight-side tires had a good many black marks against them on this account and clincher tires are still occasionally subject to this annoyance. This condition was one of the prime excuses for the introduction of the quick-detachable clincher tire. Because some of the early straight-side tires blew off the rim, certain car makers concluded that this type was not safe. It was not appreciated universally that the straight-side construction is a purely mechanical method of attachment and independent of inflation pressure. At the same time the detachable idea was so meritorious that all tire manufacturers were compelled to put out some sort of a "detachable" tire. Inasmuch as the soft-bead clincher had represented the best practice in was natural to combine the inextensible bead of the straight-side with the clincher idea in an attempt to provide a detachable tire that would not blow off the rim. In the undeveloped state of the tire-building art it was felt that in order to be perfectly safe a tire must hook under the clinch of a rim. The later development of the straight-side tire has, however, shown conclusively that the problem of safety was simply one of designing the tires to have proper strength at the weak point, so that at present, for every several hundred that fail by rim-cutting and blowouts, only one tire blows off the rim.

TABLE II—TIRE AND RIM EQUIPMENT ON CARS PRODUCED 1913-1916

	1913		1914		*1915		*1916	
Type	No. Cars	Per Cent	No. Cars	Per Cent	No. Cars	Per Cent	No. Cars	Per Cent
Q. D. Clin.	98,000	24	66,500	19	50,000	8	22,000	2
Str. Side.	79,500	19	172,000	35	266,000	40	529,000	46
Reg. Clin.	175,000	41	281,000	46	348,000	52	601,000	52
Univ. Rim.	67,000	16	None used	....	None used	....	None used	....
Totals	419,500	100	519,500	100	664,000	100	1,152,000	100

*Figures are for manufacturers' season—July to July.

TABLE III—SOFT-BEAD CLINCHER TIRES AND ONE-PIECE CLINCHER RIMS ON 1916 CARS

Name	Tire Sizes		Name	Tire Sizes	
Bell		3½	Monroe	3	3
Briscoe		3½	Metz		3½
Chevrolet	3	3½	Regal		3½
Dort		3½	Overland		4
Elco		3½	Pullman		4
Ford	3	3½	Scripps-Booth		3½
Maxwell		3½	Sphinx		3½

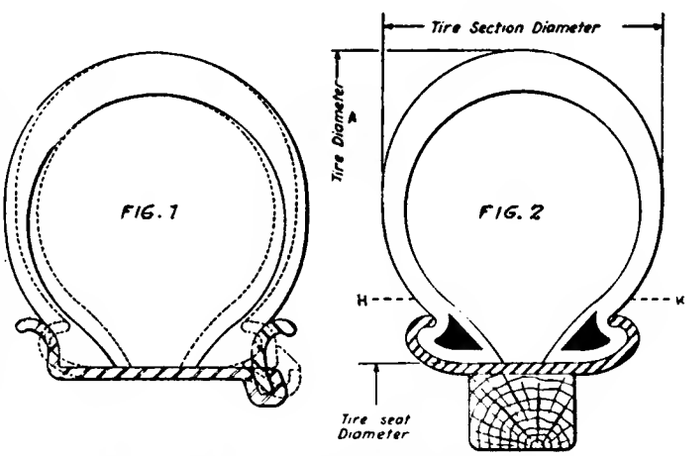


Fig. 1—Straight-side tire (full lines) superimposed on quick-detachable clincher tire (dotted lines). Fig. 2—Soft-bead clincher tire mounted on one-piece rim

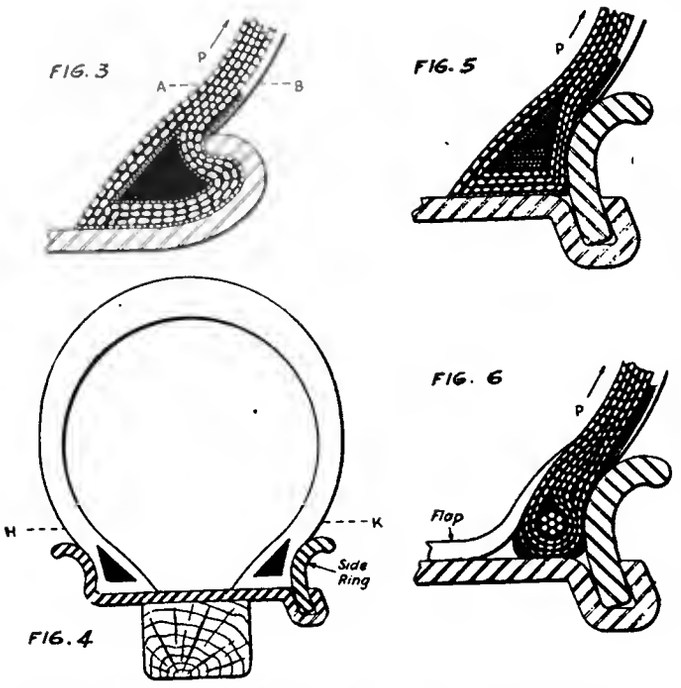


Fig. 3—Details of clincher rim and bead. Fig. 4—Straight-side tire mounted on two-piece detachable rim. Fig. 5—Inextensible braided-wire bead. Fig. 6—Inextensible twisted-wire bead

How completely the straight-side tire has lived down original prejudices is evidenced by the fact that 529,000 new cars will be delivered on straight-side tires during the 1916 season.

Ease of Applying

The 3-in. clincher tires are no more difficult to remove and apply than the other types, but beginning with the 3½-in., each larger size is correspondingly more difficult to handle. In applying the quick-detachable clincher tires the bead needs considerable coaxing to get it properly seated under the rim clinch; and the carcass of the tire is often so stiff as to make it difficult to slip the locking ring into place. This is especially true with the oversize tires. The quick-detachable tire is frequently found to be frozen to the rim by rust, thus requiring much effort in removing it. This tire on a split rim is really a formidable proposition; application is difficult and removal almost impossible.

Table IV—Straight-Side Tires on 1916 Cars

Name	Tire Sizes			Name	Tire Sizes		
Abbott		4	4½	Jackson		4	4½
Allen	3½			Jeffery		4	4½
Alter	3½			Jones		4	
Apperson		4	4½	King		4	
Auburn		4		Kissel		4	4½
Briscoe	3½			Lexington		4	4½
Buick		4	4½ 5	Loxier			4½
Cadillac			4½	Marion		4	
Case		4		Meteor			4½
Chalmers		4		Mitchell		4	
Chandler		4		Moline		4	4½
Chevrolet	3½			Moon		4	
Cole			4½	Oakland	3½	4	4½
Daniels			4½	Olds		4	
Davis		4	4½	Paige-Detroit		4	
Dodge	3½			Peerless			4½
Empire		4		Regal		4	
Enger		4		Reo		4	4½
Franklin		4	4½	Ross		4	
Glide		4		Saxon	3½		
Grant	3½			Studebaker		4	
Haynes		4	4½	Stutz			4½
Hollier		4		Scripps-Booth		4	
Hudson			4½	Sun		4	
Hupp		4		Overland		4	4½
Interstate		4		Velie		4	

Service refers principally to the distribution of the sizes required by the trade. Owing to the extreme flexibility of the movements of the automobile, competition forces dealers to carry all the sizes in demand in clinchers, quick-detachable clinchers, and straight-side types.

Early in this paper it was stated that the tire and rim questions boil down to a question of the survival of the fittest. The statistics in Table II show very decidedly the trend.

It is just a question of time until the quick-detachable clincher will become eliminated. This tire had a legitimate place during the period of development, but with the straight-side tires giving entire satisfaction, there is no excuse for continuing the former type. Dealers have to carry the three kinds of tire with many sizes common to each type. With the quick-detachable clincher eliminated, nearly one-third the stocks could be discontinued, which would mean correspondingly better service on the other two types, less capital tied up in stocks, greater incentive to carry all sizes, and ultimately less expense to the whole industry, and more simplified production.

Tire Equipment of Various Makers

To further explain the situation, I have prepared the Tables III, IV and V (from published information), showing by size and type the tire equipment used on the principal cars. Pneumatic-tired trucks are not included.

The total estimated production in 1916 is 601,000 cars using clincher tires and one-piece clincher rims. This estimate applies to the fourteen makers listed in Table III.

Table V—Quick-Detachable Clincher Tires on 1916 Cars

Car	Tire Sizes		Car	Tire Sizes		
Cunningham	4½	5	Pathfinder		4½	
Fiat	4½	5	Pierce		4½	5
Locomobile	4½	5	Premier		4½	
Marmon	4½		Stanley		4½	
McFarlan	4½		Stearns	4	4½	
Mercer	4½		Stutz			5
National	4½		White	4	4½	5
Packard	4½	5	Winton		4½	
			Westcott	4	4½	

The total estimated production in 1916 is 529,000 cars using straight-side tires. This estimate applies to the fifty-two makers listed in Table IV.

The total estimated production in 1916 is 22,000 cars using quick-detachable clincher tires. This estimate applies to the seventeen makers listed in Table V.

From the three groups tabulated we observe (1) Clincher tires are confined to 3 and 3½-in. sizes. (2) Straight-side tires are used in 3½, 4 and 4½-in. sizes. (3) The quick-detachable clinchers are confined to the 4, 4½ and 5-in. sizes.

Concluding Comments and Predictions

The pneumatic tire has passed through its evolutionary stages. Future developments will be confined to refinements intended to eliminate the common tire troubles, and to increase the tire mileage.

The American standard inch clincher-rim contours, the British standard millimeter clincher-rim contours, and the American wide standard inch straight-side rim contours will undoubtedly survive all others.

Outside of the contours, however, rims are still in process of evolution. In the struggle to minimize weight, expense and tire troubles the existing demountable types may lose ground, particularly as the light-weight one-piece clincher and the two-piece straight-side rims, either on permanent or detachable wheels, apparently offer the next step forward.

Extra Types Will Be Eliminated

We now have uneconomical duplication in sizes in three types of tires performing similar service, but the law of natural selection will effect the elimination of the unnecessary types. Probably clincher tires (in America) will be confined eventually to motorcycle and 3 and 3½-in. automobile tires. Straight-side tires will be used in some 3½-in. and in all larger sizes. The quick-detachable clincher will shortly disappear from use.

The export markets in absorbing American cars will assimilate American constructions more and more readily. Straight-side tires will be introduced into these markets dur-

ing the coming season as original equipment on some American cars. This type will presently be appreciated as much abroad as it is in America. Thus we are to initiate a step that will result ultimately in a single world-wide standard for pneumatic tires and rims.

Figs. 2 to 11 are inserted for the benefit of persons desiring more detailed information on tires and rims.

The base portions of the tire in Fig. 2 have sufficient elasticity to permit their being stretched and pried over the the edges of the rim when applying and removing it. The extensible bead core is made of semi-hard rubber.

The bead in Fig. 3 is understood to be the entire portion of the tire below the line *A-B*. The bead core is made of semi-hard rubber, which has just enough stretch to allow it to be pried over the rim. The tires are made about ½ in. smaller than the tire-seat diameter of the rim. This insures a snug fit against the rim and prevents the tube from pinching.

The internal bursting pressure of the air sets up stresses in the direction indicated by arrow *P*. These stresses are resisted at the hook of the clinch. In other words, a soft-bead clincher tire in its functioning is positively dependent on the air pressure to maintain its shape and position.

In Fig. 4 the side ring is cut in one place and can be removed by prying out with a screw driver. Figs. 5, 6 and 7 show enlarged details of three prominent types of straight-side beads. Each bead is made inextensible by an endless reinforcement of braided wire (Fig. 5), twisted wire (Fig. 6), and wire cables (Fig. 7).

In the type shown in Fig. 7 the fabric plies are tied under the inextensible reinforcing wires; thus the side wall stresses (*P*) are transmitted from the carcass fabric to these circumferential wires. It will be seen that a strictly mechanical method is used to fasten the tire to the wheel in contrast to the soft-bead clincher method, which is analgous to the action of an elastic band. The inside diameter of the tire is slightly greater than the corresponding rim diameter (1/32 to 3/64 in.), which permits the tire to be applied and removed easily.

While the chance of pinching tubes under the beads of straight-side tires is remote flaps are used in the larger sizes, as a precaution.

In the quick-detachable clincher rim, Fig. 8, the side ring is endless while the locking ring is cut in one place. In removing the base of the tire and the side ring embracing it must be crowded bodily toward the center of the rim far enough to clear the inner edge of the locking ring. The locking ring can then be removed by prying out with a screw-driver, after which the tire and the side ring can be removed.

Figs. 9, 10 and 11 show enlarged details of the bead structure of the quick-detachable clincher tire. By comparing Figs. 5 and 9 it will be appreciated readily that Fig. 9 simply shows a straight-side tire with the addition of a clinch filler. This clinch filler is not tied into the body of the bead (by gripping with pliers the whole filler can easily be torn off the tire); consequently it is of absolutely no value in helping to hold the tire in the rim. Its real function is to fill the void that would otherwise exist.

Fig. 11 compared with Fig. 6 shows a similar situation, except that the outside ply of the carcass is laid so as to include the clinch filler. In Fig. 10 the quick-detachable construction closely resembles the regular soft-bead clincher construction. In this case, however, the bead core is made of a mass of cords impregnated with hard rubber extending circumferentially around the tire. The bead of this tire is really semi-extensible.

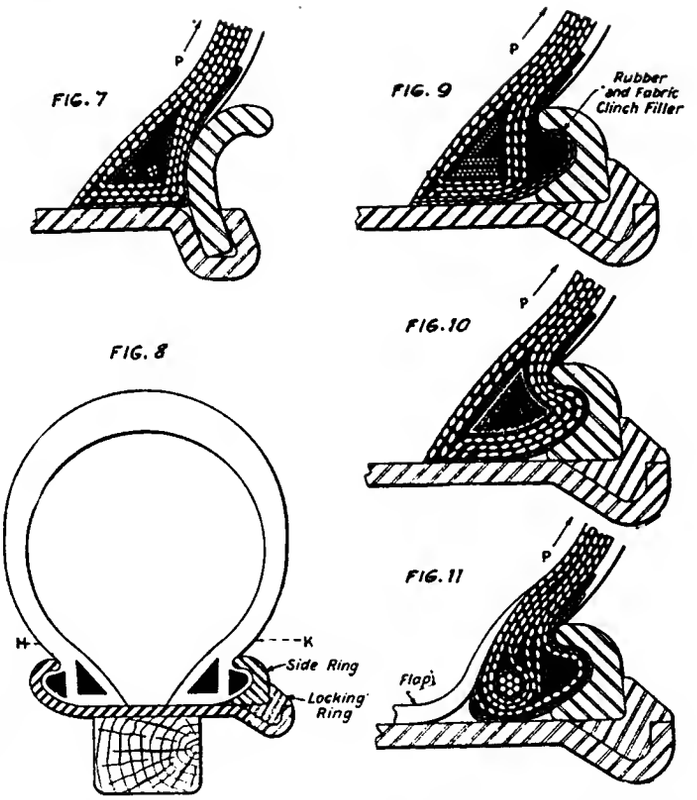
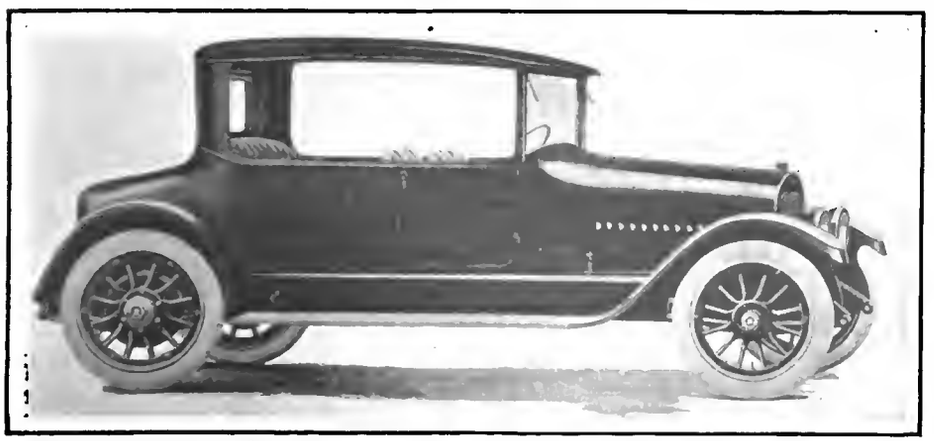


Fig. 7—Inextensible wire-cable bead. Fig. 8—Quick-detachable clincher tire and rim. Fig. 9—Inextensible braided-wire bead on quick-detachable clincher tire. Fig. 10—Bead of parallel cords on quick-detachable clincher tire. Fig. 11—Heavy wire bead on quick-detachable clincher tire

The New Cole-Springfield Body Types



AT the left is illustrated the new Cole-Springfield body, which, fitted to the standard eight-cylinder Cole chassis, is styled the Tourcoupé and sells for $2,195. This is one of the new group of all-weather type bodies announced last week by the Cole Motor Car Co., Indianapolis, Ind., the other models consisting of the Cole-Springfield Toursedan, which is a seven-passenger car meeting the requirements of both touring car and limousine and selling at $2,195, and the Towncar listed at $2,492. These bodies are luxuriously fitted out, being finished in American flag blue with dull black trimming and mouse gray upholstery. There are automatic electric door lights and light switches are located both at the driver's seat and in the tonneau.

Miller Differential Has New Motion

Frictional Resistance to Free Differentiation in Proportion to Tendency to Spin—Free for Turning Corners Yet Stiff Against Spinning

IN these days it is not often that a patent is granted for a new mechanical motion, as almost every conceivable sort of mechanism has been used for one purpose or another. However, the inventors of the Dorr-Miller differential have obtained such a patent in addition to their main patent for an entirely new differential mechanism.

Like many differential devices the Dorr-Miller is hard to describe, though its action can be grasped quickly when a model is held in the hands, so it may be best to explain firstly what it does and secondly how it does it. What it does is to differentiate with perfect freedom as long as there is no driving pressure on it, to tighten up as the driving load increases, and to tighten up in proportion to any and every tendency to differentiate when the driving force is constant. In other words the more the circumstances of the road and driving effort endeavor to produce wheel spinning, the more does the device compensate for this tendency by interposing frictional resistance.

Friction in Proportion to Load

The reason for this action can be expressed loosely as follows: There are two disks forming the two halves of the differential with the special mechanism between them. These disks and the mechanism are contained within a differential case of the usual sort made of steel. The action of the driving force of the engine tends to spread the disks apart, so causing them to press upon the inner walls of the case. When running straight ahead case and disks revolve solid, just like any other differential, but when one wheel tries to turn faster than the other its tendency is resisted by the friction of the disks pressing on the inside of the case. This means that, when outside circumstances accelerate one wheel the internal friction tends to slow that wheel down or to accelerate the other wheel, which is equivalent to saying that the friction causes both road wheels always to try to turn at the same speed. If one wheel is jacked off the ground and the engine started in gear, the raised wheel will revolve freely just as with the conventional type, but the slightest resistance offered to the free wheel, the least touch of the brake for example, immediately transfers torque to the wheel resting on the ground and the car rolls off the jack. This is because the resistance causes the two disks to spread apart, whereupon they rub against the inside of the differential case and the frictional drag caused by a light resistance applied to the free wheel is enough to cause the locked wheel to move the car. With the clutch out the differential is just as free and differentiates just as perfectly as any other type.

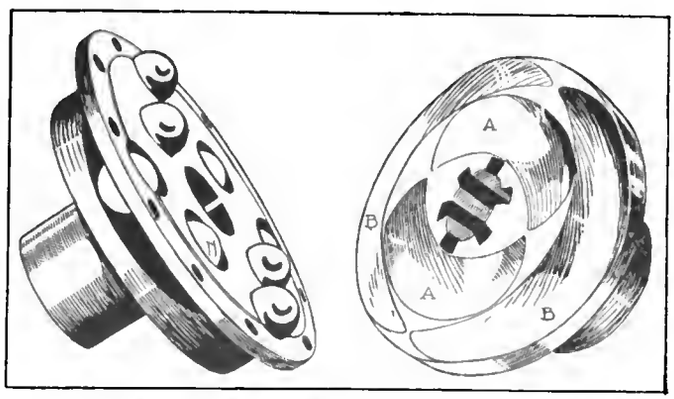


Fig. 1—Sketch to explain action of Dorr-Miller differential

Ball Forms Grooves

Now to describe the mechanism by which these results are obtained. Referring to the sketch Fig. 1 the two disks are seen on right and left. Each disk has grooves cut in the face, *A* and *B*, and these grooves are deep and wide at the middle of their length, tapering off at each end. The form of these grooves may be pictured by taking a ball and rolling it along some plastic material like putty. Rolled gently it will make no mark but if pressure is applied it will sink in, going deeper and deeper as the pressure is increased. Imagine the pressure increased regularly until the ball was buried for a depth of half its diameter and then released again till the ball once more rolled up on the flat surface of the putty, and you would have a straight groove exactly like the curved grooves cut in the Miller differential disks.

Having got the disk, imagine a plate with four holes in it, each just large enough to hold a ball of the same size as the ball with which the grooves were generated. Stand the plate on the disk with a hole opposite the center or deepest part of each groove and drop in four balls. Then, if the groove is half the ball diameter deep and the plate is as thick as the groove is deep, the four balls will lie in the holes and will just come flush with the face of the plate.

Effect of Turning Plate

Now turn the plate around upon the disk and each ball will roll along its groove till it reaches the end and, as it rolls along, it will rise through the hole in the plate till it no longer engages the groove (having come to the end) but stands half projecting from the hole. In the sketch the plate is shown with eight balls, four being at the centers of the grooves and four at the ends.

Next, continue the turning of the plate and the four balls which were standing out will begin to sink down again into the next groove. In other words the outer grooves *B* and the inner grooves *A* guide the balls just as though they were running in a ball thrust bearing, with the difference that the balls reciprocate to and fro through the holes in the retaining plate.

But so far we have considered only one disk and the plate. The other disk has corresponding grooves and, if we imagine it placed on the plate as shown in the sketch, the grooves will be at right angles to those in the left hand disk. The balls which are standing half way out of the plate as sketched will just fit in the centers of the grooves in the right hand disk.

Having thus assembled the essential parts think what will happen if the plate in the middle is revolved while an equal resistance is applied to each of the two disks. The ball which is at the bottom of the groove in one disk cannot rise through the hole in the plate because it is opposite the neutral point between the grooves in the other plate, and this applies to each of the eight balls. Thus the two disks will turn with the plate, all three at the same speed.

Balls Expand Differential

Now, another thing that is obvious occurs. Each ball is trying to roll along its groove, when the center plate is

turned, and it is prevented from doing so by the opposite disk which prevents it from rising through the hole. This causes a thrust or spreading action tending to force the disks apart. But there is a case around both disks to which the bevel drive gear is bolted, precisely as with the conventional differential, so the back of each disk is pressed against the interior of the case behind it and the harder the driving pressure on the plate the harder will the disks try to separate and the harder will they press on the walls of the case. Which explains how the frictional resistance to differentiation increases as the driving effort increases.

How It Differentiates

So far so good, but perhaps it is still not clear how the device can differentiate at all. To follow this action suppose that we stand one disk on the table, put the plate and the balls in position just as in the sketch and then place the other disk on top. Now, leaving the center plate free, turn the upper disk. This causes the upstanding balls to act like dowel pins in the plate and so makes the plate move forward in the same direction as we are turning the upper disk. As soon as the plate has moved, the upper balls will begin to run down into the grooves in the lower disk and the lower balls to rise up into the grooves of the upper plate. The balls act exactly like the planet wheels in a bevel differential and the center plate will revolve at *half* the speed of the disk we are turning. Of course this action can be reversed, that is if we turn the center plate the free, upper disk will revolve at *twice* the speed of the plate.

If this experiment is tried with the parts as shown and with no case to hold them together, a slight touch on the disk when turning the plate will at once cause the disk to jump; showing that small resistance creates a strong tendency for the two disks to separate. Since the device will operate as a perfect differential with one side stationary and the other free, it is obvious that it will still operate if we allow the under disk to turn too. Instead of standing the lower disk on a table, rest it on a greasy slab of glass. Then a sharp twist given to the center plate will cause the upper disk to move fast and will also cause the lower one to move slowly.

Fig. 3—The complete differential ready for assembly in the rear axle

Another Explanation

There is another way of explaining the action of differentiation. It is sometimes not clear, even with the differential in the hands, why it is that the two disks cannot revolve at the same speed without moving the plate. To explain this imagine a ball at the bottom of the lower groove *A* in the sketch. For this ball to get to the upper groove it has to run up to the end of lower *A* over the dividing piece and then down into upper *A*. Now it cannot do this unless two things happen together, one being that the other disk moves round so as to bring the deepest part of its groove over the dividing line at the time the ball crosses, and the other that the center plate also moves to allow the hole in which the ball lies to come round from the starting position to the finishing position of the travel of the ball.

The device is not only hard to describe in words and sketches, it is even hard to follow when handling the actual model, but it becomes clear after a little concentrated thought.

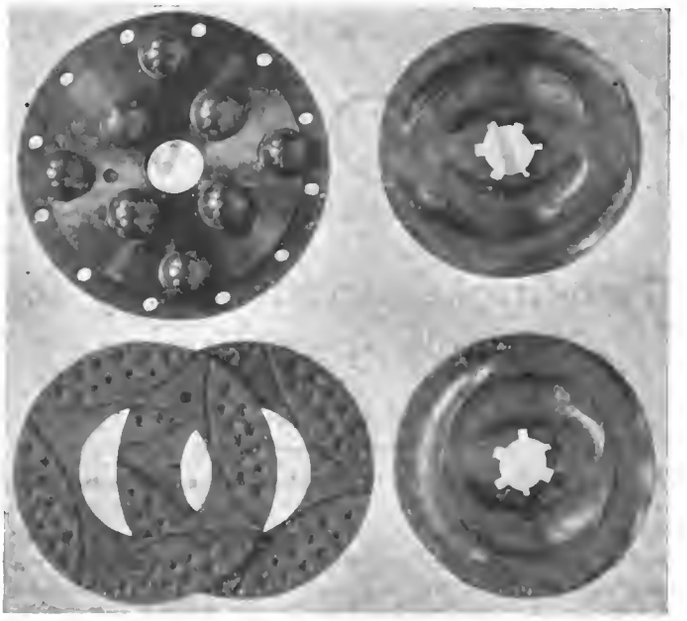


Fig. 2—All the internal parts of the differential as they appeared after the Purdue University test

Another thing which is not readily clear is why the differential will allow a car to pull out of a hole when one wheel only has a grip of the ground. To grasp this action suppose the wheel in the hole is spinning. Then all the power of the engine is going to this wheel. Since the expanding action of the differential causes internal friction the power is really divided between that absorbed by the spinning wheel and that used up in friction. But as soon as the other wheel moves the friction is relieved; therefore the friction exerts a torque upon the wheel having a grip on the ground and as the friction is large the torque is also considerable.

Self-Locking Action

This self-locking action by which the friction induced by the spreading of the disks arrests the spinning of the wheel without traction and converts its motion to torque on the stationary one may be explained in another way. Imagine each wheel with an independent brake. Obviously if a brake is applied to the spinning wheel it will be slowed down and the torque will be transmitted through the differential to the other wheel.

Of course there is no such brake in the differential under discussion, but the spreading of the disks into contact with the differential casing acts in the same way. Both disks are separated with equal force, but only that on the side of the spinning wheel has a braking effect because only on that side is there motion taking place between the disk and the casing relatively.

In practice the spreading action produces considerable forces and presses the disks against the containing case with heavy pressure. Their surface is large and provided with lubricating grooves as shown in the photographic illustration, and extensive tests made at Purdue University show that there is practically no measurable wear within a reasonable time. There is no backlash whatever when the gear is new, and none after a considerable period of use. Incidentally, the Purdue tests were made in a stout rear axle taken from a well known car and the forces applied were so great that the axle drive shafts were twisted till one of them broke off; which means the loads were greatly in excess of anything that could occur in practice.

At present the differentials are being manufactured on a small scale by the Miller Transmission Co., Karpen Building, Chicago. Arrangements are heing made for a very large output in the near future.

The FORVM

DO TWO-CYCLES OPERATE SUCCESSFULLY UNDER ALL LOAD AND SPEED CONDITIONS?—MORE VIEWS ON DIFFERENTIAL PROBLEM—RATTLING FENDERS

Two-Stroke Unsatisfactory for Variable Speed Engine

By C. C. Hinkley
Chief Engineer, Chalmers Motor Co.

I HAVE passed through considerable experimental work on two-stroke engines and in conclusion will say that they left a lot to be desired. For constant speeds and steady loads I believe they are very satisfactory especially for marine work; but, for variable speed engines of varying loads I have never been able to make them operate quite satisfactorily. I have never been able to make them two cycle under all conditions of load and speed. This is the one main drawback in connection with this motor which caused me to shelve the idea some time ago. It may be that my experimental work was not carried as far as it might have been at the time. However, I would very much hesitate to go into it again, knowing the difficulties that are to be encountered.

Resistance Differential Logical Solution

By John Squires
Vice-President and Secretary, Signal Motor Truck Co.

WE agree that it is obvious that from a constructional point of view it is desirable to eliminate the differential.

The writer can recall many situations in his past personal experiences in driving trucks, where the elimination of the differential would have been much of a handicap and consequently we cannot agree at the present moment that, from the operation point of view, this elimination would be desirable.

The resistance differential seems in our mind to be the logical solution of the matter at the present time, and we would prefer to see this more fully developed than that the differential be eliminated altogether.

Should Conduct Differential Experiments

By B. T. Birdsall
President, Kosmath Co., Inc.

IN regard to the elimination of the differential from trucks. This is a subject on which I have not given much thought but has been put forward by one axle maker. It would seem to me, however, that very thorough and exhaustive experiments should be conducted over a considerable period of time and in different localities before it would be safe to adopt so vital a change.

There is no question that if we could eliminate the differential it would be a good thing in many ways, but at the present time I would regard it as more or less of a dangerous proposition.

Fenders Rattle Too Much

By E. T. Crilley

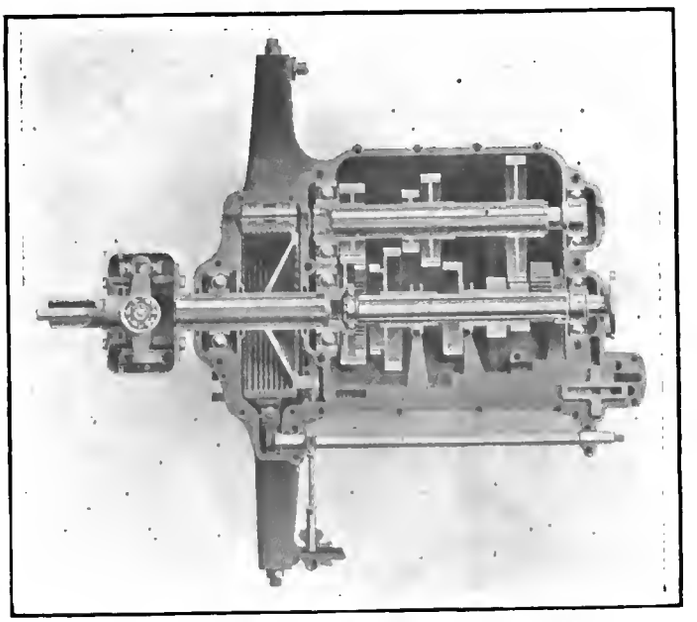
ONE of the most disagreeable things about the modern car, it seems to me, is likewise one of the most unnecessary. I refer to the rattling which frequently emanates from the fenders, especially after the car has been in use for some time. Of course, if the fenders are bent or broken in any way, some noise may be expected, but if our designers and builders would give the matter a little attention, I am sure that rigid mounting and elimination of loose or chafing edges would be avoided.

Universal Joints in 1905

By W. J. P. Moore

I WAS very much interested in your article on the above subject in THE AUTOMOBILE for May 25.

I am sending you an illustration of a ball bearing universal I used on the tail shaft immediately behind the gearbox in a car I built in 1905 and with which I had very satisfactory results; perhaps it will be of interest to you.



Ball bearing universal used on a car built in 1905

The History of the Pneumatic Tire—10

Further Activity in 1892—Michelin Tire Enters the Field—Introduction of Multiple Inner Tubes—Rapid Adoption of Pneumatic Tires for Bicycle Use

The History of the American Automobile Industry—37

By David Beecroft

CONTINUING the story of the tires invented or brought out in the year 1892, as begun in last week's installment of this series, there are a number of constructions which have not been mentioned. Some of these are briefly reviewed this week.

Sercombe-Bolte Construction

The Sercombe-Bolte tire of 1892 used a rim with its edges hooked outward instead of inward, and the tire had a flat metal wire in its edge of a diameter large enough to fit into these hooks. These metal wires were flexible enough to be forced into place, and when in place, prevented the tire edge from being pulled out of the groove, the main part of the strain being taken on that part of the rim which formed the point of the hook. This shape, however, caught dirt badly, was not easy to apply, tended to rim-cut and sometimes pinched the air tube.

The Michelin Tire

The Michelin tire, originated in France, was introduced in 1892 and used a rim flat on top but deeply grooved at its edges much like the rim of the Duryea cushion tire except larger. The tire casing had beads on its outside which were dropped into the bottoms of these grooves and endless rings placed in position over them, so the beads could not be pulled out. This rim, however, being of special shape and particularly objectionable because it filled with sand and mud, did not find favor and was quickly superseded by the Burris-Michelin, which used a casing having wires in its edges like the Dunlop but without the Dunlop rim. The rim used was flat bottomed and the wired edges were larger than the bottom of the rim so that a ring of square rubber or fabric could be placed in the corners of the rim and form a shelf for the edges of the tire casing. When this shelf ring was removed, the tire could be easily lifted over the rim edge and removed. It was one of the many attempts to evade the Dunlop wire-base construction.

Use of Multiple Tubes

In the same year, 1892, was introduced a tire having three air tubes or compartments any one of which could be used if another became punctured. The fault with this construction was that the point which punctured one was likely to puncture the next, unless it was found and removed, and often this required that the casing be examined on its inner surface. The multiple-tube idea has therefore not found favor. The same inventor, Dorr, developed a tire much like the Michelin but using a rim like the Burwell. Metal rings separate from the tire, instead of incorporated in their edges as in the Burwell, were used to hold the beads up into the outwardly turned rim hooks. This tire was found disadvantageous in much the same way as the Burwell and was not produced to any great extent.

The Pneumatic Gains

The indisputable advantage of the pneumatic tire forced the larger bicycle companies to supply it this year, in spite of the good business conservatism which prompted them to continue the all-rubber tires. The Pope Co., Morgan & Wright, and a number of others simply split the base of the hose pipe tire at one or two places and inserted an air tube, having closed ends which were abutted together, after which the openings were laced and the tire put in place. Canvas protectors were provided where the air tubes might be damaged by the lacing or the slits, and in some cases this canvas was extended completely around the air tube as on many modern air tubes. The Victor company, to avoid removing the tire and recementing it whenever it was necessary to remove the air tube, fitted its bicycles with rims having an opening through which the air tube could be reached and inserted or removed.

The Hose Pipe Type

It is well to distinguish the so-called hose pipe single tube tire in which the several layers are composed of ordinary canvas about an inner air tube and the hole vulcanized together, resulting in the identical structure found in a canvas-made hose pipe, whence the name. The only novel feature is the adjoining of the ends to form an angle and the insertion of a valve in the tube for the purpose of inflation.

The Rostrum

Steps in Installing an Air Starter

EDITOR THE AUTOMOBILE:—Please give a full explanation of the principle involved in the construction of an air starter? My four-cylinder engine has 4¼ by 5½ in. bore and stroke. I have a B Prest-O-Lite tank, a high pressure gage and safety valve.

Kindly describe and illustrate the parts necessary in this work.

Pittsburgh, Pa. J. G. H.

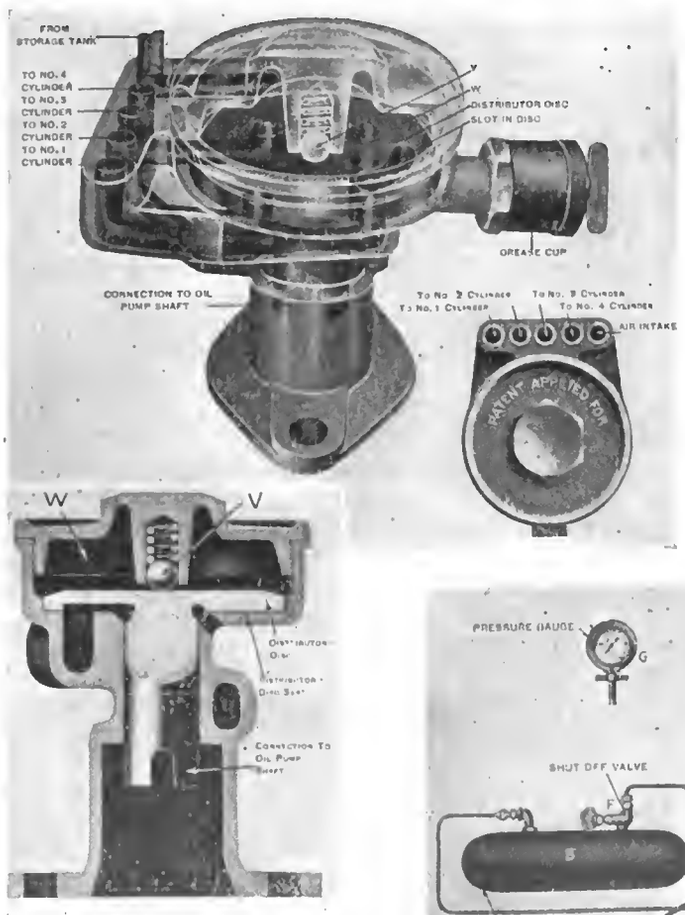
—The principle of the air starter is very simple as it is merely an arrangement for introducing compressed air instead of gas into the cylinder. The compressed air in expanding cranks the motor until it takes up its own cycle. It would not be practicable for you to attempt to make an air starter with the equipment you mention as one of the important parts of the system is a pump and check valve to maintain pressure in the tank. The amount of money which you would have to spend in installing the pump would be out of proportion to the return. Another necessary part of the system for an air starter is a distributer which directs the flow of the compressed air to the proper cylinder.

To give you an idea of the operation of a compressed air system a description of that used on the 1912 Chalmers 36 model 10 will be of interest. Fig. 2 gives a general layout of the air starting system together with the necessary piping and connections. As in all compressed air systems the operation of this device primarily consists of the introduction of charges of compressed air into the cylinders which are ready for the working stroke in their order of firing. The engine is operated with compressed air until regular explosions take place in the cylinders, after which the air supply is shut off and the motor takes up its regular operation on its own power.

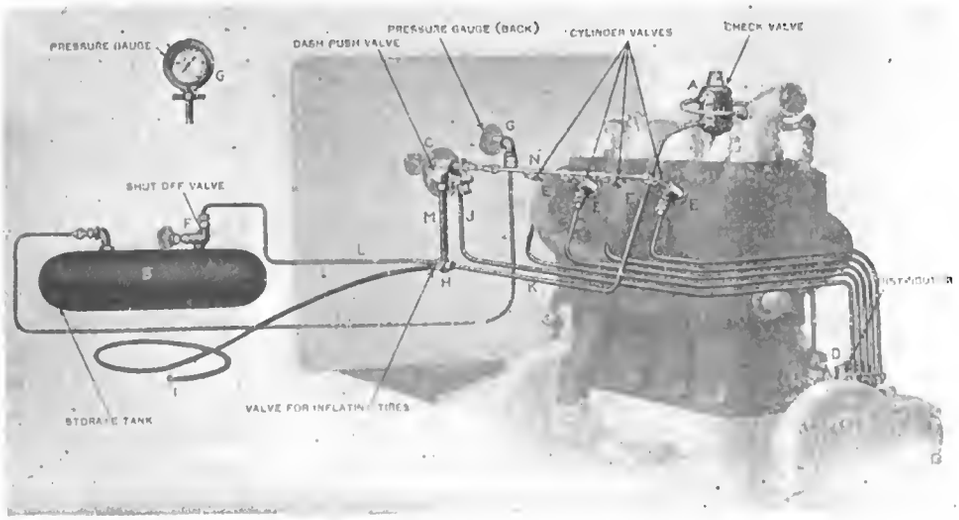
Referring to the illustrations, the parts of the Chalmers air starter are as follows: Check valve *A* for compressing air in storage tank *B*, a pipe *K* and *L* for carrying air from the check valve to the storage tank, a pipe *L* and *M* which carries air from the storage tank to the push valve *C* on the dash; a pipe *J* which carries compressed air from the push valve to the distributer *D*, four pipes through which air is carried from the distributer to the various cylinders; poppet valves *E*, one in each of the cylinders, by means of which compressed air from the distributer is admitted to the cylinder ready for the working stroke; a pressure gage *G* on the dash which keeps the operator informed of the amount of compressed air in the storage tank and a shut-off valve *F* which disconnects the starting mechanism from the storage tank.

Check Valve Is Important

The check valve is shown in Fig. 3. It is one of the most important parts of the system and on 1912 Chalmers consisted of a waterjacketed case inside of which is a check valve *O* held in place by a spiral spring *Q*. As the explosion occurs in No. 1 cylinder during the regular operation of the motor a part of the pressure of combustion passes through an



Left—Fig. 1—Details of distributer used in air starting system on 1912 Chalmers 36 model 10. The lower illustration is a vertical section



Right—Fig. 2—Layout of the air starting system used on the 1912 Chalmers model 10, showing piping

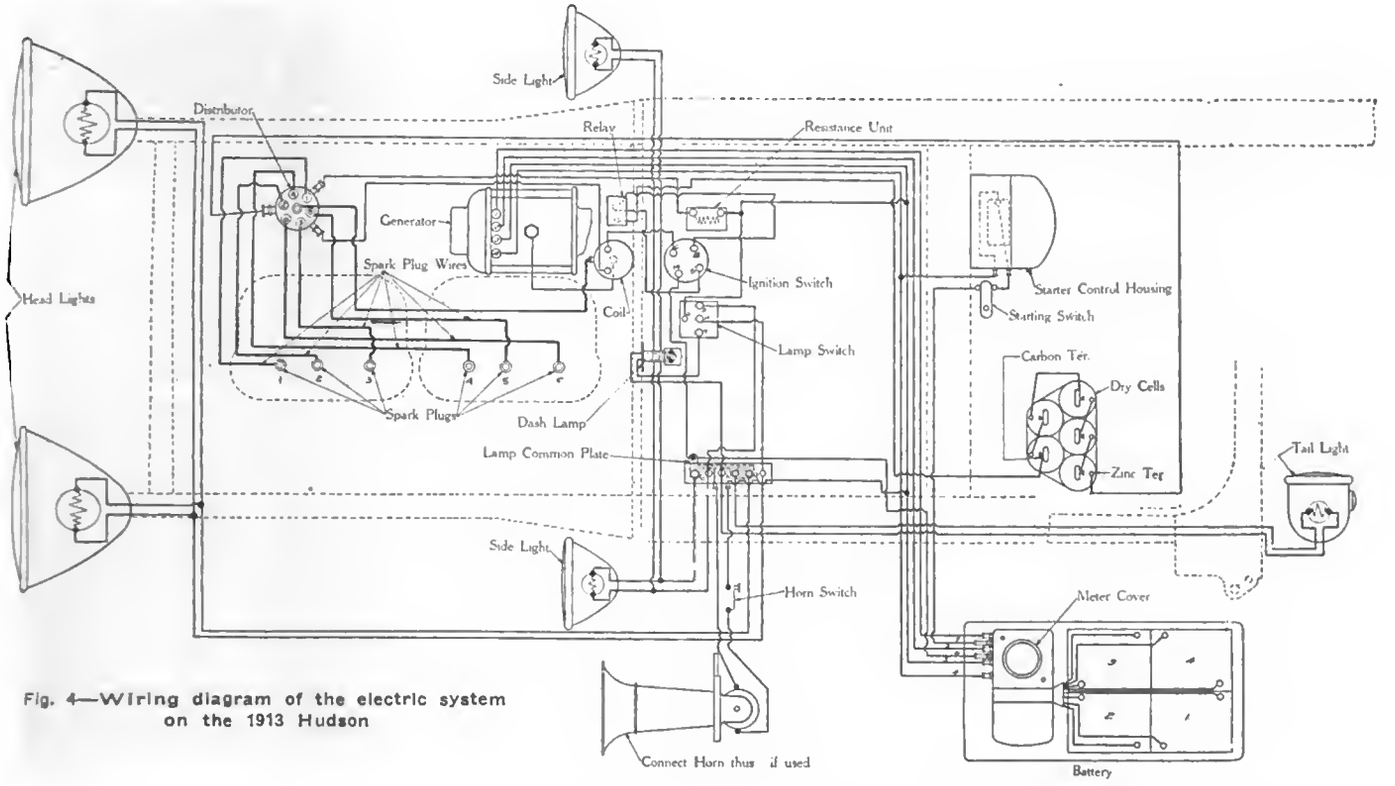


Fig. 4—Wiring diagram of the electric system on the 1913 Hudson

opening *R* lifting the valve *P* from its seat and allowing the escaping pressure to pass out through a pipe *S* into the storage tank. The storage tank on this car was lined with lead to prevent corrosion and was tested for a pressure of 600 lb.

The function of the distributer is to send charges of air into the proper cylinders ready for the working stroke in their order of firing. It is geared to the pump and magneto shaft and positively timed so that the charges of compressed air are fed to one cylinder at a time. As shown in Fig. 1, it consists merely of an air-tight case in which operates a small gear-driven disk. This disk is held in place by a steel spring and ball *V*. When air is released from the storage tank by the dash push valve it passes into the space *W* above the distributer disk. This pressure forces the disk down tightly upon its seat. As the disk revolves the air above it passes through the slot into one of the four holes beneath the disk and thence to the proper cylinder which is ready for the explosion stroke.

These are the main points of the system and as you will no doubt see it is quite a complicated installation and the equipment that you have will hardly be sufficient to allow you to arrange a starter.

Valve-Grinding Should Be Uniform

Editor THE AUTOMOBILE:—In grinding valves, should the valve be rotated in only one direction or should it be rotated back and forth without changing its position on the valve seat very materially?

Oyster Bay, N. Y. S. P. M.

—Since the object of the grinding is to make the valve seat tightly and smoothly on its seat around its entire circumference, the valve should be rotated in both directions with a uniform motion and from time to time during the process should be lifted and shifted on the seat so that all points will be ground evenly.

Wiring Diagram of 1913 Hudson

Editor THE AUTOMOBILE:—Kindly publish wiring diagram for attaching a dash ammeter to a 1913 Hudson model 54 so that same will indicate charge and discharge. I have made an attachment by cutting in the instrument in No. 1 wire from the motor generator, but this shows charge only, no discharge being indicated when motor is not running and all lights on.

Penn Yan, N. Y. A. T. B.

—It is not possible to connect an ammeter on this model so as to read charge and discharge. We note that you have inserted the instrument in the No. 1 wire from the motor generator, but this is not to be recommended. The best method is to remove the wire from the cut-out relay on top of the control switch and connect the ammeter between this wire and the terminal from which it was removed. A suitable length of wiring and metallic conduit would have to be provided to enable the ammeter to be located where desired. Wiring diagram of the electric system used in the 1913 Hudson appears in Fig. 4.

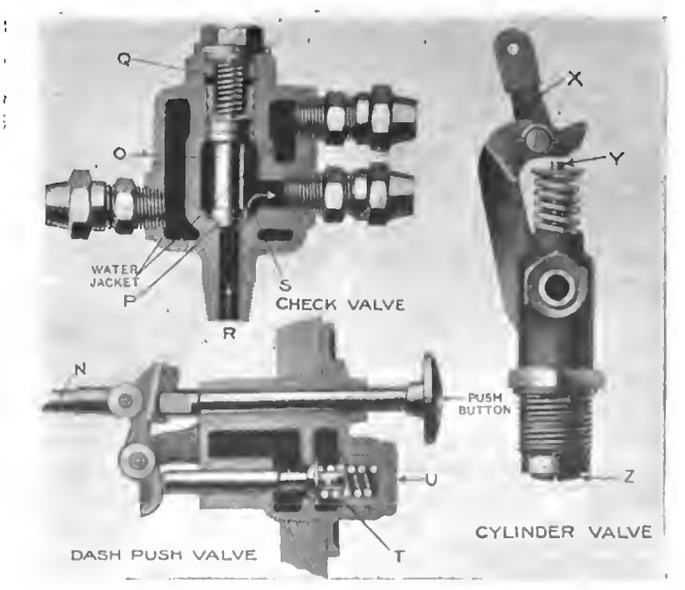


Fig. 3—Valves used in air starter on 1912 Chalmers

ACCESSORIES

J-A-Y Vacuum Gage

BY means of this vacuum gage a constant check may be kept on the gasoline as it is fed to the carbureter, showing just what is going on in the Stewart vacuum fuel feed tank. The gage is attached to a tap already existing in the tank, and registers every float operation of the tank, thereby telling at all times if the gasoline line is clear, if the carbureter is properly adjusted and if the car is making as many miles per gallon of gasoline as it should. In fact the device is a constant index to the gasoline feed system, showing when the supply in the tank should be renewed, and instantly indicates a development of any misadjustment or wasteful condition. It is easy to install, all that is necessary being the mounting of the gage on the cowlboard and attaching it to the fuel tank as indicated in the illustration. It sells for $5.—Webb Jay Corp., Karpen Bldg., Chicago, Ill.

J-A-Y vacuum gage which is a complete index to the Stewart fuel feed system

L-G Auto Lock

This lock is designed for cars having central control with a ball-and-socket type of shifting lever. The lever is locked in neutral position by a hinged ring which passes around the base of the lever. The ring is fastened by a padlock. It may be instantly applied to any car with this type of lever, it is said. Price $3.—Howard Automobile Co., San Francisco, Cal.

L-G auto lock designed for use on cars fitted with center control

Des Moines Spark Intensifier

The Des Moines spark intensifier operates on the spark-gap principle, its body being cylindrical with an insulated core carrying the conductors, an opening permitting the spark gap to be seen. The body of the intensifier has a little bracket at one end by which it is attached to the terminal of the spark plug and at the other end a binding screw for the high-tension lead. The width of the gap is adjustable. The makers claim that plugs which are badly sooted and fouled, or that have broken porcelains, will fire with the intensifier in the circuit when they would give no spark otherwise. The intensifiers sell for 75 cents apiece, or $3 for a set of four.—Des Moines Sales & Supply Co., Des Moines, Iowa.

Miller Safety Pilot

This device is intended for Fords and consists of a single coiled spring inclosed in a cylinder which is attached to the front axle at the middle by a bracket held by two clip bolts. An inner cylinder connected to the spring has a clamp projecting from an opening in the outer cylinder; this clamp attaches to the cross-rod of the steering gear. The spring normally holds the steering wheels in the straight-ahead position and tends to steady steering and minimize the strain on the hands of the driver in all positions of the wheels. Price, $5.—Safety Mfg. Co., Quincy, Ill.

Work bench for the equipment of private garages. It has steel legs and iron rails

Miller lock for Ford control levers

Protexall Dusters

These one-piece suits are an absolute protection against dirt. They are said to be cool and loose and are hooked over the regular clothes or even over an overcoat. The material is easily washed, is strong and durable and is furnished in several colors, both plain and striped. There is a combination loose and roll collar, a wide two-button adjustable cuff, buttoned side slits giving easy access to all pockets, continuous front opening. Sizes from 36 to 50 in. corresponding to coat sizes and may be had with extra long or sleeve length for tall men.—Protexall Co., Abingdon, Ill.

Garage Bench

This bench is for automobilists who have their own garages. It is a substantial construction, 4½ ft. long by 26 in. wide and 24 in. high. It is provided with a heavy cast steel vice and a drawer large enough to hold all ordinary tools. The legs are of steel and the cross rails malleable iron. Price, $14.50.—Motor Engineering Co., Cleveland, Ohio.

Bale's Puncture Plugger

This puncture plugger is injected into the tube with the result that when a puncture occurs, the hole is clogged by the liquid and air leakage is prevented. It is a fibrous compound largely composed of rubber and is in a semi-liquid state. As soon as it enters the punctured hole, it solidifies.—Bales Puncture Plugger Co., 301 North Illinois Street, Indianapolis, Ind.

Woods Everloc Patch

This patch is applied with cement, no heat being required and is said to permanently repair either blowouts or punctures. The material comes in sheets 6 by 18 in. and may be cut to any size. One sheet will repair 100 ordinary cuts or 250 nail punctures.—Price $1. A heavier patch for casing repairs sells for $1.50. —W. C. Wood Co., Minneapolis, Minn.

Luvium Metal Ford Pistons

Lightweight pistons of Luvium metal are now being made for Ford cars. Luvium metal has a specific gravity of 2.67 to 2.70. Though having the lightness of aluminum, it is said to have a tensile strength greater than cold-rolled steel, or twice the tensile strength of cast iron. It is made in hard and malleable forms and has proven satisfactory

Above—Control of Nokolyd electric signal
Below—Nokolyd signal mounted on car

for cylinders, connecting-rods, gears, crankcases, sprockets, magneto parts and other uses, the wearing qualities being considered superior to steel by the manufacturer. The new Ford pistons, in sets of four, sell at $21 per set. The company also makes other standard pistons. Inland piston rings made by the Inland Machine Works, St. Louis, Mo., are used. —Whitman Luvium Co., St. Louis, Mo.

Nokolyd Electric Signal

The Nokolyd is an electrically operated signal; the signal proper consists of a box mounted at the rear of the car which shows, in large letters, the words, Left, Right and Stop, controlled by a small lever on the steering wheel; the lever works over a dial lettered to correspond to the signals and having a neutral position. The letters are illuminated at night. Current may be obtained from the storage battery or from a special set of dry cells. The signal lists at $20.—Nokolyd Signal Co., New York City.

Adco Shock Absorber

An inclosed auxiliary spring replaces the rear spring shackle, the movable side members being corrugated and moving in corrugated slots which give increased wearing surface and prevent rattling of the operating parts. The construction practically makes the device dirt and waterproof. There are two springs—an outer coil, which is said to perform the initial work, and a stiffer inner spring which assists the outer one when the load is heavy. An elliptical adjusting nut at the top prevents the device from getting out of adjustment. There is a removable screw plug at the bottom so that grease may be put in. Price $20 per pair.—Auto Device Mfg. Co., 62 Mason Street, Milwaukee, Wis.

Brisk Blast Jack and Pump

These tire saving jacks are made with a simple rack and sector lever operated lift worked by the foot. A similar lifting jack designed particularly for Fords and other light cars has a height of 10½ in., 6½-in. lift and weighs 8½ lb. Price $3.

The company also makes a steel foot pump. It has two seamless steel cylinders, 1½ and ⅞ in. diameter, respectively, cold rolled steel plunger rods, hardwood handle and brass screw connection to fit any tire. Price $2.50. Another design with a single 1¼-in. cylinder sells for $2.—Brisk Blast Mfg. Co., 1515 North Twenty-fifth Street, St. Louis, Mo.

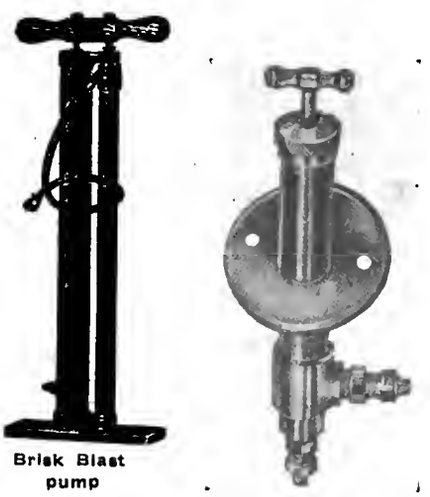
S-O-S Polishes

The No-Rub body polish is a liquid which will increase the brilliancy of the body surface but will not restore the finish once it has been destroyed by wear, abuse or neglect. It is applied with cheesecloth and after drying the body should be rubbed with a dry cloth. Price, pts., 57 cents; qts., $1.35.

The metal polish is a liquid which is applied with waste or cotton flannel, rubbed briskly and polished with a soft dry cloth or a chamois. Price, ½ pts., 25 cents; pts., 40 cents; qts., 75 cents.—S-O-S Mfg. Co., 167 South Stevens Street, Spokane, Wash.

Burnley Soldering Paste

The advantage of using a paste is that it spreads the solder evenly and quickly, it is said; the solder never tins before spreading. It is superior to a liquid flux because it does not run away from the point at which it is applied, and it cannot be spilled. A soldering stick is designed particularly for electrical work. It is rubbed on the heated joint and then the solder is applied in the usual way. It is wrapped in tin foil and will not corrode the wires or affect the insulation.—Burnley Battery & Mfg. Co., North East, Pa. Western Electric Co., distributor.



Brisk Blast pump

Ideal Primer and Cup

The Ideal primer is nothing more than a small gasoline pump installed on the dash or cowl. Its suction end is connected to the fuel tank and its discharge to the manifold, so that the motor may be primed by simply operating the handle. The stem of the handle is threaded so that the pump valve may be closed tightly by turning it a few times; thus leakage is prevented. It sells for $3.

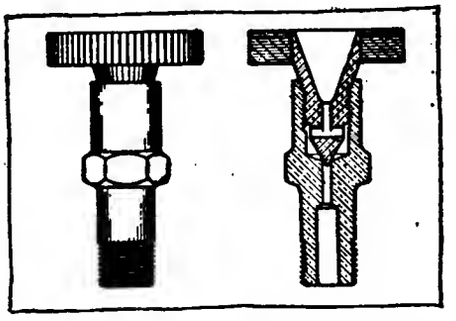
The most important feature of the Ideal priming cup is that the valve itself is of the needle type and is proof against leakage, even when used on high-compression motors. The turning knob is a fiber disk, so that there is no danger of burning the fingers. Price, nickel finish, 50 cents; brass, 40 cents.—Ideal Brass Works, Indianapolis, Ind.

Delker Trailer

The Delker two-wheeled trailer has a capacity of 1000 lb. and is made in a single model. The body is 44 by 72 in., with 8-in. panels and hardwood sills braced and ironed, and the flareboards are well braced; there is an end gate and rings at front and back so loads can be tied in. Wheels are Sarvens, riveted rims and 34 by 1¼ solid rubber tires. The axle is of 1¼-in. steel and the wheels run on Timken roller bearings. Springs are 1½ in. wide with six leaves. Finish, black with striping. Shipping weight, about 375 lb.—George Delker Co., Henderson, Ky.

Dazzle Dimmer

A diminutive roller-shade is clipped to the top of the windshield, and from it a little curtain of tinted transparent material is pulled when required. It can be put up or down at an instant's notice, and can be slipped along the windshield to any desired place. The maker states that the curtain is so tinted that it is possible to see how many persons there are in an approaching car in the face of the headlights. Price, $1.50.—The Dazzle Dimmer Co., Springfield, Mass.



Above—Ideal needle valve priming cup
Left—Ideal primer for dash mounting

The Automobile

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Materials Steady

AFTER the period at the end of last year when steel and other raw material prices seemed likely to soar to unheard-of prices, it is good to be able to record the fact that the prospects from the automobile industry's viewpoint are now brightening again. In December and January the situation looked so gloomy that actual panic threatened; now, though prices are still way up, the fear that no supplies whatever may be forthcoming seems over.

The effect of the foreign demand has been to boost American production of everything needed in Europe. In certain respects the European demand is slackening, the machine tool industry in particular is well within sight of the end of phenomenal foreign buying, while the demand for aluminum is lessening by regular, if slow, degrees. It will be a long while yet before our manufacturers can enjoy before war prices, but there is less fear now that production will be curtailed by inability to get enough steel.

Few New Multis

AS yet it is, of course, too early to make any accurate analysis of the specifications of the 1917 cars, but from what has been published and what is known to be the plan of many other manufacturers, it is obvious that there are not going to be many more eights and twelves. The four-cylinder machine is holding its own along the line; there have been several new sixes, and those formerly making sixes will mostly adhere to that type.

This tends somewhat to confirm the view which THE AUTOMOBILE has held from the very beginning of the V engine, namely, that there is ample room for all types, from the four, which is the lowest cylindricity that will provide smooth operation, to the twelve, which gives the theoretical maximum of smoothness. Having regard to the performance of the 300-cu. in. Packard aviation engine, it is rather surprising that we have heard nothing yet of a small, high grade twelve as a stock model; still there is ample time yet and the anticipation that one or two such will appear holds good.

Tonneau Windshields

ONE big change that has taken place in American automobiles in the last 2 years has been in their average comfort. While much remains to be done, much has been accomplished already, and it is thus fitting to speculate regarding the next step. That the heater, connected with the exhaust, is soon going to be expected as a stock accessory on medium and high priced cars is assured, and having thus cared for the lower extremities of the tonneau passengers the tonneau windshield appears to be the next logical step.

Of the special designs which can be bought for attachment to any car, some are fairly neat and some are very clumsy, but not one of them is as light or as simple as it might be if it were designed for one single body and if that body were designed to accommodate it. The center cowl now so popular should make the fitting of a tonneau shield a far simpler matter than it used to be with the old style of front seat back. It should provide a place for stowing the shield when not in use and points for attachment of the supports, which would not call for elaborate supporting brackets. Once tried, the tonneau shield becomes as much a necessity as the shield in front. It will be a wonderful selling argument for the first manufacturer who takes it up.

British Tax Lifted

THE proposed enormous increases in the annual license dues on automobiles in England have been abandoned as a result of the agitation of the trade press and of the various motoring organizations. The British taxes are based on cylinder bore, and would have raised the license on a Ford to over $90 a year. Instead of the increases in annual dues an extra tax for war time only has been placed on gasoline, this being 12 cents a gallon. This is in addition to the 6 cents a gallon which is the peacetime tax.

The change in the Government's plan is an advantage to the users of American cars, as these are mostly of large bore compared with the European types; but the American organizations should observe the situation with satisfaction, because it is proof of the power of motoring associations backed by a strong trade press.

$170,000,000 for Good Roads

President Signs Bill for $85,000,000—States to Pay Same Amount

WASHINGTON, D. C., July 11—*Special Telegram* — President Wilson to-day signed the good roads bill recently passed by Congress, authorizing the expenditure of $85,000,000 in 5 years by the Federal Government. The signing of the bill by the President marked the final act before the beginning of active co-operation between the national Government and the States in highway improvements, on a country-wide program.

The condition attached to the expenditure of the government appropriation is that the States shall expend an amount similar to that appropriated to them for the indicated improvement. The signing was witnessed by members of the Senate and House and representatives of various farmers' organizations. Officials of the American Automobile Assn. and the Assn. of State Highway Officials also were present.

The bill provides that in addition to the money to be spent in co-operation with the States $10,000,000 shall be provided for roads in Federal forest reserves, to be spent at the rate of $1,000,000 a year for 10 years.

The co-operative plan which became effective to-day is said to have sprung from the combined energies of the American Assn. of State Highway Officials and the American Automobile Assn.

—

Twenty-one Firms Bid for Army Light-Truck Orders

NEW YORK CITY, July 12—The Quartermaster's Department has opened bids on from one to forty ¾-ton trucks, and in response to its call, twenty-one firms have replied with bids ranging variously.

A few of the lowest bidders follow:

The Bessemer Motor Truck Co. offered to supply from one to forty ¾-ton trucks, chassis with body complete, for $995 f.o.b. Grove City, Pa. Five days after the award of order this concern promised to start shipment, and complete it within 30 days.

The Selden Motor Truck Sales Co. offered chassis model G complete, $996 each; Stewart Motor Corp., at New York, 1500-lb. chassis, $596 each; chassis with express body, $640; chassis with panel body, $676; delivery to commence on receipt of order and to be completed in 20 days.

T. B. Jeffery Co., 1 to 40 Jeffery rapid-service trucks, with express body and top cover, in lots of one to twenty-five, $850.60; in lots of twenty-five to fifty, $840.75. Delivery, three complete units every working day, to start one week after award.

General Motor Truck Co., regular model No. 15 chassis, complete with flare board body, $1,096; extra for electric self-starter, $125; extra for generator and electric lights, $80; extra for canopy tops, $40. Delivery a week after award, four a day thereafter from Pontiac, Mich.

Reo Motor Car Co., model M truck, six-cylinder, at $1,000 each. Delivery, six per working day.

Studebaker Corp., forty 1-ton, with express body, $1,200, or forty 1-ton, with staple body, $1,250, less 15 per cent, or $1,020 net. Delivery 2 weeks after award, and four a day thereafter.

Republic Motor Truck Co., ¾-ton truck, $897, including express body, f.o.b. Alma, Mich. Order completed in 5 days, ten a day.

Denby Motor Truck Co., one to forty trucks, open express, flare board bodies, furnished with solid or pneumatic tires, $990 f.o.b. Detroit; with Allis-Chalmers electrical system, $1,075. Delivery with electric system, ten in 24 hr.; fifteen every additional 24 hr.

Day-Elder Motor Truck Co., Open express body, $175; delivery starting 10 weeks after award, with two to four a week thereafter; chassis complete, $895; electric self-starter and lights, $85 extra.

—

Only Three Bids for Shop Trucks

NEW YORK CITY, July 10—Only three truck companies put in bids at the Depot Quartermaster's Department last Saturday for proposals for furnishing the United States army with from one to fifty motor truck machine shops.

The Hurlburt Motor Truck Co. stated that it could supply from one to twenty-five trucks for $7,000 each. Shipment could begin 90 days after award of order.

The J. G. Brill Co. offered to supply one to fifty machine shop truck bodies at $429 per body. The White Company put in a bid for the one to fifty complete 3-ton truck machine shops, less tools and machinery, for $3,445, delivery to start 5 weeks after placing of order, with five a week thereafter.

—

Marmon Adds Closed-Body Types

INDIANAPOLIS, IND., July 11—The Nordyke & Marmon Co. will increase its output of closed cars considerably this fall. The bodies will be built by such firms as Holbrook & Co., New York; New Haven Carriage Co.; Kimball & Co., Chicago; and the E. J. Johnson Co. of Pittsburgh.

The light-weight characteristics of the chassis will be maintained in these bodies and it is stated that Marmon closed cars will turn the scales at from 3800 lb. to 4000 lb. The floorboards are lower than usual, on account of the special frame construction and the total height to the top of the roof from the ground will be 81 in., fifty-four of these being from the floor to the inside of the roof. Extra wide rear doors will be fitted and all the windows will slide instead of folding, giving any degree of opening desired.

The standard line includes limousine, landaulet, town car and convertible sedan. Deliveries will be commenced in August or September.

—

Milburn Raises Price $100

TOLEDO, OHIO, July 10—The Milburn Wagon Co., manufacturers of the Milburn Light Electric, like the majority of other automobile manufacturers, has been compelled, owing to the increased cost of labor and materials, to advance the selling price of one of its products. Announcement is made that the model 22 brougham, formerly selling at $1,585, will be listed at $1,685, taking effect July 15.

Sales Congress Opens

President Wilson in Address to 3000 Indorses Better Business and Salesmanship

DETROIT, MICH., July 10—*Special Telegram*—President Woodrow Wilson to-day gave his indorsement to "the betterment of business through the betterment of salesmanship." When he addressed the World's Salesmanship Congress in the Arcadia Auditorium he was enthusiastically received by the audience of 3000, to whom he drew close in his brief but explicit remarks.

He pointed out the future that lies in store for the United States and attributed success in selling relations and in business to a close understanding between the two parties to the transaction. His opinion of his audience and of American business was indicated when he said:

"I have always believed, and I think you have always believed, that there is more business genius in the United States than anywhere else in the world."

—

King 8 Makes Providence-Detroit Run on High Gear

DETROIT, MICH., July 12—*Special Telegram*—At 7 o'clock this morning a King eight model E stock car arrived here from Providence, R. I., having made the entire distance of 837 miles on high gear. Both the gear shifter and differential housing are sealed and the car has the standard ratio of 4.64 to 1. The driver was A. F. Justin of the Longley Motor Sales Co., of Providence. Passengers were H. G. Belcher of the *Providence Tribune*, H. H. Weeks, R. J. MacKenzie and C. F. Stanley. The route covered was from Providence to Albany, through the Berkshires, Albany to Buffalo, Buffalo to Niagara, through Canada by way of Hamilton, London and Windsor. Roads through Canada were found very bad. The biggest day's travel was on Tuesday, when 349 miles were covered.

—

King Used Champion Plugs

NEW YORK CITY, July 11—The King eight-cylinder car, which covered 10,850 miles in 2 weeks during the latter part of June without stopping its engine used Champion spark plugs. The object of the test was to demonstrate the stability of the King engine and its equipment.

—

Perfection Heater on Cole

CLEVELAND, OHIO, July 7—The 1917 Cole-Springfield model will be equipped with the Perfection heater, manufactured by the Perfection-Spring Service Co., this city.

Gillette To Build Sleeve Engine

May Take Over Amplex Plant To Build Wilmo Engine and Accessories

SOUTH BEND, IND., July 8—It is unofficially stated that William Gillette, the millionaire razor king, will take over the Amplex Auto & Machine Works, located at Mishawaka. The new company will be known as the Gillette Motor Co., and will manufacture the Wilmo rotating sleeve motor patented by M. L. Williams, formerly of South Bend, now of Chicago. Mr. Williams will be interested in the plant and will move to Mishawaka, where he has purchased a residence. The company will also manufacture automobile accessories. Ray Austin of Mishawaka will be the chief engineer of the company and C. E. Erickson of Chicago will be the general manager. The Amplex was built a number of years ago and eventually was purchased by Hovey & Starrett of Detroit, later going into the hands of a receiver. It was purchased by Rudolph Kamm, one of the original stockholders, and has been operated as a job machine plant.

Smith Resigns from Chalmers to Join Harry Newman

MILWAUKEE, WIS., July 8—F. H. Smith, assistant sales manager of the Chalmers Motor Co., Detroit, Mich., has resigned to become associated with the Harry Newman organization, Milwaukee, Chicago, Springfield, Ill., as manager of the northwest division. The northwest division will continue to be handled from the Milwaukee store at 700-706 Grand Avenue.

Guy Resigns from Advance-Rumely

SOUTH BEND, IND., July 8—J. H. Guy, vice-president and treasurer of the Advance-Rumely Co., Laporte, who has been with that organization since the spring of 1913, has resigned from the concern and in a short time will return to New York. When Mr. Guy went with the Rumely company it was his intention to remain but a short time, but when the troubled conditions of 1913 came he stayed on to help straighten out the company's affairs.

Higrade Motors May Locate Plant in Grand Rapids

GRAND RAPIDS, MICH., July 8—Business men in this city have pledged $50,000 for the erection of a plant for the Higrade Motors Co., which will build commercial vehicles. As proposed by J. E. Pratt, W. J. Loomis and L. W. Coppock of the company, $100,000 cash working capital will be put up by the Higrade company, providing the business men of Grand Rapids will buy the site of 20 acres selected by Pratt and his associates, and will build the plant on 5 acres of it. The plant will be leased at 7 per cent of the cost, plus 3 per cent for depreciation of buildings.

The site will cost between $12,000 and $15,000 and the building in the neighborhood of $35,000. The company was incorporated last week with a capital of $250,000. J. E. Pratt heads the organization. A brief description of the truck appeared in THE AUTOMOBILE for June 29.

Watkin Wright Roller Sales Manager

PHILADELPHIA, PA., July 7—L. W. Watkin, Jr., who for the past 9 years has been connected with the sales and engineering department of the Standard Roller Bearing Co., has recently become sales manager of the Wright Roller Bearing Co., this city, and Spring City, where its factory is located. This company manufactures taper roller bearings for the automobile trade.

Benford Need Not Change Form of Plugs

NEW YORK CITY, July 11—The decision of Judge Hand, recently rendered in the case of the Champion Spark Plug Co., insures to the Benford Mfg. Co. the right to make and sell its Reliable type ½-in. plug exactly in the same form and proportions as before the initiation of the suit, the only stipulation being that none of these plugs shall have the black finish or the brand in red.

A New Marathon Tire

CUYAHOGA FALLS, OHIO, July 7—The Marathon Tire & Rubber Co., this city, has brought out a new ribbed tread tire, named the Runner. There will be no change in price with the usual 5000-mile guarantee.

The tread of the new tire has three parallel ridges of rubber surrounding two hollows. The design protects against side slip. The new tire is furnished with white tread and fabric body or with black tread and whipcord carcass.

W. J. Forbes, Accessory Man, Dies

BOSTON, MASS., July 8—W. J. Forbes, one of the pioneer accessory men in New England, and who built up a big business making bodies of various kinds for Ford cars, died here this week following an illness of some weeks. He entered the accessory field 17 years ago.

Brown Leaves Premier

INDIANAPOLIS, IND., July 6—H. M. Brown is resigning as stock superintendent of the Premier Motor Corp. to accept a position as production manager for a concern in northern Indiana.

Saxon Six Averages 34⅔ M. P. G.

206 in Non-Stop Run—Average 23.5 M.P.G.—175 M.P.Qt. of Oil

DETROIT, MICH., July 10—Results of the Saxon Motor Car Co.'s 300-mile non-stop run, conducted in all parts of the country by the Saxon dealers on July 1, have indicated that the Frye Motor Car Co., St. Louis, Mo., attained the greatest mileage ger gallon, and hence this dealer gets the silver loving cup that was posted as the award for the winner. The Saxon six driven in the test by this concern averaged 34 2-3 m.p.g.

In the non-stop run, 206 Saxon sixes participated, traveling a total distance of 61,800 miles, and having a grand average of 23.5 m.p.g. of gasoline and 175 miles to the quart of oil.

A newspaper man acted as observer in each case, and while the tests were not official, the results obtained are accurate in all cases so far as known. Some of the contestants encountered bad roads and hilly country, while rain interfered in other localities.

Some of the results obtained are as follows:

Place	Dealer	Average mileage per gallon
St. Louis, Mo.	Frye Motor Car Co.	34 2/3
Rochester, N. Y.	Wm. Knipper	20.1
Stockton, Cal.	Parnell & Letourneau	28
Portland, Ohio.	Saxon Motor Sales Co.	27 3/11
Toronto, Ont.	Saxon Sales Co.	24
Minneapolis, Minn.	Northwestern Automobile Co.	33.96
Geneva, N. Y.	C. J. Allen	32.15
Los Angeles, Cal.	Saxon Motor Sales Co.	27.57
Alva, Okla.	T. W. Bickel	26.67
Lincoln, Neb.	F. B. Packwood	23
Memphis, Tenn.	Memphis Motor Car Co.	21.1
Hazelton, Pa.	G. S. Danke	21.3
New Castle, Ind.	E. R. Skinner	24
Grand Rapids, Mich.	Grand Rapids Saxon Co.	27.5
Buffalo, N. Y.	Loveland Company	25.7
Cincinnati, Ohio.	Hellman Motor Car Co.	26.1
Wilkesbarre, Pa.	Sterling Motor Car Co.	18.6
Chattanooga, Tenn.	Jones Automobile Co.	19.5
Kansas City, Mo.	Bond Motor Co.	26.69
Galesburg, Ill.	Seacord & Sons	21.9
Providence, R. I.	Saxon Motor Vehicle Co.	24.6

25,399 Saxons Shipped in Year

DETROIT, MICH., July 10—The Saxon Motor Car Corp., this city, shipped in the fiscal year ended June 30, 25,399 cars compared with 12,099 in the previous year, an increase of 110 per cent.

In no month of the last fiscal year did shipments fall behind the corresponding month of the previous fiscal year. In June shipments were 3122 cars compared with 2710 in June, 1915. A new record for monthly shipments was established in April, 1916, when 3405 cars were shipped. Net earnings are estimated at $1,250,000.

England To Control Gasoline

Now Taking Automobile Census to Enable Authorities to Decide on Future Action

LONDON, ENGLAND, June 15—The long-threatened Government control of all gasoline supplies is now about to become a fact. This week an order was issued for the taking of an automobile census throughout England, every owner of a car being under an obligation to secure a form from a post office and declare to what use his car is being put, how much gasoline he has been using, and how much he considers he will use in the future. It is understood that the information obtained from this census will enable the authorities to decide on their future line of conduct.

Just before the order for this census was sent out, the gasoline committee of the Board of Trade had sent out an "Order of Priority for the Distribution of Motor Spirit." Excluding the army, the navy and the postal department, which are supplied first in any case, this order divides motor users into three classes. Class A includes the transportation of war material, fire brigades, ambulances, various government officials, police, and veterinary surgeons. Class B includes most of the commercial users of gasoline, as for agricultural purposes, the distribution of goods, taxicabs, fishing and cargo boats, motor omnibuses, railroad companies, stationary engines, and aeroplane schools. Finally in class C are grouped all other users, among them being owners of pleasure motor buses, taxicabs hired from garages, boats running for pleasure, hotels, etc.

Classes A and B First

The requirements of Classes A and B are to be given priority. Whatever supplies remain can be sold to those coming in Class C. The gasoline committee, which consists of six members of the gasoline industry working in conjunction with the government, has sent a circular letter to all garage proprietors and gasoline dealers, informing them that this priority scheme must be adhered to, and threatening more drastic measures if cooperation is not secured. At the same time the public has been reminded that the law forbids the storing of more than 60 gallons of gasoline in any one storehouse, which must be 20 feet from any other building.

If there really is a shortage of gasoline the priority scheme of distribution cannot be objected to in the main. The only unsatisfactory detail is that in Class C —comprising those people to be served last—there is no discrimination between the people who use cars merely for pleasure touring and owners who require an automobile in connection with their domestic or commercial life. There is a strong suspicion, however, that these attempted motoring restrictions are prompted more by anti-motoring feeling than by any actual or threatened shortage of gasoline. For months all England has been placarded with huge posters asking that cars should not be used for pleasure purposes. Undoubtedly much of this money has been wasted, for posters with letters four feet high have been placed in poor neighborhoods where not a single automobile owner could be found. Motorists could have been reached in a much more direct and economical manner.

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$1,000,000 Additions for Moline Plow Tractor Dept.

MOLINE, ILL., July 5—The Moline Plow Co. has decided to enlarge its plant in order to take care of its tractor department. Plans are under way by architects for the construction of buildings which will cost $1,000,000 and give employment to 1500 men. The company proposes to erect a machine shop, 100 by 765 ft.; foundry, 180 by 360; pattern vault, 64 by 230; core room, 60 by 122; mill room, 80 by 200; and cupola room, 60 by 60. The buildings to be erected, are to be devoted exclusively to the construction of farm tractors. The demand has become so great that the present facilities are entirely inadequate.

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British Tax Gasoline 18 Cents per Gallon

LONDON, June 25—England has abandoned the threatened double and treble taxes on automobiles in favor of a special war tax of 12 cents per gallon on gasoline. The amount will be reduced to 6 cents per gallon in the case of doctors and veterinary surgeons. The main features of the new law are the use of gasoline permits, supplied monthly for a specified amount of fuel, and the payment of the tax at the rate of 12 cents per gallon at the time of taking out the permit.

The recent automobile census has paved the way for this scheme. Owners of cars will have to apply to a central authority for a permit to purchase gasoline, and obviously this authority will have power to refuse the permit or to restrict the amount to be purchased. The tax will be paid at the time of taking out the permit, and gasoline can only be obtained on presentation of this document to the dealer. These permits will only be issued for periods of 1 month. It is officially stated that the gasoline tax will only be in force for the length of the war. The revenue obtained from this source is expected to be $4,810,000 per annum.

200,000 May Watch Tractor Tests

Dallas Demonstrations July 18-21 Promise to Be Big Success

DALLAS, TEX., July 8—That the interest in the first national tractor show to be held at Dallas July 18 to 21 is even greater than the committee in charge of arrangements had expected is indicated by the hundreds of queries that are received daily and by reservations that are being made at local hotels. Indications are, and plans to that end are being made, that 200,000 people will witness the tractor demonstrations. These demonstrations will be given daily, each afternoon, on the 1000-acre Caruth farm 5 miles north of Dallas.

Already there have been 123 tractors registered for the demonstration and before the week's end it is expected numerous others will be registered. Entries already made are as follows:

Avery Tractor Co., Peoria, Ill., twelve tractors; Texas Harvester Co., Dallas, Tex., ten; J. I. Case Threshing Machine Co., Racine, Wis., ten; Emerson Brantingham Plow Co., Rockford, Ill., ten; Advance Rumely Thresher Co., La Porte, Ind., nine; Twin City Tractor Co., Minneapolis, Minn., eight; Sattley Bull Tractor Co., Dallas, Tex., six; Rock Island Plow Co., Rock Island, Ill., four; B. F. Avery & Sons, Louisville, Ky., four; Moline Plow Co., Moline, Ill. four; Ford Tractor Sales Co., Dallas, Tex., four; C. O. D. Tractor Co., Minneapolis, Minn., four; Denning Tractor Co., Cedar Rapids, Iowa, four; Joliet Oil Tractor Co., Joliet, Ill., three; Peoria Tractor Co., Peoria, Ill., three; Waterloo Gas Engine Co., Waterloo, Iowa, three; Parrett Tractor Co., Chicago, Ill., three; Electric Wheel Co., Quincy, Ill., three; Interstate Engine & Tractor Co., Waterloo, Iowa, three; Waite Tractor Sales Co., Chicago, Ill., three; Simplex Tractor Co., Minneapolis, Minn., three; McIntyre Mfg. Co., Columbus, Ohio, three; Allis-Chalmers Mfg. Co., Milwaukee, Wis., two; Standard Detroit Tractor Co., Detroit, Mich., two tractors.

On Tuesday, July 18, the forenoon will be used for private demonstration, the public demonstrations being made from 1 to 3 in the afternoon. In addition to plowing, the demonstrations will cover such other operations as disking, seeding, manure spreading and operating various farm machinery. Dynamometer tests will be made with a 14-in. plow and the actual pounds drawbar pull ascertained. Exhibitors may burn any fuel they like, but must obtain it from a source designated by the management.

In addition to the tractor exhibition there will also be an extensive exhibition of accessories such as may be used with and on farm tractors. Among the accessories exhibitors who will have space are:

Sumpter Electrical Co., Chicago.
Eisemann Magneto Co., Brooklyn, N. Y.
Diamond Chain Co., Indianapolis.
Kingston Co., Kokomo, Ind.
Bennett Carburetor Co., Minneapolis.
Waukesha Motor Co., Waukesha.
Beaver Motor Co., Milwaukee.
McQuay-Norris Co., St. Louis.
V. Ray Spark Plug Co., Marshalltown, Iowa.

Hyatt Roller Bearing Co., Detroit.
Piston Ring Co., Muskegon, Mich.
Reflex Ignition Co., Cleveland.
Continental Motor Co., Detroit.
Champion Spark Plug Co., Toledo.
K. W. Ignition Co., Cleveland.
Ever-Tight Ring Co., St. Louis.
Burd Ring Co., Rockford, Ill.
Perfex Radiator Co., Racine, Wis.
Kerosene Burning Carburetor Co., Detroit.
Atwater Kent Mfg. Wks., Philadelphia.
Bosch Magneto Co., New York.
New Departure Ball Bearing Co., Bristol, Conn.
Manhattan Electrical Co., New York.
Platt & Washburn Refining Co., New York.
Diamond Chain Co., Indianapolis.
Harroun Carburetor Co., Indianapolis.

To Collect and Publish Gasoline Statistics to Reduce Prices

WASHINGTON, D. C., July 10—Another step in the fight being waged to find out the reasons for the rapid rise in the price of gasoline was taken today when the committee on mines of the House of Representatives reported favorably the Carter bill providing for the collection of information upon which Congress may base legislation to meet the constant advance in the price of gasoline. The bill, which was introduced some weeks ago by Representative Carter, of Oklahoma, authorizes the Secretary of the Interior to collect and publish all possible statistics and data relating to the production and marketing of petroleum products. These statistics and data shall embrace specifically the number of wells drilled, total amount of products and any other information of benefit and value to oil production, all of which shall be for the general information and use of the public. The bill carries an appropriation of $20,000 to defray the expenses of the investigation during the present fiscal year.

It is expected that final report of the Federal Trade Commission on its investigation into the gasoline and oil situation in the United States probably will be completed within 2 weeks.

Chevrolet to Add in N. Y.

NEW YORK CITY, July 10—The Chevrolet Motor Co., this city, has let a contract for the erection of two additions to its automobile plant. They will be five stories, 200 by 200 ft., and three stories, 100 by 150 ft. respectively.

Mitchell Refinancing Completed

Capital Consists of 125,000 Shares of No Par Value—Stock at $67

NEW YORK CITY, July 11—The Mitchell Motors Co., Inc., has been formed and will acquire and operate the business of the Mitchell-Lewis Motor Co., Racine, Wis. The new company has a capital of 125,000 shares, no par value, and the issue has been syndicated by Ladenburg, Thalmann & Co. and A. G. Becker & Co. of Chicago. The offering price of the stock is $67 a share.

The Mitchell-Lewis Motor Co. was founded in 1903 and the output has grown from eighty-two cars in 1904 to 6186 in 1915. For the present fiscal year to end Oct. 13, the output will be upward of 10,000 cars.

On this output and results obtained thus far, earnings for the present fiscal year are estimated at $1,400,000, or over $11 per share. During the 10 months ended Oct. 31, 1915, net profits of the company were $815,756 or $6.50 per share.

An audit by Price, Waterhouse & Co., shows total net tangible assets of $4,500,000, equivalent to $36 per share. Net current assets are over $2,000,000, of which $926,672 is cash.

Mitchell cars are being produced at present at the rate of 15,000 per annum and the present plants have an annual capacity of 18,000 cars.

The company will acquire the plant of the Mitchell Wagon Co., in which the bodies for its cars are now built. This will make the company one of the few which build the bodies for their output. It is stated that the saving through the acquisition of the body plant in the next fiscal year will amount to about $200,000.

Maxwell to Purchase First Preferred

NEW YORK CITY, July 12—At the monthly meeting of directors of the Maxwell Motor Co. only routine business was transacted.

Under the provision of the sinking fund of Maxwell first preferred stock, the company will pay to the Central Trust Co. as agent, about $140,000 to be applied to the purchase of Maxwell first preferred after advertising for offers. The sinking fund may purchase up to, but not above, par. At present prices for the stock the sinking fund would be able to buy over 1600 shares.

Tireoid Directors Announced

CHICAGO, ILL., July 12—The Tireoid Co., this city, manufacturer of a puncture sealer under that name, has announced its board of directors as follows: A. W. Armour, vice-president of Armour & Co., this city; M. J. Insull, president of the Middle West Utilities Co., this city; N. N. Lampert, president of the Chalmers Motor Co. of Illinois; Lafayette Markle, president of the L. Markle Co., Studebaker distributor in Chicago; H. H. Merrick, general manager of credits of Armour & Co., Chicago; H. E. Otte, vice-president of the National City Bank, Chicago; W. T. Perkins, assistant cashier of the National City Bank, Chicago; C. W. Price, president of the Overland Motor Co., Chicago; F. E. Price, vice-president of the Overland Motor Co.; W. L. Rohrer, president of the Tireoid Co.; and Maj. R. E. Wood, General Asphalt Co., Philadelphia.

Tireoid is a semi-liquid compound, mostly mineral. It was invented a year ago by R. T. Garvin, a chemist. The company guarantees for a period of 6 months from date of purchase that the compound will seal all punctures of a diameter not to exceed that made by a nail.

Aluminum Lower

NEW YORK CITY, July 11—Activities in the automobile materials markets last week were on by a drop in aluminum and a rise in crude rubber. Lead was lower as was tin. Both lard and linseed oils rose in price. The rest of the market was steady.

Aluminum has steadily dropped during the past few weeks and is now quoting 5 cents a lb. lower than 2 weeks ago. Para rubber has been picking up in price for several weeks. Last week it rose 3 cents to 68. Ceylon rose 2 cents after a fractional loss during the previous week.

To Cut New York City Taxicab Rates

NEW YORK CITY, July 10—Taxicab rates in this city are to be cut as a result of the decision of Chicago interests to combine with local ones to give service on a cash basis. According to the plans, 200 cars will be put in service and the lowering of rates will be con-

Daily Market Reports of the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.60	.60	.60	.60	.60	.58	— .02
Antimony, lb.	.17	.17	.17	.17	.17	.17	...
Beams and Channels, 100 lb.	2.67	2.67	2.67	2.67	2.67	2.67	...
Bessemer Steel, ton	42.00	42.00	42.00	42.00	42.00	42.00	...
Copper, Elec., lb.	.26½	.26½	.26½	.26½	.26½	.26½	...
Copper, Lake, lb.	.26½	.26½	.26½	.26½	.26½	.26½	...
Cottonseed Oil, bbl.	10.75	10.77	10.70	10.65	10.65	10.60	— .15
Fish Oil, Menhaden, Brown, gal.	.55	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime, gal.	1.05	1.05	1.05	1.10	1.10	1.10	+ .05
Lead, 100 lb.	6.85	6.85	6.85	6.45	6.45	6.40	— .45
Linseed Oil, gal.	.64	.64	.64	.64	.64	.69	+ .05
Open-Hearth Steel, ton	42.00	42.00	42.00	42.00	42.00	42.00	...
Petroleum, bbl., Kans., crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.92	.92	.92	.92	.92	.92	...
Rubber, Fine Up-River, Para, lb.	.65	.65	.65	.66	.66	.68	+ .03
Rubber, Ceylon, First Latex, lb.	.58	.58	.59	.59	.60	.60	+ .02
Sulphuric Acid, 60 Baume, gal.	3.00	3.00	3.00	3.00	3.00	3.00	...
Tin, 100 lb.	39.60	39.50	...	39.13	39.13	38.50	—1.10
Tire Scrap, lb.	.05¾	.05¾	.05¾	.05¾	.05¾	.05¾	...

summated through having only one charge, regardless of the number of passengers carried.

The new concern will charge as follows:

New Rates—For one, two, three, or four passengers, 20 cents for the first third of a mile, 10 cents for each succeeding third of a mile; 1 mile, 40 cents; 2 miles, 70 cents; 3 miles, $1; 4 miles, $1.30; 5 miles, $1.60.

Present Rates—For one or two passengers, 30 cents for first half mile and 10 cents for each additional quarter of a mile; 1 mile, 50 cents; 2 miles, 90 cents; 3 miles, $1.30; 4 miles, $1.70; 5 miles, $2.10; for three or more passengers, 30 cents for the third of a mile, 10 cents for each additional sixth of a mile; 1 mile, 70 cents; 2 miles, $1.30; 3 miles, $1.90; 4 miles, $2.30; 5 miles, $3.10.

The new company will be known as the Brown Taxicab Co., and will be run jointly by the managers of the Yellow Taxicab Co., of Chicago, which has been successful, and the Town Taxi Co., Inc., and the Club Cab Corp., this city. The Walden W. Shaw Livery Co. of Chicago, will build the taxis and will have an interest in the new concern.

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Dividends Declared

Grant Motor Co., quarterly of 1¾ per cent on preferred, payable Aug. 1 to stock of record July 15.

Continental Motors Co., cash dividend of 5 per cent, payable July 15 to holders of record July 5. Company paid stock dividends of 100 per cent in February and October last and 200 per cent in October, 1912.

Stutz Motor Car Co., third dividend of $125,000 out of earnings, equal to $1.62½ per share on 75,000 shares of the Stutz Motor Co. of America.

Curb Securities Active

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Stutz, Chevrolet and United Motor in Demand—Entire Market Strong

NEW YORK CITY, July 11—Automobile stocks on the curb last week showed much activity and were in great demand. Stutz has been especially strong since Saturday, when it was influenced by the initial dividend declaration of $125,000 out of earnings of the company. Another curb stock which showed much strength was United Motors. After displaying weakness at the outset it made a sharp recovery, regaining all of the loss and making a further fractional advance. Chevrolet advanced on heavy buying to 228 or 13 points.

The Stock Exchange quotations were featured by a substantial rise of 19⅝ points by Studebaker common. Though the issues showed little activity, nevertheless prices held steady with few bad losses. Those that did gain showed increases ranging fractionally to five or six points.

Willys-Overland closed yesterday strong at 74¾ on rumors of an increased rate on the common and a common stock dividend. Overland directors are to meet this month and this action is expected to take place by interests down in Wall Street. The present dividend rate is 6 per cent or $1.50 per share, $25 par value. In the Spring of 1915 a 5 per cent stock dividend was declared. With the 200,000 car schedule fulfilled it is expected that the company will earn close to $20,000,000 this year. The 7 per cent dividend on the $15,000,000 preferred stock requires $1,050,000, after which above earnings will be equal to about 85 per cent on the $22,500,000 common outstanding.

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N. Y. Organizations to Amalgamate

NEW YORK CITY, July 7—The first steps toward amalgamation of the two large automobile organizations of New York State, representing 115 automobile clubs, were taken at a meeting of the directors of the New York State Motor Federation at Rome to-day.

Appointment of a committee of five to confer with a similar committee of the New York Automobile Assn. concerning consolidation, followed the report of President M. M. Wall, of Buffalo, who was in secret conference with President Rowe of the American Automobile Assn.

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Receiver for Twin City Track

ST. PAUL, MINN., July 8—Upon petition of the Standard Lithographing & Printing Co. Judge Hugo Hanft of the Ramsey county district court has named Philip Herzog receiver for the Twin City Speedway Co. The receiver furnished a $5,000 bond. Plans had already been made to put the company into bankruptcy and to have its assets sold to F. H. Wheeler, who resigned last Fall as president. Before the receiver was appointed Treasurer A. C. Gooding of the State of Minnesota was given a note for

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co. (new)	..	..	64½	65½	+ ½
J. I. Case pfd	70	79	82	90	—4
Chalmers Motor Co. com	90	93	173	178	..
Chalmers Motor Co. pfd	96	98	98	101	—2
Chandler Motor Car Co	..	..	110	111	+1½
Chevrolet Motor Co	..	..	228	230	+13
Fisk Rubber Co. com	..	..	..	160	..
Fisk Rubber Co. 1st pfd	..	..	114	120	..
Fisk Rubber Co. 2d pfd	..	..	120	..	..
Firestone Tire & Rubber Co. com	500	506	880	..	+10
Firestone Tire & Rubber Co. pfd	109	111	112	114	..
*General Motors Co. com	156	158	470	541	..
*General Motors Co. pfd	101½	102¾	110	112	+10
*B. F. Goodrich com	51	53	74	74¾	— ½
*B. F. Goodrich pfd	103½	104	113⅛	113½	..
Goodyear Tire & Rubber com	270	273	225	230	—5
Goodyear Tire & Rubber pfd	106	107	105	107	..
Grant Motor Car Co	..	..	11	12	—1
Hupp Motor com	..	..	7½	7¾	—½
Hupp Motor pfd	..	..	80	110	+10
International Motor Co. com	12½	13½	..	9	..
International Motor Co. pfd	35	37	..	25	..
*Kelly-Springfield Tire & Rubber com.	161	162	69	71	—1
*Kelly-Springfield Tire & Rub. 1st pfd	85½	87	95⅜	97	+ ⅜
*Lee Rubber & Tire Corp	..	..	46⅜	46½	—2⅛
*Maxwell Motor Co. com	34	36	78	78¼	—1
*Maxwell Motor Co. 1st pfd	82	84	84½	85	—1
*Maxwell Motor Co. 2d pfd	30¾	32	54	56	— ½
Miller Rubber Co. com	190	192	225	230	—125
Miller Rubber Co. pfd	103	106	104	106	—1
Packard Motor Car Co. com	..	112½	..	180	..
Packard Motor Car Co. pfd	96	100	100	104	..
Paige-Detroit Motor Car	..	..	..	50	..
Peerless Truck & Motor Corp	..	..	24	25	—2
Perlman Rim Corp	..	..	..	..	..
Portage Rubber Co. com	35	38	117	120	—2
Portage Rubber Co. pfd	92	95	118	119	—2
Regal Motor Co. pfd	..	..	..	..	..
Reo Motor Truck Co	15¼	16	36½	37	—2
Reo Motor Car Co	30	31	43	43½	+3
Saxon Motor Car Co	..	..	79	82	..
Standard Motor Co	..	..	5	7	—2
*Stewart Warner Speed. com	67¼	68	100	102	—2
*Stewart Warner Speed. pfd	105	107	..	..	..
*Studebaker Corp. com	77	79	132⅜	132¾	+19⅛
*Studebaker Corp. pfd	99	100	108	110	+ ¾
Stutz Motor Corp	..	..	63	63⅜	+5
Swinehart Tire & Rubber Co	77	78	86	88	—2
United Motor Corp	..	..	71⅜	71⅝	+5⅛
*U. S. Rubber Co. com	45	47	52½	53	—1¼
*U. S. Rubber Co. pfd	105½	106½	110⅛	110⅜	+ ⅛
White Motor Co. (new)	103	108	54¼	55	—3½
*Willys-Overland Co. com	123	124	74¾	75	+1¼
*Willys-Overland Co. pfd	100½	102½	107	109	+ ½

Quotations furnished by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

Auto Body Co	..	..	..	40	..
Chalmers Motor Co. com	..	92½	174	182	—2
Chalmers Motor Co. pfd	94½	98	96	..	..
Continental Motor Co. com	195	..	36¼	37¼	+1¼
Continental Motor Co. pfd	82	86	9½	10½	..
Ford Motor Co. of Canada	1275	..	..	365	..
General Motors Co. com	156	158	470	545	..
General Motors Co. pfd	101½	102½	..	116	..
Maxwell Motor Co. com	34	36	77½	80½	—2
Maxwell Motor Co. 1st pfd	81½	83½	84½	87½	..
Maxwell Motor Co. 2d pfd	31	33	55	58	..
Packard Motor Car Co. com	110	115	..	180	..
Packard Motor Car Co. pfd	96¼	100	102	104	..
Paige-Detroit Motor Car Co	..	..	..	50	..
W. K. Prudden Co	19½	21½	40	43	..
Reo Motor Car Co	29⅞	30½	42½	43½	+2½
Reo Motor Truck Co	15¼	16	36¼	37	—1¼
Studebaker Corp. com	77½	79	132	135	—2½
Studebaker Corp. pfd	98½	100½	105	..	..
C. M. Hall Lamp Co	..	..	..	33	..

INACTIVE STOCKS

Atlas Drop Forge Co	..	26	..	40	..
Kelsey Wheel Co	205	..	..	350	..
Regal Motor Car Co. pfd	..	25	17	..	..

*At close July 10, 1916—Listed New York Stock Exchange.

$680 as the proportion of the receipts for the race on July 4 belonging to the the federal militia, which paraded as a brigade before the race in front of the grandstands as a feature of the program.

W. C. Barnes, who represented the A. A. A. at the race has announced that no more races will be held on the Snelling speedway with the sanction of the American Automobile Assn. until J. F. Sperry and the present management are ousted and reorganization of its property takes place.

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Haibe's Ogren Wins on Grand Rapids 1-Mile Track

GRAND RAPIDS, MICH., July 8—Notwithstanding the fact that he went through the fence and drove over a pile of lumber, nearly hit the ambulance that was rushing to the spot to offer aid, and driving outside the course until he came to a gate where he could get back on the track, Ora Haibe, driving an Ogren, the same one with which Otto Henning went through the fence at Benton Harbor July 4 and suffered serious injury, lost less than one lap of his two-lap lead over Ralph De Palma and came back and won the 100-mile dirt track race here this afternoon, pulling down $1,000 in prize money for his rough ride.

The 1-mile track at Comstock Park has been an outlaw track, but the ban was lifted for one day and sanction was given by the American Automobile Assn. for the event in which eleven cars were entered, but only six started. The summary follows:

Car	Driver	Time	Prize
Ogren	Haibe	1:46:03.4	$1,000
Mercedes	De Palma	1:47:59.0	500
Stutz	Burt	1:50:27.2	300
Mercer	Andrus	2:05:14.8	200
Hudson	Mulford	Flagged	
Vernon Spl.	Kline	Flagged	

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Far Side Stop for Buses

NEW YORK CITY, July 10—Far side stops will be hereafter made by the Fifth Avenue buses instead of the near side as has been done for the past 15 months. According to the company, the near side stop, which worked well with trolley cars, was a pitfall for the unwary so far as the buses were concerned. Many serious accidents were narrowly averted, it was said, as, seeing a bus drawn up beside the curb on the near side, pedestrians hastened to cross the street, believing all traffic in that direction had been held up.

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Five-Passenger Chalmers Price $1,090

NEW YORK CITY, July 10—In describing the 1917 five-passenger Chalmers in THE AUTOMOBILE for June 15, the price was given as $1,050. This was an error as the price is $1,090.

Wilcox Wins at Sioux City

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Premier Captures 50 and 20-Mile Events—D'Alene Wins 10-Mile

SIOUX CITY, IOWA, July 8—Howdy Wilcox in a Premier finished first in the feature race here Saturday. The event was scheduled as a 100-mile race, but after driving the 10 and 20-mile preliminary events the drivers agreed to cut the distance in half. Their claim that the track was in no condition for the longer distance seemed justified and the A. A. A. officials consented to the change.

Wilcox's time for the 50 miles was 40 min. and 59 sec., showing an average of 72.57 m.p.h. His mount is fast and the slow time recorded in the feature race of the day is indicative of the condition of the course. Dave Lewis was second, Art Johnson, third; D'Alene, fourth, and Billy Chandler, fifth.

D'Alene Takes 10-Mile Race

Wilbur D'Alene, in his sixteen-valve Duesenberg finished ahead of the field in the 10-mile race. He drove a smashing race, taking the lead at the first turn, and was never headed. He was trailed by Charlie Merz in a Peugeot, Dave Lewis in a Crawford, and Howdy Wilcox in a Premier.

Wilcox got away in the second race, the 20-mile sprint, just back of D'Alene. He followed the white Duesenberg for two laps and on the third circuit just as he reached the stands passed it. He drove a sensational race and finished first with an average of 78.4 m.p.h. D'Alene's average for the 10-mile event was 79.6 m.p.h. The spectators, what few there were of them, were given a run for their money.

Because of the dense clouds of dust stirred up by the racing machines it was impossible to see what was happening on the course. It seemed impossible that drivers could pilot their mounts into the curves at the rate of 75 m.p.h. and still avoid a spill. Several times a driver was forced to turn his car into the small ditch on the inside curve to allow one of the others to pass. Hughie Hughes, in the Devlin Duesenberg, was forced out of the contest with a broken bearing. He turned three fast laps and had gone from sixteenth position to seventh when he had to quit. He had worked wonders with his car, welding a new cylinder block and manufacturing an entirely new set of bearings out of babbit. At 10 o'clock on the morning of the race the Duesenberg was scattered all over the garage.

The work was finished so that the car arrived at the track just 10 minutes before the time set for the 50-mile race. The experience of holding automobile races and of furnishing the purse by giving the driver half of the total admission was not a success at Sioux City. There were only a few more than 2000 people in the stands and the total receipts were less than $3,500, the drivers' end of the money being less than they would have received at a meet on some ½-mile tracks in this section. First money in the 50-mile race was only $408.75.

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Must Go Over 100 M.P.H.

CHICAGO, ILL., July 6—The American speedway grand prize, for which cars must average 100 m.p.h. to qualify, will be held at the Maywood Speedway, July 29, if efforts of President D. F. Reid are successful.

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Entries for Pikes Peak

DENVER, COL., July 7—A trio of Hudson Super-sixes are being prepared for the Pikes Peak hillclimb on Aug. 10-11-12, and two of them have been officially entered. One of these is to be driven by Ralph Mulford, and the other will be driven by F. A. Patterson, of Stockton, Cal.

The course measures 12 miles, 2200 ft., and has a rise of 6686 ft. In addition to the two Hudsons now entered, there are to date three Cadillacs, a Studebaker Special, a Peugeot, and it is expected that three Chalmers cars and several Kings now in course of construction will also be entered.

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Cincinnati Entry Blanks Out

CINCINNATI, OHIO, July 8—Entry blanks for the $30,000 sweepstakes race to be run at the new Cincinnati speedway on Labor Day, Sept. 4, have been sent out by the Cincinnati Speedway Co. This race is one of the A.A.A. 1916 championship award events and sanction has been granted by the association. Ten place prizes are offered, the first prize being $12,000. Five hundred dollars also is offered for the leading car each of the following distances: 100 miles, 200 miles and 250 miles. The race is for 300 miles and is open to 300 cu. in. cars. Entries close midnight, Aug. 26.

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Maxwell Factory Branch in Cleveland

CLEVELAND, OHIO, July 8—In line with the policy of the Maxwell Motor Co., Inc., of Detroit, to furnish direct factory connections in the most important buying centers, the company announces the establishment of a direct factory branch at 1828 Euclid Avenue. W. H. Keller will be branch manager.

Factory Miscellany

New Power Plant for Firestone—The Firestone Tire & Rubber Co., Akron, Ohio, has had plans prepared for a new power plant, understood to be of about 12,000 kw. capacity, or about doubling its present plant.

Pan-American Rubber Co. Formed—The Pan-American Rubber Co., Milwaukee, Wis., has been incorporated with a capital of $200,000 to make a celular pneumatic inner tire. It has established a plant in the Kopmeier Building, Third and Prairie Streets, and is already employing fifty operatives. F. J. Ramler is president and general manager.

Grand Cushion Spring Plans Factory—The Grand Cushion Spring Co., Flint, Mich., is planning a factory at the south end of Flint. L. A. Young, president of the Detroit Wire Spring Co., is interested.

Tubeless Tire Fitting Up Plant—The Tubeless Tire & Rubber Co., Millersburg, Ohio, is fitting up a large plant for the manufacture of automobile tires.

Commercial Body Company Formed—The Commercial Auto Body Co., St. Louis, Mo., has been incorporated with a capital stock of $50,000 by H. F. Cartwright and others, and will extend an existing plant, adding new equipment, largely wood-working.

First Gerlinger Truck—The first truck manufactured by the Gerlinger Motor Car Co., Tacoma, Wash., has been delivered to the Bilrowe Alloys Co., that city. The construction of the truck manufacturing plant was commenced the first of the year and the plant is now in shape to turn out from ten to twenty trucks per month. Plans have already been made to double the capacity of the plant at once.

Kissel Employees' Outing—One of the largest industrial outings to be held in Wisconsin this summer will be that given for its employees by the Kissel Motor Car Co., Hartford, Wis. The 2000 or more employees and families will travel to Waukesha Beach, Pewaukee Lake, in special trains to Waukesha, and then by trolley to Pewaukee Lake. No other Wisconsin industry has ever arranged for an outing on so elaborate a scale nor has any similar picnic crowd ever traveled so long a distance as this for an outing.

Koenig & Luhrs' First Truck—Koenig & Luhrs, Quincy, Ill., turned out this week the first complete truck produced by their new factory. It has a 35-hp. engine, will carry a 1500-lb. load at a speed of 20 m.p.h., and is equipped with pneumatic tires, electric lights and starter. Plans are being made to turn out a large number of these trucks annually.

Pullman to Build—The Pullman Motor Car Co., York, Pa., will build a plant at Grantley station, just south of this city. When placed in operation the new factory would at first employ at least 1000, which would be increased to twice this number within a short time.

Dreadnaught Tire Takes Over Old Co.—The Dreadnaught Tire & Rubber Co., Baltimore, Md., is formed to take over the assets, properties and business of the old company of similar name, but has no connection whatever with the old company. Officers of the company are: John Hiltz, Sr., president; J. P. Lauber, vice-president; Wm. C. Schmetisser, treasurer; H. James Lopper, secretary.

Milwaukee Stamping to Add—The Milwaukee Stamping Co., Sixty-fourth and Pullen Avenues, West Allis, Milwaukee, is about to award contracts for a large factory addition, to cost between $18,000 and $20,000. Plans have been prepared for a reinforced concrete and brick structure, 72 by 122 ft. The company does a large business with automobile manufacturers and also makes a general line of hardware specialties in sheet metal.

Tire Plant for Spooner—J. H. Newbury, Warsaw, N. C., and Akron, Ohio, interests, have practically closed a deal for the establishment of a tire and rubber factory at Spooner, Wis., where an enormous supply of hydroelectric current for manufacturing purposes is available at low rates. Spooner capital has decided to take an interest. It is proposed to build a new plant, the first unit of which will be 60 by 150 ft. in size.

The Automobile Calendar

ASSOCIATIONS

July 9-13—Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
Sept.—Indianapolis, Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.
Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.
Dec. 2-9—Electricians' Country-wide Celebration.

CONTESTS

July 14-15—Los Angeles to San Diego, Commercial Vehicle Endurance and Reliability Demonstration.
July 15—Portland, Ore., Track Race, Northwest Auto Assn.
July 15—Omaha, Neb., Speedway Race.
July 15—North Yakima, Wash., Track Race, Hiller-Riegel Co.
July 20—Uniontown (Pa.) Hillclimb, Uniontown Motoring Assn.
July 22—Kansas City, West Speedway Race, Kansas City Speedway Co.
July 22—Oriskany Falls, N. Y., Hillclimb, Auto Club of Utica.
Aug. 5—Tacoma Speedway Race, Tacoma Speedway Association.
Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12—Portland, Ore., Track Race, Hiller-Riegel Co.
Aug. 18-19—Elgin Road Race, Chicago Auto Club.
Aug. 26—Kalamazoo, Mich., 100-Mile Track Race.
Sept. 1-2—New York, N. Y., Sheepshead Bay Speedway, 24-Hour Race, Trade Racing Assn.
Sept. 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.
Sept. 4—Cincinnati, Ohio, Speedway, Cincinnati Speedway Co.
Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.
Sept. 4—Indianapolis Speedway Race.
Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4-5—Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 16—Providence Speedway Race.
Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.
Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30—New York City, Sheepshead Bay Speedway Race.
Oct. 7—Philadelphia Speedway Race.
Oct 7—Omaha Speedway Race.
Oct. 14—Chicago Speedway Race.
Oct. 19—Indianapolis, Ind., Race Indianapolis Motor Speedway.
Oct. 21—Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

SHOWS

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.
Sept. 10-16—Milwaukee, Wis., Show, Wisconsin State Fair, Machinery Bldg.
Aug. 2-9—Hollywood and West End, N. J., Show, Atlantic Exhibition Co.
Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

TRACTOR

July 17-21—Dallas, Tex., Tractor Demonstration.
July 24-28—Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4—St. Louis, Mo., Tractor Demonstration.
Aug. 7-11—Fremont, Neb., Tractor Demonstration.
Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.
Aug. 21-25—Bloomington, Ill., Tractor Demonstration.
Aug. 28-Sept. 1—Indiana Tractor Demonstration.
Sept. 4-8—Madison, Wis., Tractor Demonstration.
Sept. 11-16—Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Week in the Industry

New England Trade Items—The Metz company, Waltham, Mass., has moved its retail branch at Boston from that city to Cambridge where it has a service department in the former home of the Ford.

The Longley Motor Co., Providence, R. I., agent for the King and Dort, has moved into its new home on Broad Street.

Frank Coveney, for some years with the Studebaker Corp. at Boston, Mass., has joined the Nettleton-Crittenden Co. agent for the Chandler in that city.

The Imperial Auto Supply Co., with branches at New York, Chicago and Minneapolis, has opened a branch at Springfield, Mass.

W. B. Hennigan, for some years with the Winton branch at Boston, Mass, is now sales manager of the Paige Detroit agency at that city.

A persistent rumor states that the Sterling Motor Car Co., Brockton Mass., has received another large war order.

Mountain Trade—The Auto Equipment, Denver, celebrated its seventh anniversary with a banquet for its employees in the Metropole Hotel last week. This wholesale supply house at 1554-1556 Broadway now has a territory of fourteen States and reports on business outside of the Denver district were made by L. E. Robinson, manager of the Colorado Springs branch, and J. R. Alexander, traveling representative. President S. T. McCollum, Treasurer S. E. Howe, Jr., and Publicity Manager A. P. Porter conducted a lively program of business betterment talks. The concern has recently enlarged its display facilities and is regarded as one of the strongest accessory houses in the Rocky Mountain region.

The Gould-Esser Co., Denver, a machinery concern at 1613 Blake Street, has secured the Colorado distributing agency for the Troy trailer.

The Mulnix & Rarie Auto Sales Co., Denver, the new name under which the firm of Mulnix & Rarie is operating in new quarters at 35 East Colfax Avenue, has taken the Roamer and Halliday distributing agencies for Colorado and Wyoming in addition to the Grant and Pathfinder agencies it has held for the same territory.

A. O. Stout, Buckingham, Col., has secured the Pullman agency for Logan and Sedgwick Counties.

The Wagner Garage Co., Denver, Kelly-Springfield and Denby truck distributor for Colorado, has had its garage at 1541 Cleveland Place appointed official service station for the Scripps-Booth.

The Steamboat Mercantile Co., Steamboat Springs, Col., has taken the Velie agency for Routt and Moffat Counties.

The C-B Auto & Service Co., Denver, a new $5,000 concern organized by W. C. Borah and C. A. and E. N. Harman, who are respectively president, vice-president and secretary of the firm, has opened a used-car and rental business at 1439 Cleveland Place.

W. Aldridge, Denver, general manager and one of the organizers of the Highway Auto Sales Co., 1435 Cleveland Place, Crow-Elkhart and Argo distributors for Colorado, has sold his interest and gone out of the motor car business.

The Vim Truck Sales Co., Denver, is the name of a new Colorado distributing agency for the Vim truck opened at 801-807 Broadway by C. F. Cole, formerly Pathfinder distributor for Colorado.

Canadian News Items—The Ford plant in Winnipeg, Man., delivered this month 300 cars to buyers. Last week, to Winnipeg owners alone, forty cars were sold.

In 1909, the first year the Ford company was there, the number of Ford cars sold in Manitoba was thirty; in Saskatchewan, twenty-one, and in Alberta, twenty-one. These were sold at a price of $1,350, without top, windshield or speedometer. Last year, 1915, the company sold in the same territory 4200 cars, as against seventy-three in 1909, at a price of $630 each, fully equipped.

This year, estimated on a basis of present sales, it is anticipated by the management of the Ford company that over the same territory they will have distributed 8000 cars, sold at a price of $570, fully equipped.

Girdwood Lamb Motors, Ltd., is the name of a new motor company just formed in Montreal and incorporated with a capital of $500,000. The three-floor building situated at 973 St. Catherine Street West has been taken as its Montreal headquarters. In addition to handling the agencies of the Maxwell and Reo cars and trucks, one of the most up-to-date repair shops in the Province of Quebec has been installed on the premises. In addition, there is garage room for 160 cars. Mr. R. F. Girdwood, one of the oldest automobile dealers in this city, has been appointed president and Mr. Lamb has been appointed secretary-treasurer.

E. J. Parker, one of the best-known automobile men in Western Canada, has taken the position of general supervisor with the Chalmers Motor Co., having jurisdiction over the territory from Fort William to the Western Coast.

The Globe Shock-Absorbing Tire Co. of Canada has incorporated at Toronto, Ont., with a capital of $1,000,000 to manufacture a resilient or shock-absorbing vehicle, automobile and commercial tire, head office to be at St. Catherines, Ont. Incorporaters are Isaac Normandy and Howard J. Ecclestone, of St. Catherines.

The F. S. Carr Rubber Co. of Canada has been incorporated at Ottawa with a capital of $200,000 to manufacture rubber, automobile and carriage fabrics. Head office to be situated at Granby, Que., and the incorporators are J. E. Day, J. M. Ferguson and J. P. Walsh, all of Toronto.

St. Louis Items—New agencies and changes in existing sales arrangements during the past week in St. Louis are:

The Newell Motor Car Co. will handle the Detroiter, this arrangement having been completed during a visit of W. H. Van Duesen, director of sales for the Detroiter Motor Car Co. The Newell company now becomes distributer for Haynes, Sun, Dort and Detroiter.

The El-car Motor Sales Co. has been designated as the distributing agency for the El-car, manufactured by the Elkhart Carriage & Motor Co., Elkhart, Ind. The territory of the company includes the St. Louis trade district.

The Fred Campbell Auto Supply Co. is exclusive sales agent here for the White Star Refining Co., Detroit, and has stocked the complete line of that company.

The John Berry Automobile Co. has become agent for the Dearborn 1-ton truck attachment. The attachment was put on exhibition Tuesday.

D. A. Livingston, well known to the trade here as a salesman, announces the organization of the Supreme Motor Co., which will begin business in this city early in August. The new company has closed a contract for the selling agency of the Simplex-Crane chassis. The company will probably handle two lower priced lines but has not determined upon these, nor has it decided definitely upon the location of showrooms.

E. E. Denniston has taken charge of the wholesale department of the Overland Automobile Co., St. Louis. Mr. Denniston comes from Buffalo, N. Y., where he was distributer for Stevens-Duryea and later conducted a truck-body-building plant. Here he succeeds H. A. DeWitt, who resigned as sales manager.

The Automobile

Vol. XXXV
No 3

NEW YORK, JULY 20, 1916

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Chicago, Ill., U. S. A.

The Automobile

Vol. XXXV New York—Thursday, July 20, 1916—Chicago No. 3

Nash Takes Over Jeffery

Together with Lee, Higginson & Co., Purchases Entire Stock of Company

Kenosha, Wis., July 14—C. W. Nash, who is just retiring from the presidency of the General Motors Co., and Lee, Higginson & Co., of Boston, who financed the General Motors Co. several years ago, have purchased the entire stock of the Thomas B. Jeffery Co., makers of passenger and commercial vehicles. The purchase price is said to involve about $9,000,000, which would mean about $300 per share, as the Jeffery company is capitalized at $3,000,000.

To Continue Line

Mr. Nash retires from the business of the General Motors Co. on Aug. 1 and after that date will take up active management of the Jeffery business. At a recent meeting of the department heads of the Jeffery company, at which Mr. Nash was present, plans were made for the active continuance of passenger cars and trucks. Charles T. Jeffery, Harold W. Jeffery and Thomas M. Kearney, who make up the present board of directors, will continue on the board, at least for the present.

Another Combine Possible

No further details could be secured from Mr. Nash, and probably none will be made public until after the next meeting, which will be held in Boston on July 19. Predictions, however, are being made that the connection of Mr. Nash with the Eastern banking syndicate means the re-entrance of this group into automobile manufacturing and that the Jeffery purchase is only the first step in the formation of another big automobile combine.

The Jeffery company is one of the largest motor car plants in the Middle West. It was founded 17 years ago as a bicycle plant by the late Thomas B. Jeffery of Chicago. One of the products with which it has achieved considerable success during the past few years is the Jeffery Quad a four-wheel-drive truck which has been used extensively for military purposes both in this country and abroad.

23,879 Carloads June Shipments

New York City, July 18—Shipments of automobiles in June totaled 23,879 carloads, according to figures given out by the National Automobile Chamber of Commerce, which met at the Detroit Board of Commerce last week to discuss the freight situation. This figure compares with 17,075 carloads in June, 1915. For the 6 months ending June 30 shipments totaled 151,163 carloads compared with 89,613 carloads for the same period in 1915. It was also estimated that the earnings of railroads from shipments of finished products alone from automobile and truck factories will exceed $35,000,000 for the current year.

The meeting was interested particularly in subjects considered by the official classification committee at its meeting here to-day. This committee fixes the rates used by railroads east of Chicago and on its docket for the New York meeting are the ratings for speedometers and connections, lamps used on automobiles, magnetos, automobile trunk racks, automobile doors, dashes, wheel rims, steering wheels and most important of all, automobiles, passenger and freight. The automobile men approved some of the proposed ratings but were opposed to the ratings suggested by the classification committee on lamps, steering wheels and single automobiles and trucks.

Lamps would be rated 50 per cent higher than electric lamps for other uses and single trucks considerably higher than at present. It is claimed by the automobile interests that there is no justification for these changes. They will also ask for a specific rating on automobiles and trucks when boxed in carloads, as such shipments are now charged the same as when not boxed.

Dealers' Upheaval in New York

Silver Takes Chalmers—Overland Opens Branch—New Mitchell Sales Co.

New York City, July 17—Broadway's automobile row has experienced the greatest changes in the last few days that it has had for years, the Overland, Chalmers and Mitchell agencies all figuring in the changes. C. T. Silver, who has handled the Overland and Willys-Knight for many years, has discontinued them and taken the Chalmers agency, the Chalmers branch having been discontinued. The Overland company is establishing a branch and has in the meantime opened temporary quarters in the Circle Building on Broadway with E. B. Jackson, formerly manager of the Packard company of New York, as manager. A new organization, the Mitchell Motors Co. of New York, has been formed to handle the retail Mitchell sales in the metropolitan territory and the Carl H. Page company, which previously handled the Mitchell, will in future confine its effort to the wholesale end of the Mitchell in part of this territory. Mr. Jackson has been succeeded as Packard manager by Emlen Hare, who for some time has been in charge of the special truck department of the Packard company here. Further, George Stowe, who has managed the Chalmers branch here, has taken charge of the sales in the newly formed Mitchell Motors Co. of New York.

The Willys-Overland company's direct factory branch for the direct sale of Overland and Willys-Knight cars follows the policy already put in force of establishing its own branches in the most important cities in this country.

The Overland company has had in progress the erection of one of the largest service buildings in this territory with a view to taking over its own business, locating a temporary showroom at

(*Continued on page* 118)

S. A. E. Meets in Washington

First Standards Meeting Under Government Auspices Held at Bureau of Standards

WASHINGTON, D. C., July 18—For the first time the Society of Automobile Engineers has taken an officially recognized place in the work of national standardization. This was on the occasion of the meeting of the newly-appointed aeronautic engine division of the S. A. E. standards committee which met here today at the Bureau of Standards, representatives of the Bureau, of the army and navy and of the aviation industry being present. The chief business was to discuss the program of the division which was created because the army and navy authorities consider it vitally important that many things in connection with aeroplanes should be standardized with the greatest rapidity possible. The meeting was in every way a success, and it is obvious that the most vital matters will be handled very quickly.

The meeting was opened by Dr. S. W. Stratton, director of the Bureau of Standards, who made a short speech of welcome. He spoke regarding the great importance of the work which the S. A. E. were about to begin and stated that the bureau with its splendid equipment for testing, would be able to undertake a good deal of research work which would be necessary. Henry Souther, chairman of the aeronautic engine division and consulting engineer to the U. S. signal corps, then took charge and an immediate start was made on the more pressing problems.

The S. A. E. was represented by Howard E. Coffin of the Naval Consulting Board, A. Ludlow Clayden, chairman of the standards committee, and Coker F. Clarkson, general manager. Among members of the division well known in the automobile world were F. S. Duesenberg, designer of the Duesenberg racing motor; A. F. Milbraith, Wisconsin Motor Co., and H. M. Crane, Simplex Automobile Co., each of whom has been building aircraft engines. Another S. A. E. member who has been prominent in the flying field, Glen Martin, took a prominent part in the discussions as did Elmer S. Sperry, a prominent member of all the aeronautic societies and of the Naval Consulting Board. Captain Clark of the army aviation department and Lieutenant Richardson of the navy also spoke repeatedly, throwing much light upon troubles encountered in the use of aeroplanes.

Owing to the continued full power running of aeroplane engine spark plug troubles are prominent and several ignition experts, notably the Bosch company, consider that the small metric plug is better suited for heavy duty than the ⅞-in. S. A. E. standard. The idea is that the thinner shell allows the heat to escape more readily from the insulator. That practical experience bears out the contention was soon obvious, but some doubt remains because most experimenters change the make of plug at the same time as the size. The general opinion, however, was distinctly in favor of the small plug and it is expected to settle the question at the next meeting to be held in about 30 days.

Next arose a long discussion on the possibility of creating a standard propeller hub, so that only one size could be used for all aeroplanes. Some members contended that this was impossible, but it is understood that a standard hub is being used in France, so one or two sizes should take care of all requirements in America. The meeting voted to send blueprints of the French standard to all interested parties for comment on its desirability as a standard.

What Is Right-Hand Motion?

A somewhat involved argument took place on the definition of a right-hand or left-hand engine. It is necessary to define the viewpoint and, even if this is done, there remains the difficulty that propellers are right and left-hand pitch and in some cases a left-hand pitch propeller might go on either a right or left-hand engine. The difficulty was solved by adopting a definition standardized by the electrical industry, which states that direction of revolution shall be described as clockwise or counter-clockwise, the observer standing looking at the driving pulley with the motor behind the pulley. In other words, an automobile engine would be a counter-clockwise engine because its rotation is counter-clockwise when looking at the end from which the power is taken.

—

N. A. C. C. Mid-Summer Meeting at Christmas Cove

NEW YORK CITY, July 18—Alfred Reeves, general manager of the National Automobile Chamber of Commerce, has left this city for Christmas Cove, Me., to attend the mid-summer meeting of the Chamber at Clifton, Samuel Miles' summer home.

The meeting will be held on July 25 and the directors will leave on the next day. Following are those invited:

Hugh Chalmers, R. D. Chapin, Hudson; C. W. Churchill, Winton; Chas. Clifton, Pierce-Arrow; T. Walter Drake, Hupp; C. C. Hanch, Studebaker; Wilfred C. Leland, Cadillac; Alvan Macauley, Packard; W. E. Metzger, Argo Electric; R. E. Olds, Reo; Carl H. Pelton, Maxwell; H. H. Rice, Waverley; Windsor T. White, White; John N. Willys, Willys-Overland; Col. George Pope, A. L. Riker, Locomobile, and Alfred Reeves, general manager, together with some personal friends of Mr. Miles.

Eclipse Entitled to Bijur License

Disputed Contract of License Declared Valid—Appeal To Be Made

BUFFALO, N. Y., July 14—The Eclipse Machine Co., Inc., Elmira, N. Y., and Vincent Bendix, Chicago, have been awarded the decision in their suit with the Bijur Motor Lighting Co., Hoboken, N. J., Judge Hazel rendering the decision in the district court here to-day. The suit was brought by the Bijur company in 1914 for infringement of its patent on a starting motor gear, contending that the Bendix gear used in motor starting apparatus infringed patent No. 1,095,696 granted to Joseph Bijur in May, 1914.

Previous to the suit an alleged contract was entered into between Vincent Bendix and Joseph Bijur by which Bendix and the Eclipse Machine Co. were given the right to manufacture the Bendix drive device under the Bijur patent. The suit largely centered around this contract, which was declared by the Bijur company to consist only of tentative arrangements intended to be subsequently embodied in an agreement. Judge Hazel decided otherwise, holding that the contract fairly expressed the intention of the parties and was without ambiguity or indefinitiveness.

A second point of importance in connection with the contract was that it bore the signature of Joseph Bijur, president of the Bijur Motor Lighting Co., and that it had not been passed upon or authorized by the board of directors. The court held that the signature of the president was sufficient to make the contract valid, in that the president has both presumptive and actual authority to bind the company by the contract to which he agreed. The court declared the contract valid and that the Eclipse Machine Co., and Mr. Bendix were entitled to a license under the Bijur patent.

The Bijur Motor Lighting Co. intends to have Judge Hazel's decision reviewed on appeal which will be taken at once.

The case is of unusual interest because the type of drive for starting motors involved in the suit is now in almost universal use on American-built cars. The Eclipse Machine Co. commenced the manufacture of these devices in January of 1914, under a license from the inventor, Vincent Bendix of Chicago, and in May, 1914, a patent for a similar device was issued to Joseph Bijur. By the disputed agreement Bendix and his licensee the Eclipse Machine Co. were given rights to manufacture the device under the Bijur patent as well as under the Bendix invention. Soon after this the Bijur company brought suit.

5000 Tractors for Texas

Farmers Ready to Purchase at 1916 Tractor Demonstration in Dallas

By S. P. McMinn
Staff Correspondent

DALLAS, TEX., July 18—*Special Telegram*—More than 12,000 people witnessed the opening of the national circuit of farm tractor demonstrations here to-day. The city is thronged with farmers and their families, many of whom came in their automobiles, and all interested in tractors, either contemplating an immediate purchase or investigation with a view of buying machines for use on their farms. Around the field on which the demonstrations were held 350 automobiles were parked and many more were continually driving up. It is expected that fully 200,000 persons will witness the demonstrations here before they are concluded.

The farmers of Texas will purchase 5000 farm tractors in 1916. Last year Texas farmers bought upward of 1700 tractors, and in the past three seasons tractor manufacturers and dealers have disposed of more than 3300 machines in Texas.

With the formal opening of the first of the 1916 national tractor demonstrations here to-day this city is crowded with farmers who are ready to purchase machines and with motor car dealers and garagemen who are ready and willing to complete arrangements to do business with the farmers. One big distributer of automobiles already has signed up to distribute tractors. This is the Frawley Motor Co., distributer of Reo and Briscoe cars. The Frawley company has contracted to distribute throughout the entire State of Texas, and possibly also Oklahoma, the Denning tractor produced by the Denning Tractor Co., Cedar Rapids, Iowa.

It is reported on good authority that at least four other big automobile distributers, and possibly five, will make similar connections with other tractor concerns this week. The Dallas demonstration is held on the Caruth farm, of 1000 acres, near the city. There are now ninety-five tractors on the ground.

Hutchinson, Kan., Next

The demonstration will be formally opened to-day, and every day until Friday there will be public demonstrations of power plowing, disking, harrowing, cultivating and the use of tractors for other farm work, such as ensilage cutting, wood cutting, pumping, etc. Saturday the entire demonstration will be moved in special trains to Hutchinson, Kan., and from there to the other centers included in the circuit.

PAUL SMITH

Paul Smith, Chalmers Sales Manager, Dies from Fall

NEW YORK CITY, July 15—Paul Smith, vice-president and general sales manager of the Chalmers Motor Co., Detroit, Mich., died to-day after falling from the window of his room on the tenth floor of the Hotel Biltmore.

Mr. Smith had just completed a $6,000,000 deal with C. T. Silver for the transfer of the local agency of the Chalmers company. He was suffering from an attack of ptomaine poisoning which is said to have had nervous complications.

The position of vice-president of the Chalmers company had been held by Mr. Smith for the last 2 years.

He was 33 years old and born in Maine. He was educated at the University of Illinois to be a physician. Ten years ago he was a physician in Columbus, Ohio, but for only a short time. From there he went to Detroit, working as a day laborer in an automobile plant. Shortly after this he became Columbus agent for the Goodyear Tire & Rubber Co. While he was sales manager for the Goodyear company in New York City, Mr. Flanders became interested in him and made him sales manager for the E.M.F. Co. This was in 1909. In 1911, he assumed the same position in the E.M.F.-Studebaker Co. In 1912 he organized the Flanders Motor Car Co., and the following year joined the Lozier forces. It was in 1915 that he became associated with the Chalmers organization.

Mr. Smith was a member of the Detroit Athletic Club, Fellowship, Harmonic, Racquet, Anchor, Curling and other clubs of his home city. He also had served as a first lieutenant in the First cavalry of the Illinois National Guard. Besides the widow, he is survived by a daughter.

Plan Greater Sales Efficiency

Nation's Leading Business Men Form World's Salesmanship Congress

DETROIT, MICH., July 13—Greater efficiency in industry through greater efficiency in salesmanship is an object of the World's Salesmanship Congress which concluded a 5-day session in this city to-day. The organization was rounded into a permanent form with an attendance of nearly 3000 and plans to proceed actively with its work for better conditions in business and merchandising.

Able addresses were delivered by a large number of executives from all parts of the country and from many lines of industry, although the motor car men predominated in leadership because the science of selling has been well developed by them and because the idea of the Congress originated in Detroit, the automobile capital. One of the first steps discussed was an effort to have established selling courses in existing schools and colleges. Better and more complete text books on selling are desired and an effort is to be made to classify all selling knowledge brought out by the addresses and discussions at the Congress.

For a continuance of the work and the permanence of the organization, Norval A. Hawkins, general sales manager of the Ford Motor Co., was made president. The vice-president is Bartley J. Doyle, president of the Keystone Publishing Co., Philadelphia.

The Executive Board represents various line of business and is made up of:

President, Norval A. Hawkins, general salesmanager, Ford Motor Co., Detroit.

Vice-president, Bartley J. Doyle, president, Keystone Publishing Co., Philadelphia.

Secretary-manager, to be selected by board.

John Wanamaker, New York and Philadelphia.

John H. Patterson, president, National Cash Register Co., Dayton, Ohio.

Edward A. Woods, president, National Association of Life Underwriters, Pittsburgh.

Hugh Chalmers, president, Chalmers Motor Co., Detroit.

B. P. Neff, secretary, F. A. Patrick Co., Duluth.

Harry W. Ford, president, Saxon Motor Co., Detroit.

Harry M. Jewett, president, Paige-Detroit Motor Car Co., Detroit.

Joseph Mack, president, Joseph Mack Printing House, Detroit.

Nearly 3000 salesmen and business executives registered at the Congress, and it is planned to raise $100,000 for the promotion of the work.

The Congress opened Sunday, July 9, with addresses in 18 Detroit churches

(*Continued on page* 119)
(*News continued on pages* 117-124)

754,902
Passenger Cars Made in First 6 Months of 1916

Ninety-Nine Factories Contribute — 96 Per Cent Made in Michigan, Ohio and Indiana—Ford Alone Makes 298,000, Overland 94,477, Others Over 40,000

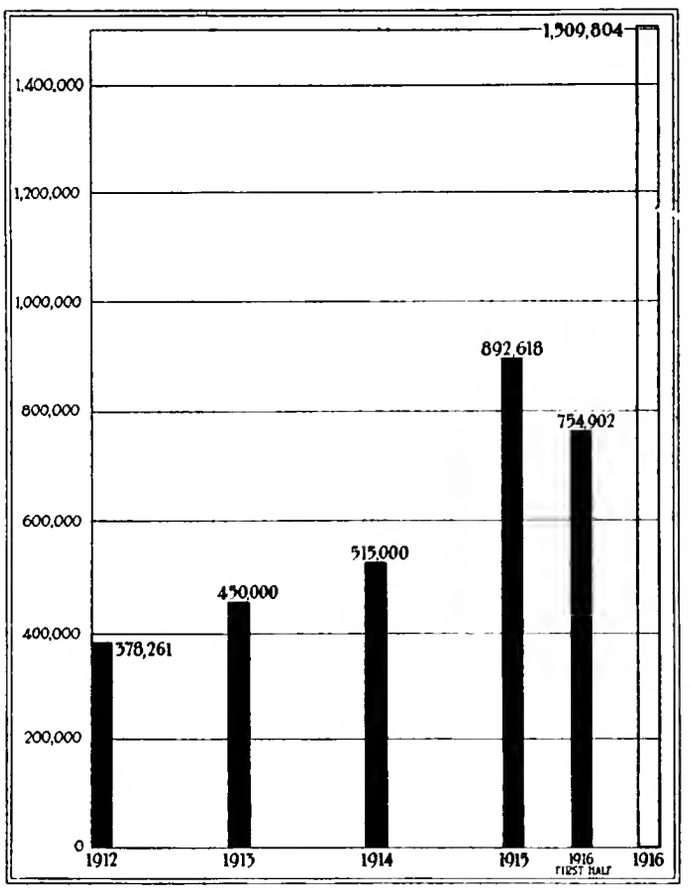
By J. Edward Schipper

WHEN Jan. 1, 1917, marks the beginning of a new year, more than 1,500,000 passenger cars less than a year old may be traveling the roads of the United States, or will have been shipped to other lands. This prediction is not based on estimates but upon the fact that **during the first six months of 1916 or the period closing on June 30 at midnight, 754,902 passenger automobiles had been completed in American factories.**

In all factories throughout the country practically without a single exception, the rate of production is being increased at the present time. During the year, from July 1, 1915, to July 1, 1916, many production records were shattered by concerns which had installed new methods of manufacture and new machinery. During the year period mentioned 1,300,000 cars were completed, and this enormous production was made in spite of difficulties which were more severe than those encountered for many years. This is particularly true regarding the shortage of raw materials and the difficulty of securing adequate quantities of labor.

Ninety-nine automobile factories produced passenger cars during the first six months of 1916. Of this number 27 are located in Detroit and immediate vicinity. Twelve are in Ohio, twelve in Indiana, and the remainder scattered about the country almost from coast to coast. Of the 754,902 cars made during the first six months of 1916, 96 per cent were made in the three States of Michigan, Ohio and Indiana. Of this, of course, Michigan claims the lion's share with the great plants centering about Detroit. Seventy-nine per cent of all the cars made in this country from January to July were made in the Wolverine State, or 595,153 in actual figures.

Ohio ranks second as a car-producing State, having made 15 per cent of the total, or 111,946. Indiana made 2 per cent during the first 6 months, giving a total number of 15,110. The remaining 4 per cent of the factories were well scattered, with a fair share in Illinois, New York and Wisconsin, where the natural railroad facilities lend themselves to the quick delivery of materials and also render possible good shipping facilities for the finished product. Both of these factors are extremely necessary to the big producing concerns, particularly as regards shipping the cars, because each car takes up such a large percentage of space in a freight car, thus necessitating a great number of freight cars to take care of even the daily product of some of the large concerns which have schedules up as high as 1,000 a day and more.



Production chart showing how first 6 months of 1916 compare with entire years of previous manufacture

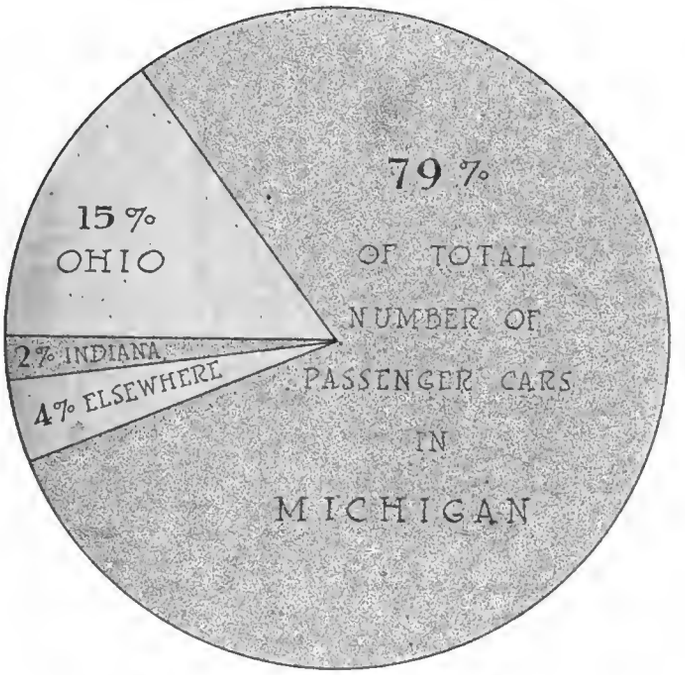
Ford leads the list of big producing concerns, with a record of 298,000 cars in the first 6 months of 1916. During the one year period of July, 1915, to July, 1916, more than 477,000 Ford cars or the parts to as-

semble them left the shipping department of the Highland Park factory. Second in order of production, as far as quantity is concerned, is the Willys-Overland plant at Toledo. This concern produced 94,477 cars during the first 6 months of 1916 and more than 150,000 during the year ending July 1, 1916. Third in production order is Maxwell, with more than 40,000 for the 6 months' period and approximately double that number for the 12 months ending July 1, 1916.

Other big producers are Chevrolet, Buick, Dodge and Studebaker, with more than 40,000 for the first mentioned and between 30,000 and 40,000 for the others for the 6 months' period. There are a great many concerns ranking between 10,000 and 20,000 for the 6 months, and among them may be mentioned Chalmers, Hudson and Saxon. With practically all these companies production activities have been such that during the first 6 months of 1916 many more cars were made than during the last half of 1915, so that the total production figure for the year ending July 1, 1916, is less than double that of the 6 months then ending.

Difficulties During Period

During the last half year, the difficulties that have beset car makers, as far as materials and labor are concerned, have by no means disappeared. At the same time, manufacturing schedules and material orders and deliveries have been adjusted to the circumstances, with the result that on the whole it can be truthfully said that production is progressing more uniformly than during the greater part of 1915. Deliveries of materials are more regular and in a great many instances manufacturers are now stocked with large quantities of the very parts that delayed them during the early stages of the present situation.



Ninety-six per cent of American cars were made in the three States of Michigan, Ohio and Indiana

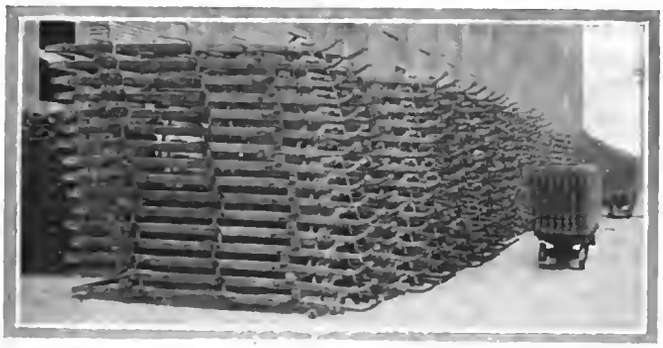
Where the improvement can best be noted is in the plants which assemble their cars from parts bought from individual manufacturers. These concerns had the greatest difficulties because a missing part would tie up the entire product and absolutely check deliveries. For instance, one concern in Indiana was unable to secure any motors except in groups of two and three for a period of three months, with the result that large numbers of completely assembled chassis minus the motors were lying useless in the plant, taking up valuable space and representing loss on the invested capital. Another concern was in practically the same position in regard to rear axles, while it had plenty of motors. Another concern found it practically impossible to secure radiators. Another had trouble with bodies, and thus it has gone throughout the entire gamut of parts. A factory would be overstocked with a certain part and would lack another, while practically next door a concern manufacturing a similar grade of cars would have plenty of the parts needed by the other concern and be short on the parts of which the first concern had plenty. It is this situation which has been considerably adjusted and which has ceased so seriously to interfere with shipments.

Although the material situation has been felt by the concerns which manufacture practically all their own parts, these are in a way more elastic. Taking motors, for example, a manufacturing concern would never be troubled to secure an entire motor, although it might be hard to secure adequate quantities of certain parts for the motor. On the other hand, assembling concerns, in many instances, were held up because they could not secure any motors at all. The completion of war material contracts by many of the steel consuming plants has no doubt tended to further relieve the market.

Statistics of Industry

Some of the statistical figures of the automobile industry are entrancing. They form a romance of big business and prodigious capital that has never been equaled in the history of the world. When it is noted that one concern alone turns out, in a half year, over $119,000,000 worth of cars, it seems almost beyond comprehension that there should be any room for other manufacturers, and yet there are ninety-eight others not turning out as many but practically all prosperous and all with definite manufacturing schedules. During the year of 1915, from January 1 to December 30, 892,618 cars were produced. This seems like a tremendous number and yet, during the first half of 1916, 85 per cent of that total have already been made. In 1914, 500,000 cars were manufactured; during the first half of 1916 that many and more than half again as much have been shipped.

Studying the production curve, almost the opposite conditions from what one would imagine would be true actually obtain. Starting with 1903, when cars first came into general demand, it would be thought that the demand created would cause an overwhelming production until the immense market was overtaken to some degree. Yet, it was not until 1909 that production actually reached 100,000 cars per year. In 1910, it had increased to 200,000, and in 1911 an actual fall-off in rate of increase is noted. Three hundred thousand cars per year was reached in 1912, and 500,000 in 1914. Here the curve takes



Overland factory. Less than one day's output, showing how much stock is required to keep up with a production capacity of 1000 cars a day

a sharp upward bend and the rate of production far exceeds anything that has gone before. Predictions of 1,500,000 cars for 1916 do not seem far amiss, even though this is an increase of more than 55 per cent over 1915, or in actual numbers, 500,000 more cars made this year than last.

The total retail value of the passenger cars built in the United States in 1915 was $565,856,450. Thus far in 1916, or for the period of the first half year, the retail value of the passenger cars is in excess of $481,100,000. These cars have already been actually sold, and in many cases manufacturers have more than sold their output for the first six months and are having difficulties in keeping up with the delivery schedules to their different dealers. This is caused, of course, both by the material shortage and by the fact that the dealers have sold more cars than their original schedule called for. It is quite true that the second reason has had practically as much influence as the first, although it is also true that more than one concern has lost as much as 45 actual days from their manufacturing schedule during this same period of time, due to movements of plant location and other disturbing factors. In fact, during this year there has been an unusual amount of factory and plant movements, as well as expansion.

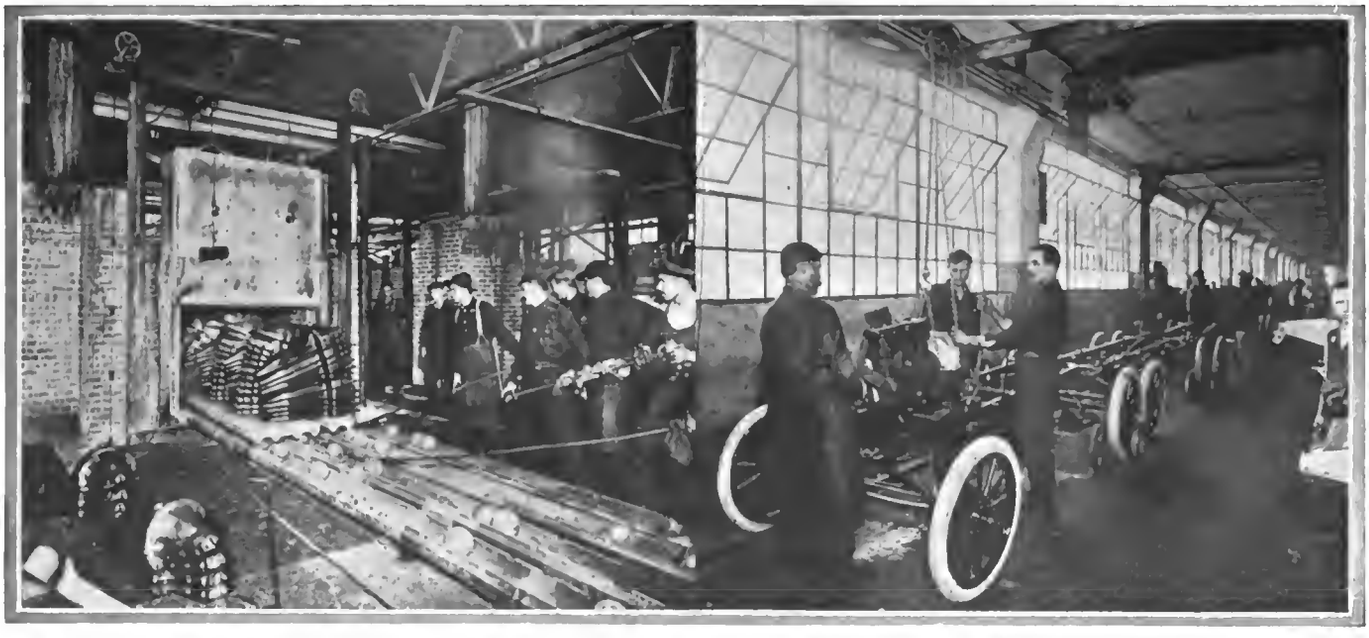
Many Add Floor Space

The addition of new floor space to a factory necessitates expanding into the new room and very often entails a rerouting of the product. There is no doubt but that at least 60 per cent of the larger manufacturing concerns have had to perform the difficult feat during the past six months of continuing their production schedule while rearranging the plant. Many new buildings have been added and many are now under process of erection. To give a few examples, the Ford company is practically doubling its factory area and predictions are made of a manufacturing schedule of 1,000,000 cars a year. In Indiana, the National company, for example, is putting up a new building and will shift into it without stopping manufacturing. Marmon, likewise, has bought new acreage. The Overland company is continually making additions to its plant and even now is just about completing a large new office building. Other plants which are adding space are Inter State, Jeffery, Haynes, Chandler, Hupmobile, Saxon, Scripps-Booth and a score of others. In practically every instance where these increases have been completed and occupied as part of the regular production plant, the change has been made without shutting down, with only a slight delay.

One of the most important problems in connection with the work of a big production concern is that of distribution. It is necessary to know the territory and the people in which the cars are to be sold, and therefore data which would tend to bring out information regarding which states are increasing fastest in number of cars, or, in other words, which are buying most, is of greatest interest. It has been said that the farmer is the greatest car purchaser of to-day, and this seems borne out when it is noted that Ohio bought more cars than any other state during the last half of 1915 and the first half of 1916. Actual figures cannot be given for increase up to July 1, 1916, but for the six months ending Jan. 1, 1916, the number of cars in Ohio increased by 58,802, or 48 per cent over its previous number.

Farmer the Greatest Car Buyer

The farmer is all-important as a car buyer. In Oklahoma, the increase of cars for the year of 1916, as compared with 1915 insofar as figures can be compiled at the present time, is 250 per cent. In Mississippi it is 195 per cent. In Louisiana, 210 per cent, and in Idaho, 117 per cent. In the great farming State of Iowa, there is one car to every fourteen persons; in Nebraska, one to every twenty persons, and throughout the other big farming states on the corn and wheat belts similar conditions prevail. The county fair of to-day is incomplete without its attending automobile exhibits. And unlike many of the pretentious automobile shows held, the farmers actually come to buy as well as to look.



Ford Methods—Ball carriers permit the trays to be rolled out of the furnace. Motors are lowered on to the completed chassis

In summing up this farm situation, a vice-president of one of the largest producing concerns approaches the situation from an interesting angle. He says, "The average value of the 7,000,000 farms in this country is $6,500. The owners of 1,000,000 of these farms have automobiles. At least 3,000,000, or one-half of the remaining farm owners who do not drive cars, are good prospects." In other words, according to this estimate, the entire output of 1916, or 1,500,000 cars estimated, could readily be absorbed by the farmer prospects alone. Estimating on this same basis of income, the same authority finds that there are 2,500,000 city people who are prospects for new cars.

Both of these estimates are for people who have never owned a motor car. They are first-time purchasers, and this does not take into consideration the ever-increasing percentage of those who are buying their second, third or fourth car, or those who own more than one.

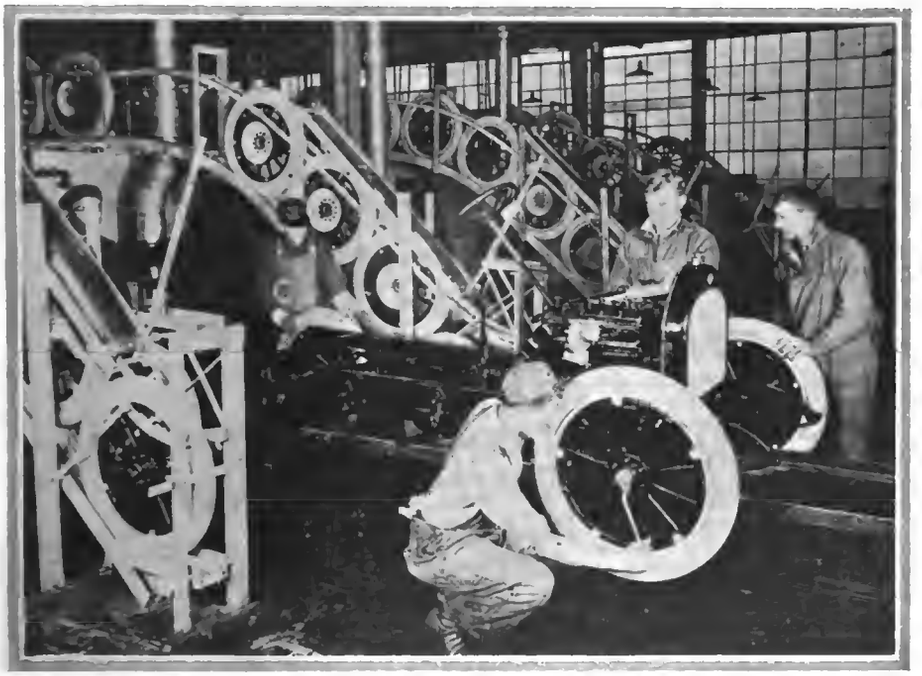
The fear that present big production schedules will saturate the market seems ungrounded when actual conditions are closely scanned. Throughout the industry, the close of the first six months of manufacture finds an optimistic current of thought in the minds of those whose business has been adapted to the modern methods of intensive manufacture, coupled with economical management. Both in the two well-defined fields of assembled and manufactured cars, the economies which have resulted from the use of up-to-date methods have enabled the product to be marketed at a profit in spite of conditions which otherwise would have been disastrous. The producers of assembled cars have reaped the benefits of the production methods in use in the parts plants, which have enabled these parts manufacturers to produce cheaply enough to allow the assembler who proceeds along modern lines the necessary margin of profit.

During the 6 months ending July 1, 1916 the number of passenger cars exported to foreign countries has been in excess of 33,000 and valued at more than $24,000,000. Detailed figures are not as yet available for the month of June, but from January until the end of May the average monthly exportation was 5645 cars and the average value of the car shipped abroad was $4,059,878 per month. The exact totals of the passenger cars shipped from the country during the 5 months ending June 1, 1916, was 28,227 cars valued at $20,299,393.

During the first half of 1916 the number of passenger cars made per month in the United States averaged 125,817. With the average monthly exportation of 5645 just about 4½ per cent of our total passenger car production is shipped abroad. Uncle Sam probably will always continue to be his own best customer, but the markets of the world are open to him and the probabilities are that the close of the European conflict will open large markets which are now inaccessible. It is of course natural to assume that the home industries of Europe will be protected, but if conditions are as they might be expected to be the market for automobiles will be larger than the recreated European factories can handle.

To sum up the situation, the 754,902 cars which have been made have practically all been sold, and in many sections of the country dealers are already clamoring for their share of the other 700,000 which are to be manufactured during the remaining 6 months, and when the year of 1916 shall come to a close, if present conditions hold until the end, the United States will have been enriched by the possession of considerably more than $1,000,000,000 worth of cars.

The prosperous condition of the automobile industry has been reflected in other lines. The companies selling manufacturing machinery have been rushed as never before. High-speed steel necessary for fast cutting and big production is at a premium and all along the converging pathways of manufacture the story has been the same, "Give us men, give us materials and give us machinery—we can use them all."



Overland factory. Wheels fed by magazines to the required points

Left—View in Maxwell factory. Each body is a step nearer completion. They are moving gradually to the point where they will be picked up by an electric hoist and set on their chassis, as the latter reach that point in their growth into complete automobiles. Right—Painted chassis just entering the drying oven. In 30 min. the moving chain will pull it out dry at the other end, and the work of assembly will continue again. Another follows it only a few feet away

Buick Returns to Four

Entirely New Small Car Added to Line —The Little Six Continued Unchanged

Front view of the new Buick four-cylinder touring car

AFTER giving up entirely for a time the manufacture of four-cylinder cars, the Buick Motor Co., Flint, Mich., is again to put them out, in addition to continuing without change the production of the little six-cylinder model that made such a hit during the past season. Reversions to fours by so large a manufacturer might be taken as a significant move, and indicates that there is a big demand for a moderate-priced vehicle of this type.

The new Buick four, which, needless to say, is to be made in large numbers, follows characteristic Buick design throughout, with perhaps more alteration in the engine than elsewhere, although that unit is a valve-in-head type as are other power plants of this make. It will sell at $665 as a touring car under the model designation of D-35, and as a roadster it will be priced at $650 and known as model D-34. In its general lines, especially the radiator, the new car is typically Buick. It has a wheelbase of 106 in., and there is plenty of room for five passengers.

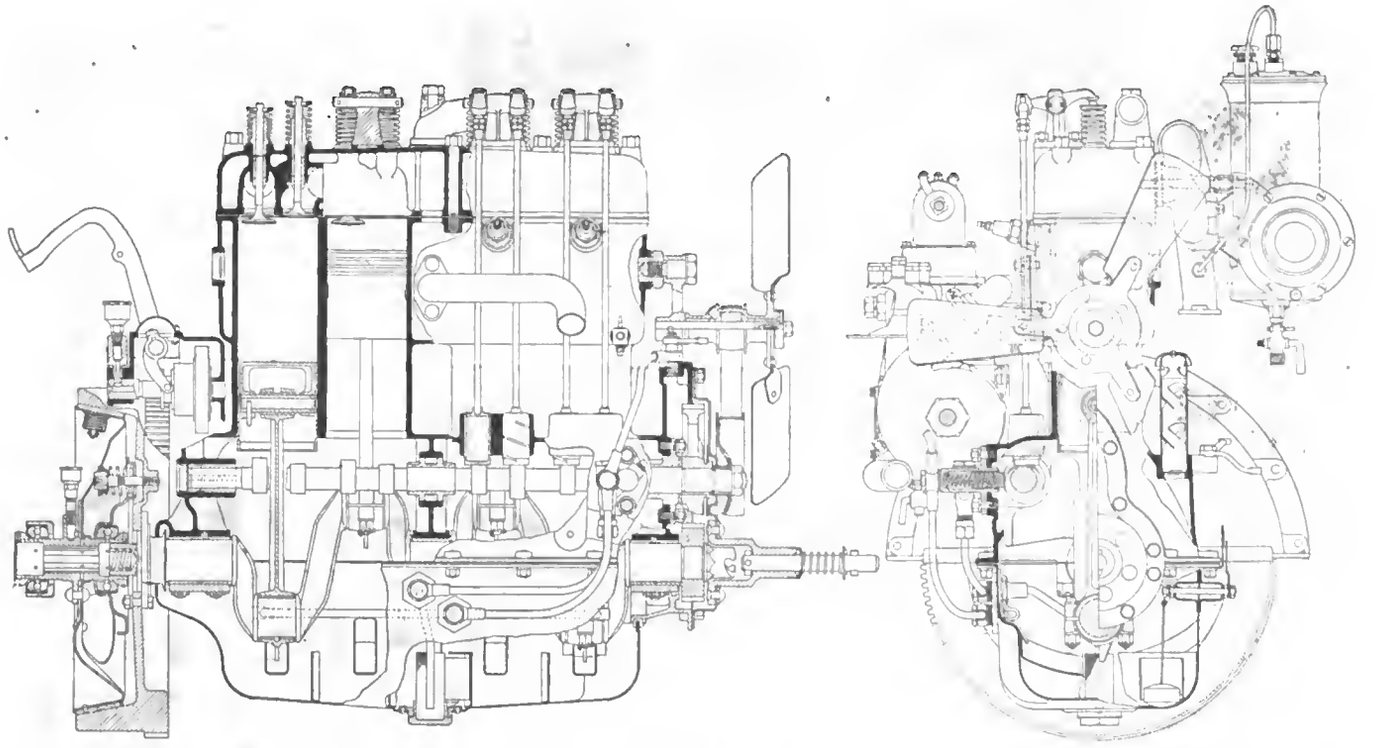
Thirty-five brake horsepower is claimed for the engine, which has a bore of 3⅜ in. and a stroke of 4¾ in., giving a displacement of 170 cu. in. and a formula rating of 18.2 hp. These cylinder dimensions are not a great deal different than those of the little six, which has a bore of 3¼ in. and stroke of 4½ in.

Other specifications of interest are the pump cooling; Marvel carbureter in conjunction with rear tank and Stewart vacuum feed; Delco combination starting, lighting and ignition; cone clutch; three-speed gearset in unit with the engine; driveshaft inclosed within a torsion tube; three-quarter floating rear axle; semi-elliptic springs both front and rear; and 31 by 4 non-skid tires all around.

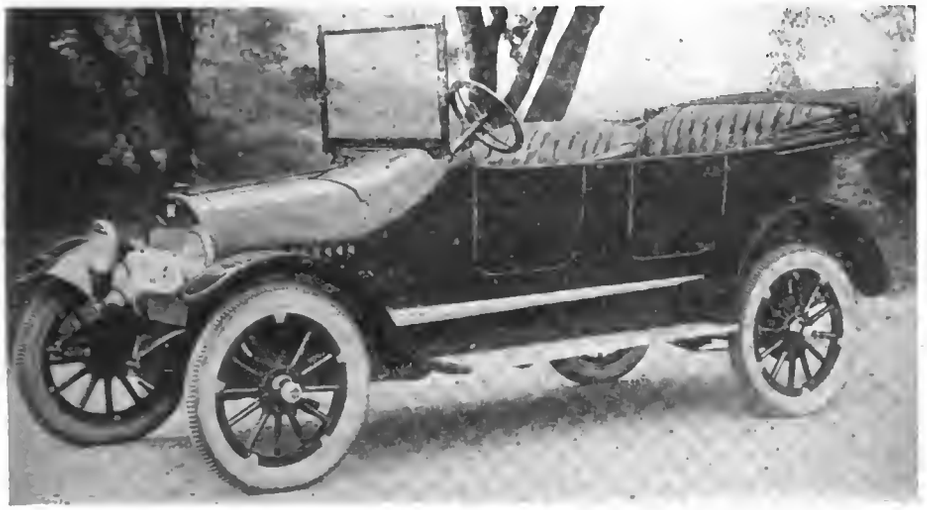
Has Detachable Head

Although the engine is an overhead valve design, it is probably the one part that is most at variance with previous construction, in that the cylinder head is detachable as a unit with the valves. It will be remembered that previous Buick construction has been to have the heads integral with the body of the cylinders, and to use valve cages, which, when removed, brought out each valve individually. The new design makes it possible to get at the valves when the head is taken off, and at the same time gives a free opening into the cylinders and pistons. The valve springs and rockers are not inclosed, but are quiet due to the lubrication provisions and the interposing of a felt pad at the ball end of the push rod, as in previous designs. The rocker shaft supports are bolted to the head casting, and this also carries the water outlet connection.

In the design of the head, special provision was made for the proper cooling of the valves, the water passages surrounding the pockets being large. On the whole, there is



The new 3⅜ by 4¾-in. Buick four-cylinder engine in section. It has a displacement of 170 cu. in. and is claimed to develop 35 brake hp. Note the characteristic overhead valves and the pump cooling



Buick five-passenger, four-cylinder touring car which sells for $665. It has a 106-in. wheelbase and uses 31 by 4-in. tires

nothing radically different in the design of the motor as compared with the conventional overhead-valve, removable-head job, yet the details have been worked out to give a surprisingly compact whole.

In its general arrangement, the motor has its push rods on the right, and both intake and exhaust manifolds occupy the left side. On the push-rod side is mounted the Delco single-unit starting and lighting outfit with ignition distributer integral. This motor-generator is driven off the pump shaft, which in turn is operated by a helical gear meshing with the camshaft gear. Mounted directly on the motor on the manifold side is the vacuum tank, and below it the carbureter, giving a very short feed pipe between tank and carbureter, with obvious advantage. The upper half of the flywheel is housed over by an extension of the upper portion of the crankcase, which is integral with the cylinder block. This extension meets an extension of the gearbox, and the two bolt together by means of a flange, giving a substantial support to the gearset and kindred parts without excessive weight.

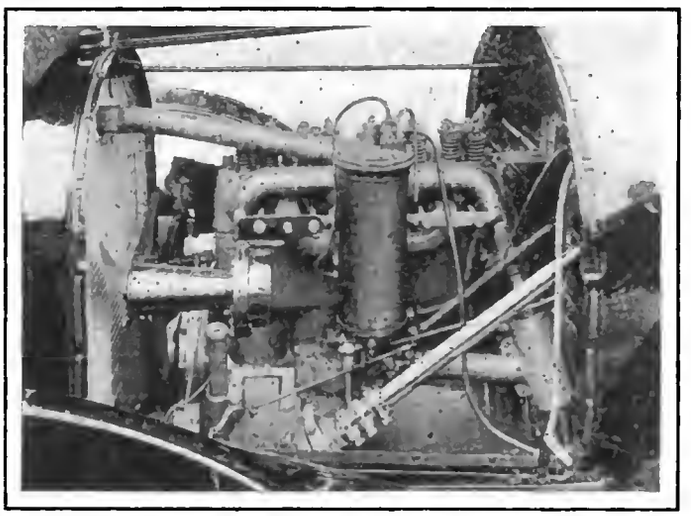
Large Valves a Feature

There are three main crankshaft bearings and an equal number carrying the crankshaft, both of which parts are of sturdy section so as to reduce the vibration and make a smooth-running engine. Valves are quite large—1½ in. diameter—and the gas passages are as direct as possible, both features being power-giving factors. Conventional connecting-rods of I-beam section, and pistons carrying three rings each are fitted, the wristpins being pinned to the pistons so that the upper rod end has a bearing on the wristpin.

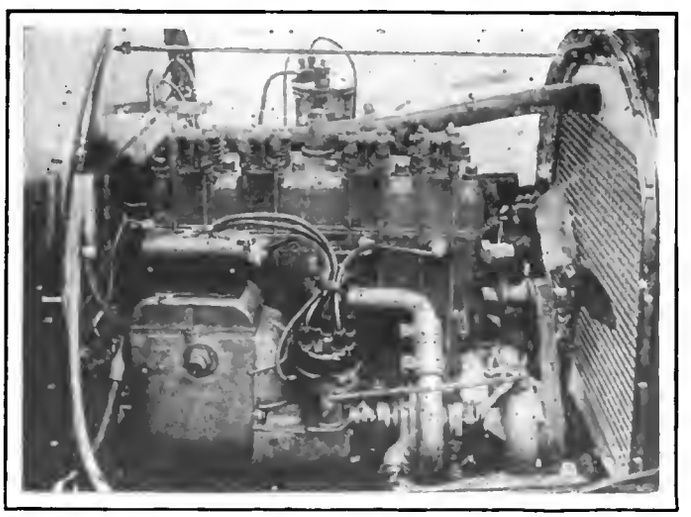
Much attention seems to have been given to working out the cooling system, as evidenced by the wide water spaces, and the carrying of the cylinder jackets well down to within about 1 in. of the bottom of the piston stroke. The water spaces in the head are extra large, and it would seem that warped valves due to heat are an impossibility. There is a three-blade pressed steel fan, belt-driven from a pulley on the end of the camshaft, with provision for adjustment of the belt tension through the rocking fan bracket that attaches to the front of the cylinder casting proper. The centrifugal pump delivers the water to the center of the cylinder block on the right side, and the passages insure even distribution all around. The cellular-type radiator is of generous proportions for this engine, and should have no trouble in caring for its needs.

Likewise, care has been expended on the design of the lubrication arrangements. Oil is drawn from the pressed-steel under part of the motor by a cam-operated plunger pump, delivered through a supply pipe to each of the troughs under the connecting-rods and also through a special lead to the timing gears at the front. It is then splashed in the usual way to the various bearing surfaces by the dipper on the end of the rod. The troughs are curved so as to follow the rod end for a considerable distance beyond its dead-center position on either side, taking care of any difference in level between one side of the car and the other. On top of each a connecting-rod upper end there is a hole drilled to catch some of the splashed lubricant and lead it to the bearing, and the tappets are spirally grooved so that they carry oil onto the entire surface of the chambers in which they work, making for quiet operation. On the left of the crankcase there is a breather, which is internally baffled so that any spray from the crankcase will not get out to collect on the outside of the engine, and there is also a float gage connecting with an indicator hand that plays over a dial mounted on the left side of the crankcase to inform the driver how much oil he has left.

In common with practically all installations now, the start-



Left side of the engine of the Buick four, showing the arrangement of intake and exhaust manifolds



Right side of Buick four engine, showing mounting of starting and lighting units and ignition distributer

The new Buick four has a wide door with plenty of room in the driver's compartment. The instrument board is neat and simple

ing motor meshes with teeth in the flywheel rim, pressing the pedal meshing the armature shaft gears with these teeth. The ignition distributer sets vertically on the front of the electrical unit, and is driven by spiral gear connection with the motor-generator shaft. Mounted on top of the motor-generator case is the ignition coil, and as the spark plugs enter the cylinders on the same side of the engine, there is a minimum of wiring from distributer to plugs, etc. These and other wires are inclosed within metal flexible conduit, a precaution against trouble that cannot be too highly recommended.

There is a leather-faced cone clutch on this car which is similar in design to that employed in other models. The cone itself is a pressing, and there are three springs placed at equal distances apart to hold the unit in engagement. There are also small springs inserted at intervals under the leather to force it out and produce a soft action. The clutch assembly includes two ball thrust bearings, the forward one taking the thrust from the engagement springs and the rear providing for the thrust occasioned by disengagement of the cone. The shaft on which the cone slides has six splines, and each of the engagement springs is provided with an adjusting nut which makes it a simple matter to give the proper tension, especially since the clutch can be reached from below the bell housing without the removal of any parts.

Chrome-nickel steel gears are used in the gearset, these having teeth of stub form so as to resist any suddenly imposed shocks. The bearing equipment for this assembly consists of a roller bearing for the clutch gear, a double-row ball bearing for the square shaft, and plain bearings with bronze bushings for the countershaft.

Ball Joint Torque Tube

The drive is taken through a single universal joint just back of the gearset, this being of large proportions and fully inclosed. The propeller shaft is also completely housed within a torsion tube that attaches to a large ball-and-socket joint on the rear of the gearcase, and terminates at its rear end in a flanged member that bolts to the front of the differential housing. Thus the torque is taken through the shaft housing and the ball joint at the front end, while the drive is through the rear springs.

Of three-quarter floating type, the axle is a compact unit designed so that all the car weight is carried on the axle tubes, with no supporting strain on the driveshafts. These are mounted on spiral roller bearings at both wheel and differential ends, with a ball thrust bearing also fitted at either side of the differential. The gears are of the bevel type, and the ring gear has fifty-three teeth to thirteen on the pinion, giving a ratio slightly over 4 to 1, thus allowing the motor plenty of chance to drive the vehicle with all the flexibility that should be desired.

In the rear spring arrangement, Buick deviates from that of the little six, which has cantilever suspension. On the new four the springs are semi-elliptic, long and flat. The dimensions are 48 in. by 2 in. wide, and the mounting is somewhat unusual in that they are not directly below the frame rails, but bracketed so that they run outside the frame. This was done principally because the frame tapers straight from the back to the front, and if the springs were placed under the rails they would also be at an angle, and this might have introduced an undesirable bending moment. As the frame is narrower at the front mounting than at the rear, the brackets at the front are simply brought out farther to allow the springs to parallel the wheels. At the rear the frame members bend down sufficiently so that the springs are mounted almost flat and this, in connection with their length, makes for easy riding, since the spring action tends to both sides of the horizontal, with dampening effect upon shocks. The front pair are also quite long, measuring 30 in. and being of the same width as the rear.

Tapering the frame from back to front is also new to Buick design, but is becoming very popular with modern car designs. It allows a short turning radius, and at the same time gives excellent support for the tapering body along its entire length. To assist the side members there are four strong cross pieces, each anchored with the aid of gusset plates.

The popular sloping lines and smooth exterior, with hood blending into the cowl, are given the car, with sufficient rake to the steering wheel to give a good appearance. Attention has also been paid to the matter of leg room in the drive seat, and almost any type of person ought to find comfort in driving the car. Equipment includes all the fittings looked for by the car purchaser of to-day, among which might be mentioned the adjustable windshield, the one-man top, the electric horn, the speedometer, the extra demountable rim and tire carrier at the rear of the frame.

Little Six Unchanged

Brought out over a year ago, the little six that is to be the new four's running mate for the coming year, really requires no lengthy description here. It is known as model D-44 as a roadster, and with that body sells for $985. The touring car on the same chassis is called model D-45, and the price is $1,020. Briefly, the specifications, which are practically the same as they have been since the car was introduced, are 3¼ by 4½ in. engine, developing 45 hp.; Delco ignition, starting and lighting; circulating splash lubrication; pump cooling; cone clutch and three-speed gearset; 34 by 4 tires and wheelbase of 115 in.

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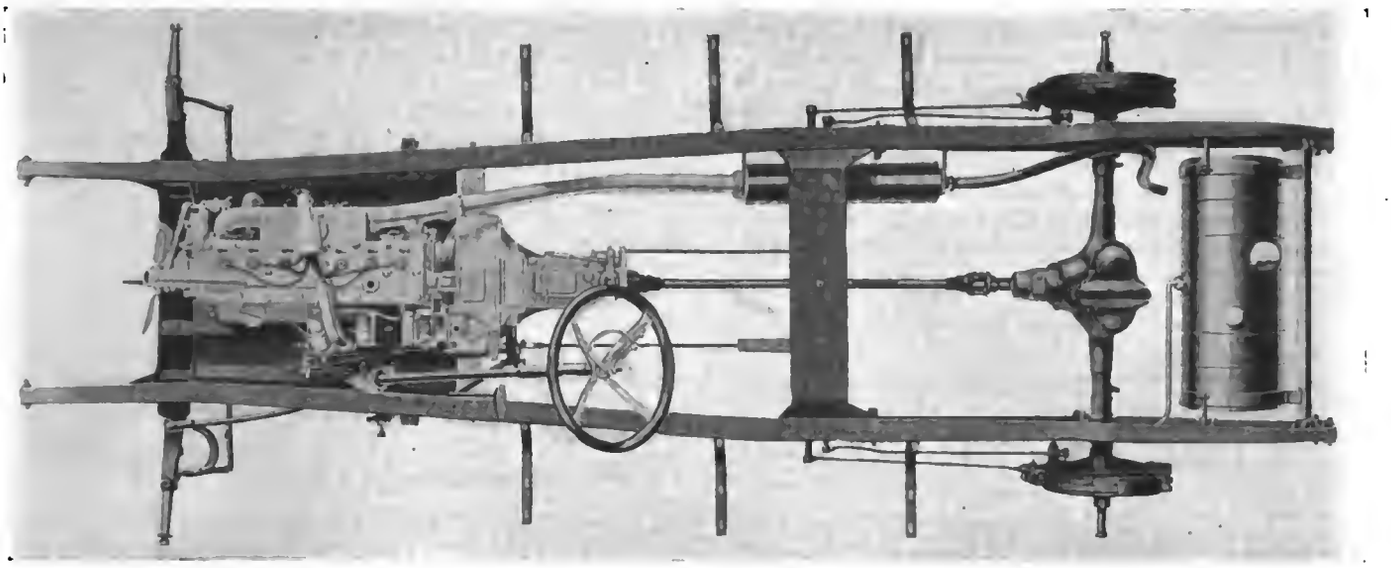
Dallas—$25,000,000 Distributing Center

DALLAS, TEX., did $25,000,000 worth of automobile business in 1915. In the city 178 buildings are exclusively occupied by the automobile industry. There are 108 wholesale and retail motor vehicle and accessory concerns located there. There are also seventy top, body and repair concerns doing business. More than 2600 employees are directly dependent upon this industry. It is estimated that these employees draw annually in salaries the amount of $28,000,000.

Such a business could not be produced if Dallas and the surrounding territory did not justify it. The State of Texas produces about one-fourth of the world's cotton crop and 60 per cent of this crop is financed at Dallas. That is the principal inducement that secured for Dallas the Federal Reserve Bank and which has caused the automobile concerns of the United States to center their Southern business at this city. Within a 100-mile circle around Dallas farm products annually are valued at $450,000,000, which is based upon figures recently obtained through census work.

There are 2500 financially rated business houses in Dallas, more than 400 factories and 275 wholesalers. One-fourth of the $400,000,000 worth of bank resources of Texas are held by Dallas banks. The average per capita wealth of the farmers within 100 miles is $7,500.



Chassis of the Marion-Handley 6-40, showing the compact unit power plant, strong frame cross-member and large gasoline tank at rear. Note the simplification of parts

Marion-Handley in Two Models

Small Six at $1,185 and Large Car at $1,385 Comprise the Line—Several Body Styles

TWO sixes will make up the line of the Mutual Motors Co., Jackson, Mich., for 1917. These cars are sold under the name of the Marion-Handley, taking the name from J. I. Handley, president of the company. The sixes are in two sizes, known as the 6-40 and the 6-60, and the two cars possess great similarity of design.

In picking out the features of the Marion-Handley line, probably the outstanding point is the lightness in ratio to power. The smaller car has about 1 hp. for each 60 lb. weight and the larger car weighs about 58 lb. per horsepower. Throughout, both cars will be seen to follow very closely the up-to-date practice of high-speed engine with light semi-flexible frame construction, giving the characteristics demanded in the way of quick acceleration and economical performance.

45 Hp. at 2000 R.P.M.

The 6-40, the smaller of the two cars, has a high-speed unit power plant, with the 3⅛ by 5-in. cylinders cast in a single block. The engine is L-head shape, has a displacement of 230.1 cu. in., and develops, according to dynamometer tests by the factory, 45 hp. at 2000 r.p.m. The upper half of the crankcase is cast integrally with the cylinders and the lower part is pressed steel, being merely used as a housing and an oil retainer. Its capacity in the latter respect is approximately 1½ gal. This part of the crankcase is detachable in the customary manner to permit of the adjustment of the connecting-rod and main bearings.

Three rings are used on the cast-iron pistons, which are 3¼ in. in length. I-beam connecting-rods are used and both the upper and lower rod bearings are 2 in. diameter by 1⅞ in. long. The crankshaft is also 2 in. in diameter and is supported upon three main bearings, the front being 2¾ in. long, the center, 2¾ in., and the rear, 3⅛ in. These bearings are lubricated by a direct feed from the oil pump, thus maintaining a supply of lubricant to the crankshaft under pressure. The remaining bearings are taken care of by splash, and the timing gears are lubricated by overflow from the front main bearings. The crankshaft gear of the timing set runs continually in a well of oil. This permits the lubricant to be carried by the gear teeth over the surfaces of the entire timing set, thereby maintaining an oil film between the teeth of the gears at all times. The pump used in connection with this system is a plunger, operated by an eccentric on the camshaft and is self-priming because it is located in the oil reservoir in such a position that the last remnants of oil are sure to drain to the pump. A relief valve is provided to regulate the maximum pressure on the oil system.

Quiet-Running Gears

One of the points which has been given attention is the matter of quietness in the valve driving system, the cam gear being of Fabroil, which is a compressed cloth produced by the General Electric Co. and has the advantage of being non-resonant. This gear has a face width of 1 3/16 in., with 10 pitch helically-cut teeth. The camshaft is carried on die-cast nickel babbitt bearings. There are three bearings for the camshaft, two being of the material mentioned, while the third is an S. K. F. ball thrust, used at the rear end of the camshaft to take the thrust loads as well as the radial, in any direction.

A special alloy steel which the manufacturers claim to have many of the characteristics of cast iron is used for the valves. They are 1 3/16 in. diameter and have a lift of 5/16 in. One of the main points in which the alloy steel resembles cast iron in the valve is that it can be ground to a perfect seat. At the same time, owing to the composition of the metal, the molecular structure is much closer and the valves have a long life without as great chances of pitting.

Electricity All Westinghouse

Cooling is by a centrifugal water pump which is driven off the timing gears and is located on the valve side of the engine, in the same line as the electric generator. In connection with the cooling system there is a two-blade aeroplane type of fan of pressed steel which runs on ball bearings and

is fitted with a rocker arm adjustment for belt tightness. The radiator is a hexagonal honeycomb type having a capacity of 4 gal. and it is mounted by two bolts on the front cross member. There is also another unusual feature in the shape of a detachable case which is of considerable assistance in the matter of making repairs.

Electrically the entire equipment is Westinghouse. There is a Westinghouse generator which weighs about 16 lb. including the automatic regulating means. The latter is of the voltage type and is such that the charging rate varies with the condition of the battery. When the battery is nearly exhausted, it is charged at a high rate, while, when fully charged, the charging rate is reduced. In addition, the usual magnetic cut-out switch is incorporated so that when the charging rate falls too low, the battery is automatically cut off, thereby preventing a reversed current flow. The battery as well as the entire system operates at 6 volts and the capacity is 80 amp.-hr. An ammeter is located on the instrument board.

Ignition is also taken care of by the Westinghouse unit, the distributer being mounted on the generator, and the same unit contains the breaker box, spark coil and condenser. These units are easy to reach for inspection, the breaker box being inclosed within a collar which can be slipped out of the way when it is necessary to inspect or adjust the points, and the distributer cap is removable, together with the spark plug leads.

Control of the ignition and lighting system is by means of a set of switches on the instrument board. The lighting system consists of the Westinghouse generator, switches, and a full set of lamps in connection with the 6-volt, 80-amp. storage battery. A single pair of headlights is used with double bulbs. The larger bulbs are 20 candlepower for road driving, with 6 candlepower for dimming. The tail light is mounted in the center of the tire carrier, and all these lamps together with the remainder of the electric equipment is wired on the single wire grounded return system. In this the chassis, frame and metal body form one circuit. The starting motor is entirely inclosed and is engaged with the flywheel gear by means of the Bendix screw pinion shift.

Large Surface in Clutch

A dry multiple-disk clutch is employed, having eleven disks lined with Multibestos. Of these, five are driving and six are driven disks. They are 8 in. diameter and made of saw steel with an annular bearing for clutch release, this bearing being lubricated by the oil from the gearset which enters the clutch by means of grooves cut in the clutch shaft. An adjustment is provided on the clutch release pedal to take up any wear or lost motion that may develop in the clutch release bearing. This is done in order that the full throw of the clutch pedal is provided at all times, thus insuring the full disengagement of the clutch.

A Three-Speed Gearbox

A conventional three-speed gearbox of compact design is employed to transmit the drive from the clutch to the rear axle. The box is mounted integrally with the motor as a unit power plant and the entire construction is kept rigid by short shafts of nickel steel. The gears in the gearset have a face width of ¾ in., and the diameter of the countershaft is 1 5/16 in. with a 1½ in. main shaft. The splines are cut to a depth of ⅛ in. The bearing mounting is made up of four annular ball bearings arranged for end play adjustment, and the reverse idler gear is mounted on a plain bronze bearing. The gear reductions in the gearbox itself are 2½, 1 7/10, and 1 to 1, with reverse of 3.4 to 1. Final reduction is 4 5/12 to 1 at the rear axle.

Hotchkiss Drive Used

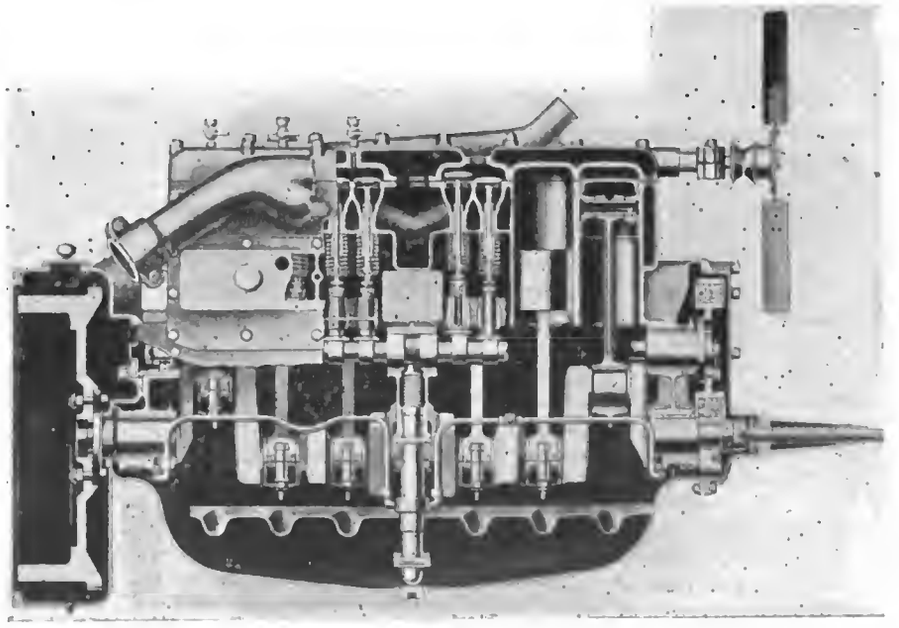
Both the drive and torque are taken by the rear springs, eliminating both torsion tubes and torque rods. A reduction of weight is further secured by the use of a tubular propeller shaft 1½ in. diameter with 5/32 in. walls. The shaft is equipped with two double ball and socket universal joints and has a fore and aft travel of 2 in. The universal cup, ball and trunnion pins are hardened and ground and packed in grease.

Robust Axle Proportions

Floating construction is used in the rear axle. This is equipped with a Brown-Lipe spiral bevel gear and is provided with a set of Hyatt high-duty roller bearings with adjustable ball bearings for side thrust. The pinion shaft is carried on two annular ball bearings which are adjustable, allowing take-up for wear or play on the pinion shaft. The drive pinion can also be adjusted in regard to the mesh with the spiral bevel ring gear. Chrome-nickel steel is used for the drive shafts and they are 1¼ in. diameter. The entire differential may be removed by taking off the inspection plate over the differential.

Two sets of brakes are used with the drums on the rear wheels as usual. The service brakes are contracting and emergency expanding, both being provided with two adjustments, one on the brake rod ends and the other attached to the brake bands. The drums are 14 in. diameter and have a face width of 2 in.

Elliott type front axles are used of I-beam section, drop forged without welds, the spring seats being integral. The steering knuckle and axle ends are fitted with bushings while the knuckle pins are hardened and ground with a trap oiler at the top of the bolt to insure lubrication. The drive lengths are designed to permit a minimum turning radius and the car is able to turn about in a 25 ft. circle. Both front and rear wheels are of heavy hickory, with twelve 1½ in. spokes. The front wheels are carried on Gurney annular ball bear-



Section through the Marion-Handley block-cast six-cylinder engine. Note the large bearings. The cam gear is of Fabroil and special alloy steel is used for the valves

At the left is illustrated the six-cylinder, seven-passenger Marion-Handley 6-40 touring car, which sells for $1,185. The body lines are smooth and the windshield slants rakishly

At the right is the Marion-Handley 6-40 as a four-passenger roadster listed at $1,185. The seating arrangement is attractive and the seats are of comfortable dimensions

ings of the "100 per cent thrust" type. A full equipment of Firestone demountable rims is furnished, adapted to 32 by 4 in. straight side tires, and non-skids are used on the rear wheels. The wheelbase of this model is 120 in.

Equipment Is Complete

In equipment the car is complete, the 16-gal. round tank being located at the rear with Stewart-Warner vacuum feed. The body is a roomy seven-passenger design of heavy gage sheet steel, with pressed steel cowl and concealed hinges. There is also a four-passenger roadster of up-to-date construction, in which the driver's seat is set forward 15 in. from the double passenger seat and a fourth or auxiliary seat is carried folded into the dash. The standard equipment also includes a Chase leather one-man top with Collins quick detachable side curtains which swing open with the door. The windshield is slanting and is provided with clear vision features. The body finish is in dark wine color with black fenders and splash aprons.

6-60 Almost Identical Design

Of similar design is the 6-60. This is equipped with a 300 cu. in. motor, having its 3½ by 5¼ in. cylinders cast in a single block. This is also a conventional L-head design, and, according to the manufacturers, develops 50 hp. at approximately 1900 r.p.m. The crankcase is cast separately of aluminum and is equipped with a pressed steel oil pan. All the bearings are supported in the crankcase and are accessible by removing the pan. The inclosed valves are 1 11/16 in. diameter with 3/16 in. lift. They are operated by a single camshaft and both inlet and exhaust valves are interchangeable and have nickel steel heads electrically welded with carbon steel stems. The ends of all the valve stems are hardened to insure against wear from tappet action. Pistons and cylinders are both made from the same grade of reverberatory furnace iron, with a piston length of 3¾ in., fitted with three diagonally split concentric rings 3/16 in. wide. The piston pins are of annealed special steel tubing hardened and ground, with the pin held stationary in the piston bosses. The bearing surface is given by a bronze bushing pressed into the upper end of the connecting-rod.

An integrally-forged low carbon steel camshaft is used, carried on three bearings of white bronze. The dimensions of these cam bearings are: 2 17/64 by 1½, 2¼ by 1⅛, and 2 7/32 by 1¾, respectively, from front to rear. The crankshaft is also carried on two bearings and is of special crankshaft steel, heat treated to give a tensile strength of 90,000 lb. to the sq. in. The main bearing dimensions from front to rear are: 2 3/16 by 2 23/32, 2 7/32 by 2⅜, and the rear or flywheel bearing, is 2¾ by 3. All the bearings are reamed to a fit on expansion arbors and then finished with a slow-running spiral cut power burnisher which is stated to give a bearing surface of over 98 per cent.

Lubrication is by force feed and splash, actuated by a horizontal pump driven by an eccentric from the camshaft. This forces oil through copper tubes direct to the timing gears and the main crank and camshaft bearings. The remaining bearings are taken care of by splash.

Throughout the remainder of the chassis, the design of the 6-60 is quite similar to that of the 6-40, with the parts necessarily stronger and larger to take care of the higher power and greater weight. The Hotchkiss drive is used but the reductions are different, the final gear ratio being 4 1/3 to 1, and the wheelbase is also greater, being 125 in., while the tires are 33 by 4½.

The body equipment includes an up-to-date seven-passenger car and a four-passenger roadster. This car is fully equipped with accessories, having a Stewart-Warner vacuum feed, Chase top, Collins curtains, full set of instruments and tools, extra Firestone rim, etc. Prices are $1,185 for the 6-40 and $1,385 for the 6-60, in either roadster or touring form.

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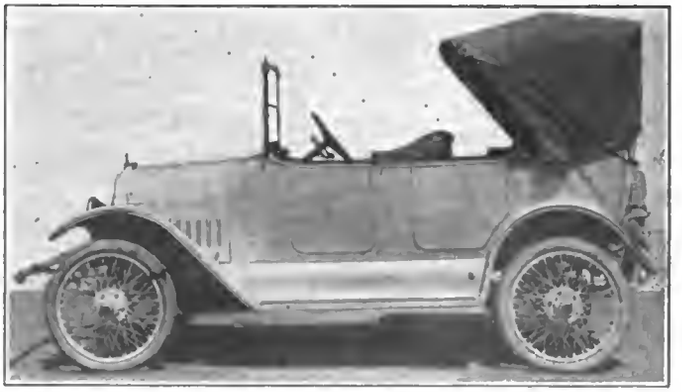
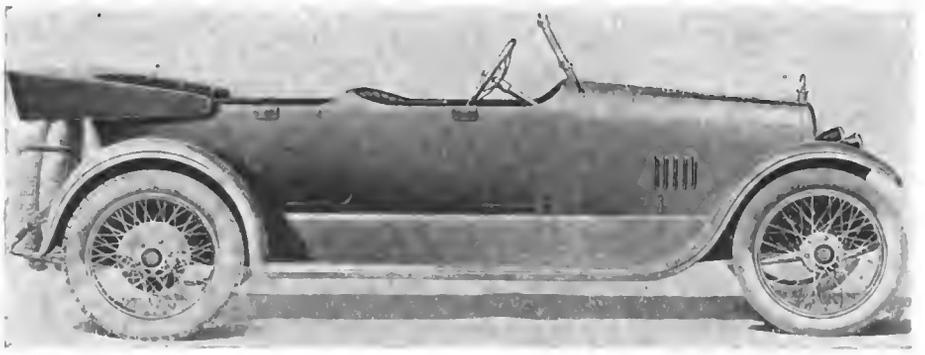
Special Maxwell with Victoria Top



Above is illustrated a recent creation by Harry J. DeBear, manager of the New York branch of the Maxwell Motor Sales Corp. It is a Maxwell touring car painted a special light blue and fitted with white wire wheels, Victoria top and slip covers to match. The car sells for $950 complete, f.o.b. New York City

Blended Ideals in Jordan



Jordan four-passenger sporting model with 127-in. wheelbase and listing at $1,750

New Six Possesses Many Points of Distinction —Chassis and Body Well Coordinated— High Finish Combines with Sound Conventional Design

THERE are some who consider it difficult to produce a really distinctive automobile from standardized parts and it is, in fact, not easy. While anyone can build a sound car from reliable components, it remains for the few to effect the best combinations, and many a body is kept from being really excellent by a few small blemishes of design or finish which can only be eliminated by painstaking care. In the evolution of the Jordan this truth has been realized, with the result that the car has not only a character of its own, but a pronounced distinctiveness apparent at the first glance and intensified by a close examination.

Every Need Considered

In starting to produce the Jordan, consideration was given to almost every sort of ideal. The requirements of the world and his wife were analyzed, argued over, tabulated and, finally, coordinated. Before any work was done on the car a list of features was prepared stating in detail every point which had to receive consideration. It was the aim of the Jordan Motor Car Co., Cleveland, Ohio, to produce a machine which lacked nothing, in which the mechanical arrangement was above criticism, the body lines just at the right pitch of fashion and the finish of a custom-built quality. The precise extent of the success achieved may be judged by the illustrations and by the description of the car which follows, but it may be summed up by saying that the Jordan immediately appeals both to the man with long automobile experience and to the individual with none.

High-Grade Parts in Chassis

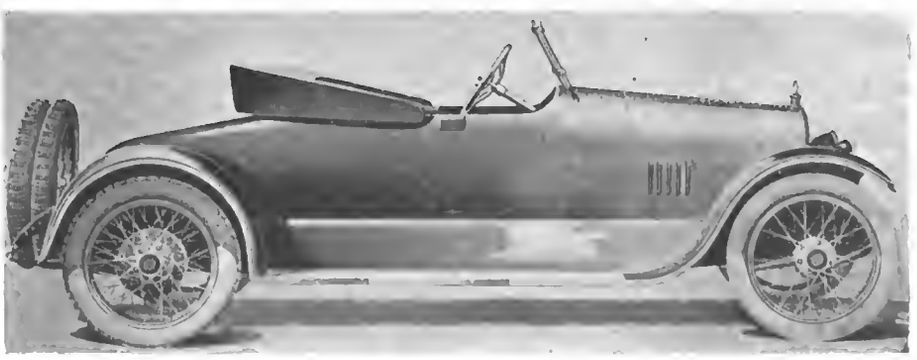
Not a unit of the chassis is untried and the specification is quite conventional, its noteworthy feature being that each component ranks high among its kind, and is the best model built by the parts specialist in question where there is any choice. Motive power is supplied by a six-cylinder Continental engine 3½ by 5¼ in., this being the aluminum crankcase type and the power plant is completed by a Brown-Lipe gearset and a Brown-Lipe multiple dry disk clutch. As to the engine accessories these include Bosch magnetic ignition, Bijur two-unit lighting and starting and a Stromberg carbureter.

As can be seen from the illustrations, the hood has plenty of width and depth, the result being that the mechanical inhabitants of the bonnet are no more cramped than the human occupants of the car body. Every essential is accessible readily.

Both front and rear axles are Timken products, the drive, of course, being by spiral bevel, and the frame is of deep section to give rigidity and enable the firmly-built body to keep free from looseness after long use.

The bodily comfort of the passengers has been studied with especial care, and a short trial of the car enables it to be stated with conviction that the ease of riding is very much above the average. It is not too much to say that very few cars indeed ride as well as does the Jordan. This desirable quality is attributable partly to the springs and partly to a special feature of the upholstery. Taking the former first, they are half-elliptic front and rear, the back springs being 59 in. long and almost perfectly flat when the load is on them. They run beneath the axle and the rear end of the frame is brought well down in a sweeping curve to carry the shackles. This low hanging allows the frame to be brought fairly close to the ground, and the flatness of the springs gives lateral strength to resist rolling action, of which there is remarkably little.

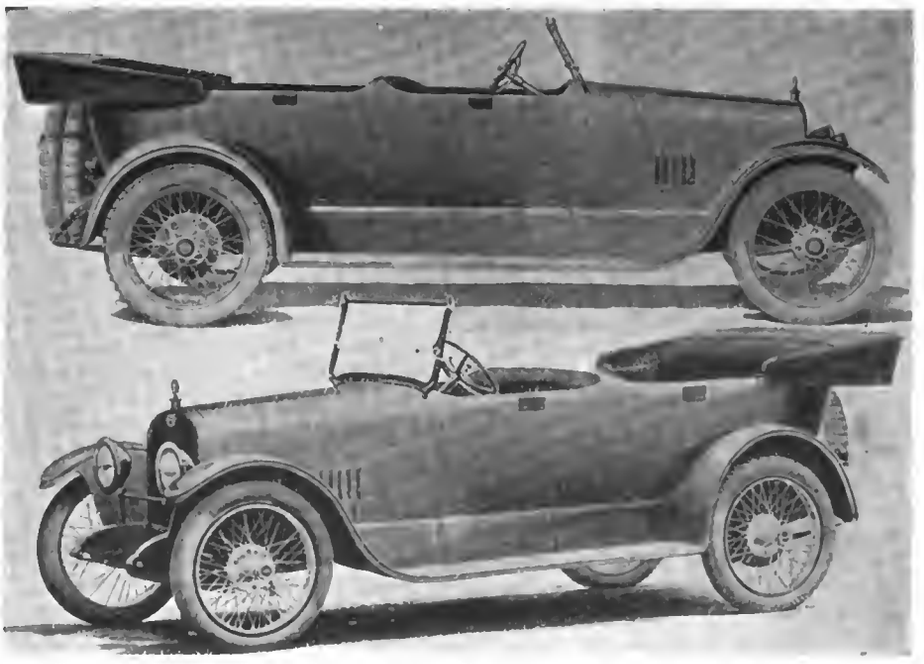
In the seat cushions the Marshall spring is used. This has been developed for high grade furniture and now makes its first appearance on an automobile. The usual nucleus of a cushion is a couple of wire frames separated by a number of large springs coiled to a big diameter. If one of these springs gives way under the stress of use, there at once appears a hollow in the cushion, because each spring supports a large area of leather. In the Marshall construction the springs are much smaller and a great number of them are used. Each little coil is sewn up in a canvas container and scores of the springs are bunched together. A little padding then goes over the top and then the leather, so that every square inch of the cushion has individual support. Owing to the number of springs used each one can be soft, so that the effect is equivalent to a pneumatic cushion, though with less bounce. Another thing that makes for comfort is the shape of the seats, for this has been worked out so that the height and depth of each and the angle of the back is just



The roadster model sells for $1,650, the same price as the seven-passenger touring car

right. The rear seat suits the woman of average stature, the front seat the average man, and to allow for variations in the stature of the driver, the pedals are adjustable over a wide range. It is specially noticeable in the front compartment that the wheel and the door are in such proportion that any man can get into the driving seat from the left side without any difficulty, even when wearing a heavy coat.

Speaking of the driver's comfort leads naturally to a comment on the placing of the gear shifting and brake levers. These are within easy reach without stooping or leaning forward, and the two are far enough apart to make the chance of a mistake extremely slight. The gear lever is carefully fitted so that it moves easily, and the clutch needs only a light spring. Also the long flat rear springs and the Hotchkiss drive cause very little variation in the relative positions of the brake parts, so that there is little lost motion on the service brake pedal and a fairly light pressure exercises great stopping power. The frame is well narrowed in front so that there is a good turning lock despite the 127-in. wheelbase.

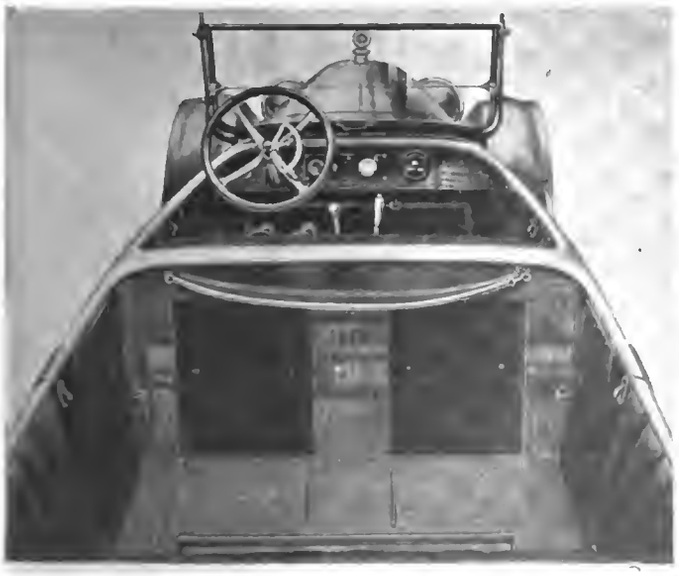


Two views of the Jordan seven-passenger touring car, which sells for $1,650

High Finish in Body

Returning to the body once more, it may be mentioned that the upholstery is all of the best hand-buffed leather, a thick yielding quality with the dull gloss that contrasts best with the highly polished mahogany work on other parts. The back of the front seat contains the folding seats which drop into compartments and are covered by leather curtains or flaps. All the rest of the seat back is light mahogany and is a regular custom style of job made of many pieces with matching grain. The center cowl effect is obtained with the minimum sacrifice of space the front corner of the rear door being cut into the edge of the center strip.

Across the back of the front seat is stretched a robe strap with a snap fastening, this being of brown leather to match the mahogany; there is a thick, soft tonneau carpet and a substantial foot-rest. These petty details of body equipment are mentioned so particularly because each one contributes to the completeness and very real luxury of the whole. It is in the choice of such detail that the Jordan has striven to raise itself into the custom-built class. The sloping windshield for example, is not just a windshield. Its proportions suit the car, its hinges work smoothly and the top sockets snap readily into place.



Plan view of the Jordan, showing smooth lines

In order to maintain the standard set the Jordan company is not planning a big output, but will use a very rigid inspection. In the main floor of the plant there is a special spot upon which each car has got to stand before it goes to the shipping bay. After every detail has had its individual inspection, after the car is reported as O.K. it has to undergo a final, painstaking checking up to insure that nothing has been overlooked.

Touring, Roadster and Sporting Models

There are three models listed, the first being a seven-passenger car and this will be ready for delivery starting Aug. 1. This car normally has wood wheels and sells for $1,650 so equipped, wire wheels costing an extra $100. Next there is to be a sporting model four-seated car on the same 127-in. wheelbase but lower built and this will have wire wheels and will cost $1,750. Finally the range is completed by a roadster costing the same as the seven-passenger model.

All types are fitted with Firestone rims and have 35 by 4½-in. tires, those on the rear wheels being of non-skid pattern while a Moto-Meter is included among the equipment.

Radiator Cap Fittings

A SCREW thread is not the best thing to use for attaching a radiator cap. It is almost universal because it is the simplest form of attachment and it is cheap, but it is not nearly so convenient as a snap attachment like, for instance, the Packard design.

The cap should be held on so that it cannot be dropped and lost and there are many ways of making cheap, secure caps without a screw thread. Even when a screw is used there seems no reason why a short length of chain should not be fixed to the inside of the cap and to some interior place on the radiator, so that the cap, when unscrewed, would still be attached to the car. A chain might rattle perhaps, but if it did a bit of plaited fishing line would serve the purpose almost as well and would last for years.

Conveyor System Aids Big Production

Progressive Assembly Methods Cut Time and Labor—Three Classes of Chain Assembly—Group Assembly Also Used With Success—Manufacture by Time Table

By Leslie V. Spencer

HOW has it been possible for car manufacturers to produce nearly as many machines during the first half of 1916 as were built in the entire previous year, without adding to their factory areas or equipment anywhere near in proportion to the increase in production? The answer is that most of the large producers have adopted some form of the moving conveyor assembly scheme. This is the last word in automobile production, and is a great step forward, putting the building of motor vehicles on the same plane with the scientific manufacture of any one of hundreds of articles of commerce in the up-to-date plants of to-day.

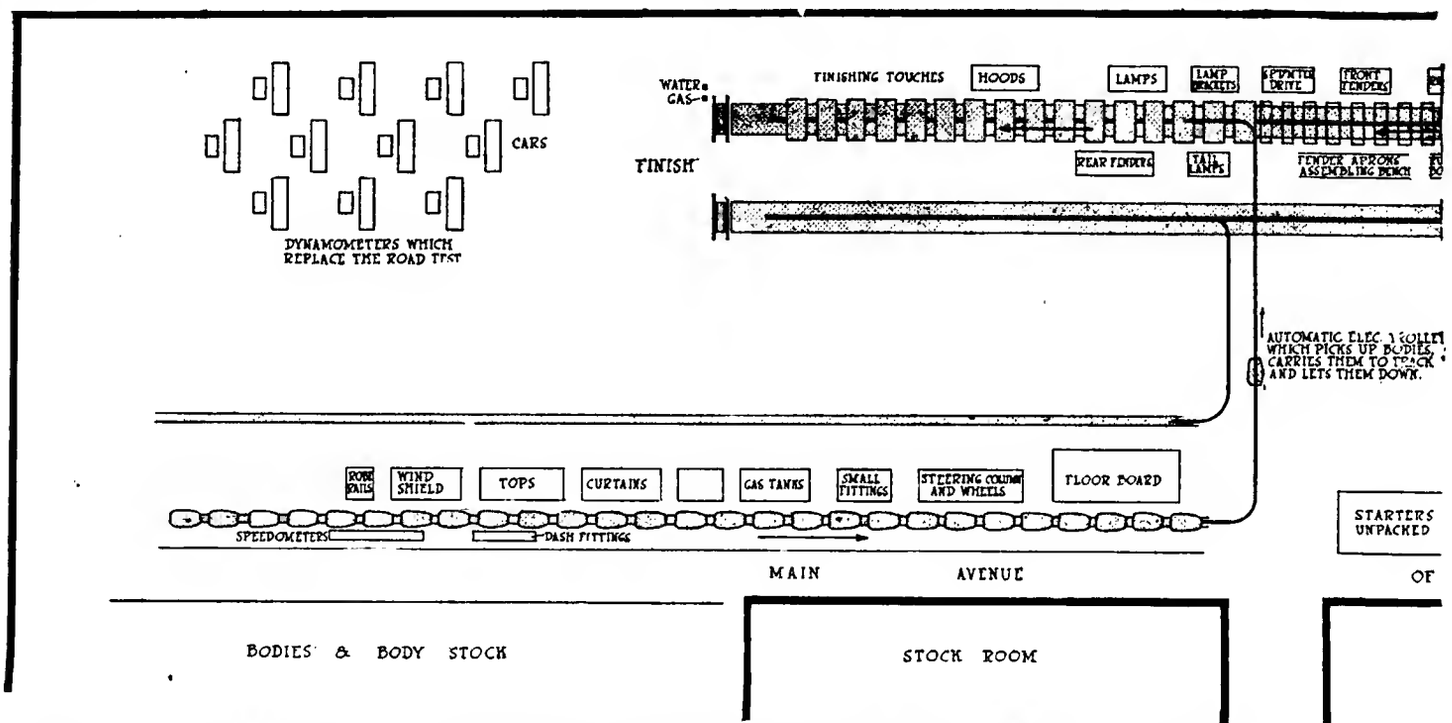
Few of us stop to think, in the present day of million-car-a-year output that only a few years ago it was an unheard of thing for any factory to turn out as many as 500 or even 300 cars a day. In 1912 Ford, always the leader in quantity output, built 78,440 cars, a daily average of about 260 cars for a 300-day year. Now we think nothing of Ford's 2000-a-day output, Overland's 1000-a-day schedule, nor of the large number of plants making well over 200 daily, such as Buick, Maxwell, Studebaker, Chevrolet and Dodge.

In all of these large-producing plants some form of the moving conveyor assembly arrangement is applied, and also in many of the plants that are very large producers, though not as yet in the 200-a-day class. This simply indicates that the industry recognizes the economy and large output possibilities of the moving chain method, and has taken it up almost universally where it is desired to build cars in any sort of quantity. In fact, the moving assembly is proving a big saving in cases where the output is as low as fifty cars a day.

Although there are three types of chain assembly, each best adaptable to certain classes and kinds of cars, the general scheme of all is the same, in that the chassis starts as a bare frame, and as it moves past the various parts, these are fitted to it by men who have specialized in the mounting of this one thing and know just how to go about it for quickest application. At the beginning of the assembly line are the piles of axles, driveshafts, springs, brake rods and other smaller parts. Each is far enough removed from the next so that there is time for the placing of one before the next goes on, unless they are parts whose application does not interfere, in which case two gangs, or even three may be working on the moving frame at one time. As the chassis moves along, other parts are added, until at the other end the machine has grown into a complete automobile ready for the road. In most cases, this moving scheme does not even except the fitting of the body—it is put in place just as any other part while the relentless chain moves steadily forward.

Three Classes of Chain Assembly

Chain assembly equipment may be divided into three classes, as stated, with respect to the method of carrying the car-in-the-making along. The Ford method is one way. In this case there are two iron rails on which the axles rest, and these slide along as the chain moves, requiring no truck for carrying the chassis even though it has no wheels of its own as yet on which it could move. Others of the big producers utilize the method of mounting the frame on a conveyor truck which is the car's constant companion until it reaches the finish end of the chain, a completed vehicle. In



Diagrammatic plan illustrating the layout of the Maxwell progressive system of manufacture and assembly which enables this plant to turn out in excess of 40,000 cars in 6 months

the third modification, the chassis is carried on a conveyor truck until it reaches the point where its wheels are attached. Then it finishes its growth on its own tires, being pulled along by a chain, however, with one of the wheels running in a guide groove to maintain proper alignment.

Obviously, each method has its advantages, and it would be incorrect to say that any one is better than the rest. The size and shape of the factory buildings, the type of car and the methods of assembly all have a bearing upon which equipment is used. If the building is long and narrow, pulling the cars end to end on their own wheels is allowable, because there is sufficient length to the conveyor to permit of this arrangement of the cars, but, where a larger number of vehicles are to be drawn along, they are carried on the conveyor trucks at right angles to the chain, affording a chain of given length a greater capacity than if the cars were end to end. At the same time, however, this adds somewhat to the width of the required space. Paige, Hudson, Overland, Studebaker, Dodge, Reo and Saxon are good examples of long and narrow plants that lend themselves to the end-to-end method on the car's own wheels, while the long and wide assembly building of the Maxwell company is admirably adapted to the type where the cars are side by side.

Aside from the room which the type of moving assembly in which the chassis is carried at least part way on its own wheels takes up, this method has the advantage of eliminating the conveyor trucks which are not only a big item of expense but add to the weight which the chain must pull, and hence to the necessary power. Besides, some scheme for returning the empty trucks back to the starting point must be devised, in most cases this problem being solved by the use of a tunnel under the conveyor, another chain pulling the empties back to the point where they are automatically returned to the assembly track, ready for reloading. However, most production men believe this to be the fastest method of progressive assembly, since it gives the conveyor the greatest capacity.

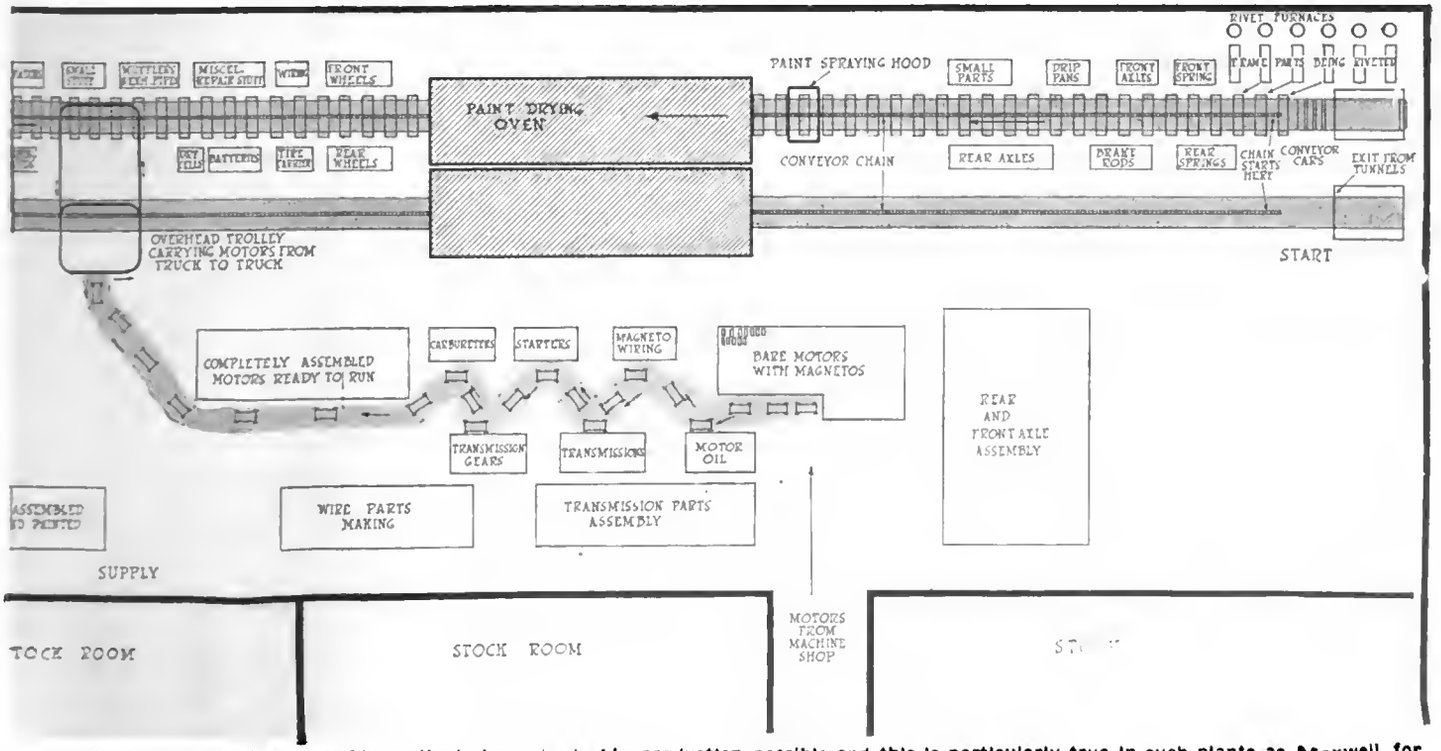
Some Have Group Assembly

There is another point for argument between these two types, this being as regards the convenience of working around the moving chassis. Those who have the end-to-end equipment believe that the workmen have more chance to get to all sides of the moving vehicle than would be the case if the chassis were carried at right angles to the chain. However, in the latter case, sufficient space is usually allowed between each chassis, so that the men have room enough to do their work.

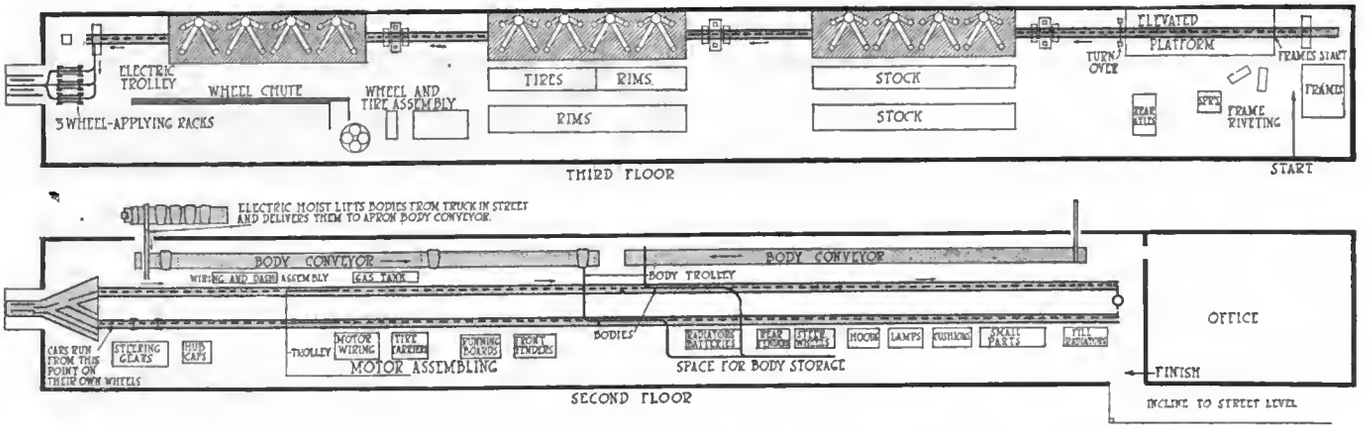
It might be well here to call attention to the fact that moving assembly of this kind is not favored by every large factory, such well-known plants as the Cadillac and Chalmers adhering to what might be termed group assembly. In this scheme crews advance the chassis step by step and each individual man is usually familiar with all of the operations required in that step. This is in contrast with the usual moving chain assembly proposition, because in the latter each man has a particular bolt to tighten on each chassis or a special part to put in place, and after he gets that one thing done, his responsibility, so far as that particular machine is concerned, is over. Where group assembly is employed, each man is familiar with all the operations that are necessary to carry the car one or more steps farther toward completion.

It is argued by those who favor this method that the men become more intelligent individuals and less like machines, and hence a better assembly is obtained. They also think that when a man finishes the particular thing he is doing he will help some other in his own crew to the end that the part or chassis, as the case may be, may be advanced to the next crew as quickly as possible. There are, of course, other arguments both ways, but the march of progress of car production seems to indicate that the trend is toward the more machine-like method of moving the chassis relentlessly.

Of course, the big advantage of moving chain assembly are that it greatly speeds up the production by absolutely regulating the output in accordance with the speed at which the chain moves. The factory production man in charge knows how many men it requires to put together a given number of cars when the chain runs at a given speed, and if the demands of the sales department are for a greater number of cars, he can positively guarantee to turn them out by running the chain faster and if necessary, increasing the number of assemblers, granted, of course, that he is not held up for lack of parts. There is a limit to the capacity of any chain equipment, but the method takes a great deal of



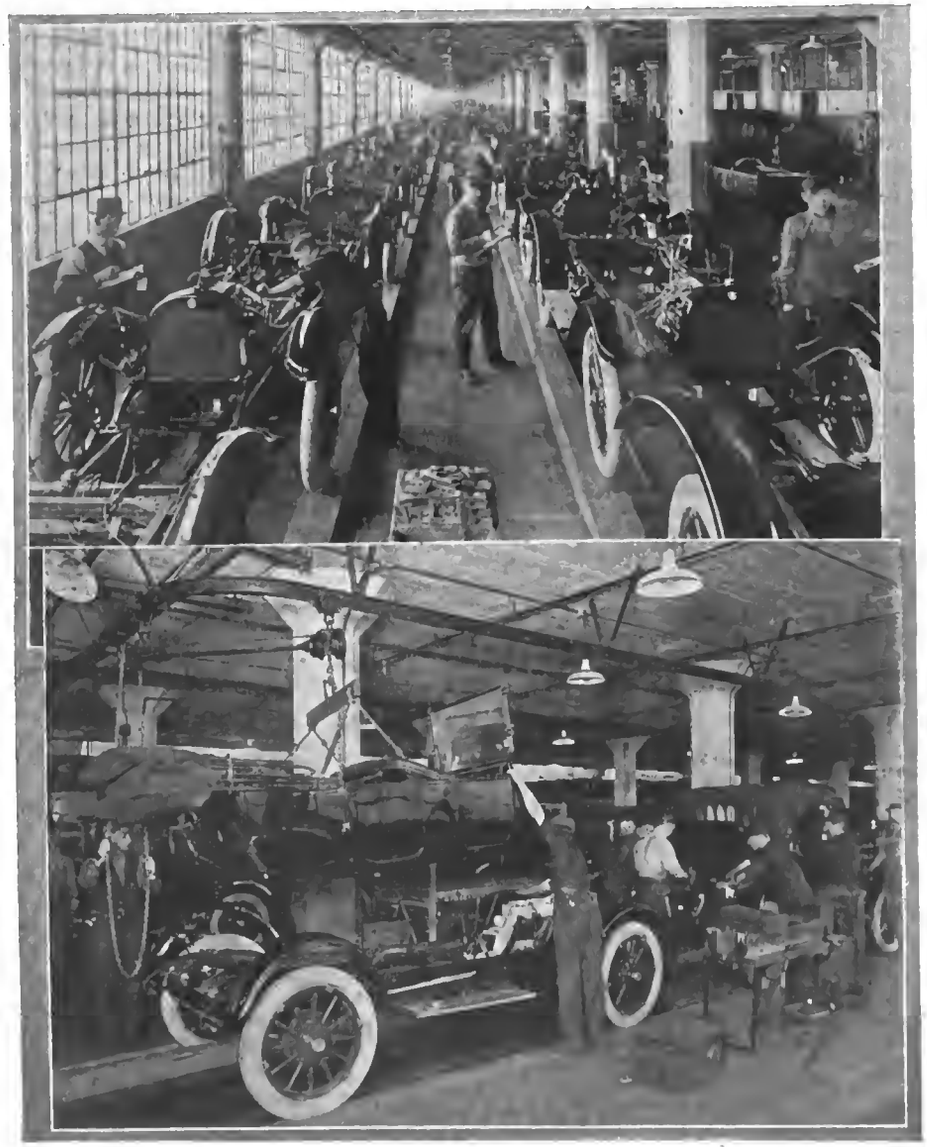
Modern progressive assembly methods have made big production possible and this is particularly true in such plants as Maxwell, for example, where the scheme diagramed above is used



Third and second floors in the Paige factory, where the chain system of assembly is employed

the uncertainty out of the production end of the business. As each man becomes more expert at doing his part, it has been found that the chains can be speeded up without materially increasing the number of men employed. The piecework system of paying the men is a big factor in increasing their efficiency, and hence the output.

Monorails play an important part in these modern assembly plants. All heavy parts are brought to the points where they are to meet the on-coming chassis by means of these overhead tracks, this applying to such units as the front and rear axles, engines and bodies. In some cases the work has been so far perfected that electric trolley systems are now installed which automatically convey the units from the stockroom or other point of supply, direct to the points where they are needed, over the moving chain, and hold them suspended ready for lowering into place with the least manual effort.



Men and methods in the Dodge plant which enable this concern to turn out more than 200 cars for every working day

In order that greatest general efficiency can be promoted, it is usually the practice to assemble as much to each unit as possible before it comes to the final chassis assembly, making it necessary to do the least number of operations on the moving embryonic car. Thus, the wheels come to the point where they are to be applied with the tires in place; bodies arrive with as much of the wiring on them as it is possible to place before they are attached to the frame; motors are possessed of all their equipment, with carbureter and ignition control rods waiting only to be connected to the steering gear to be entirely assembled, and so on. Several of the big plants even have machines for attaching the tires to the wheels, this being an example of how all parts of the manufacture are carried out with as much dispatch as is evidenced at the final assembly itself.

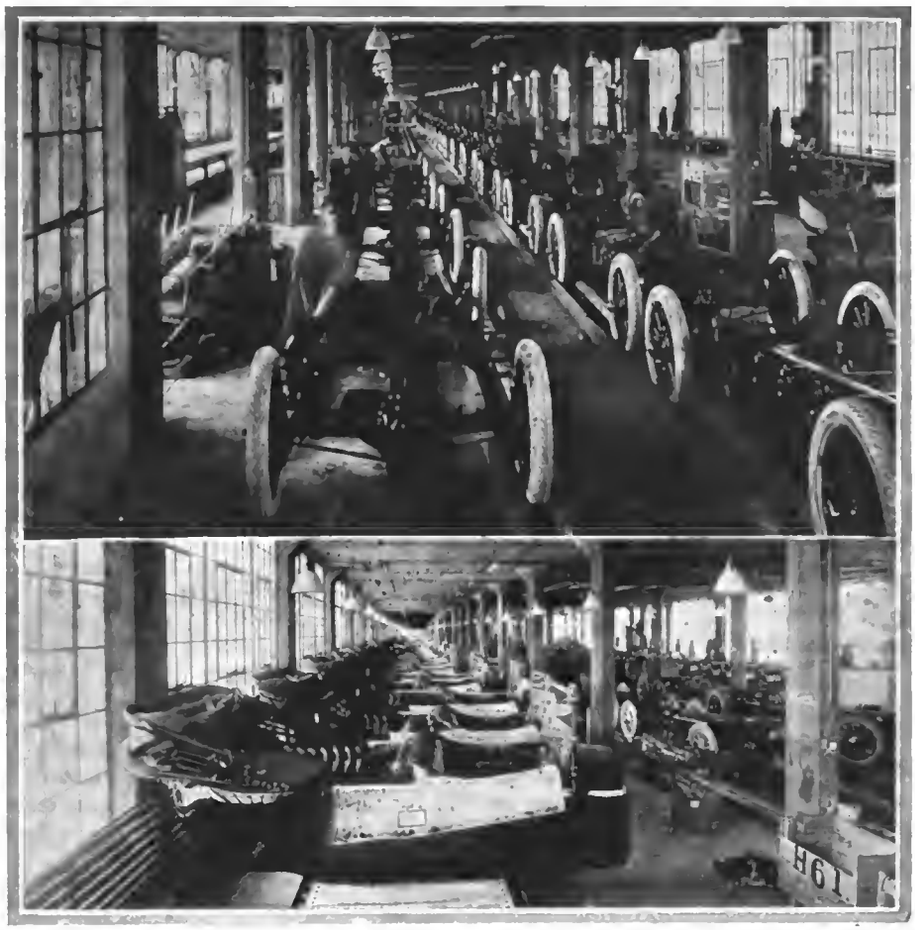
Where the scheme of carrying the car through its entire assembly on a conveyor truck is employed, great ingenuity has been displayed in devising means for quickly and almost automatically unloading the finished car from the truck onto its own wheels, to be driven to some other point under its own power for final test. Usually, when the conveyor truck gets to the unloading point, track, conveyor truck and automobile are all lowered sufficiently for the car's wheels to rest upon the floor, the truck that has been its companion up to this time dropping down, and automatically engaging the return chain that is to pull it back underneath the assembly chain to the starting point.

An advantage of the method where the wheels carry the chassis part of the way is that no mechanism for un-

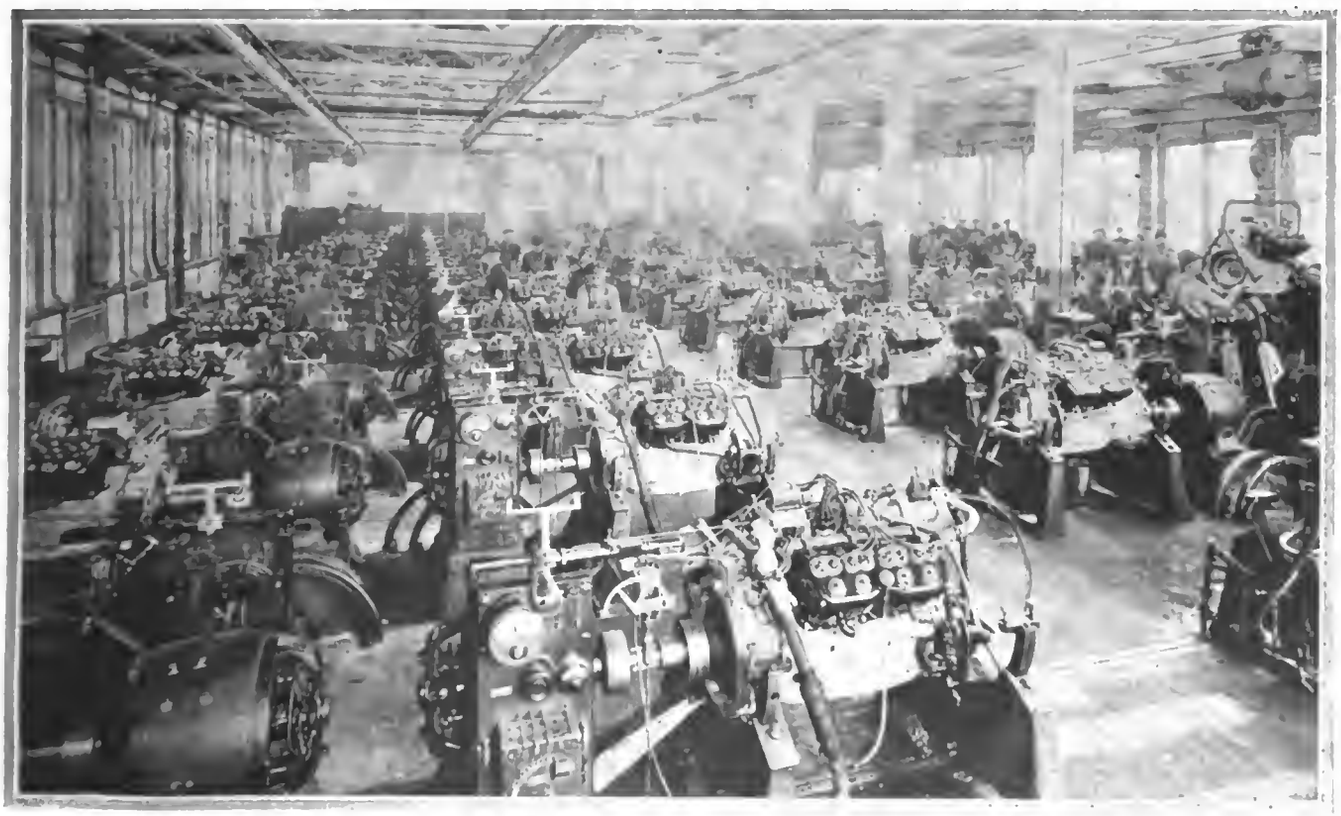
loading is necessary, but there must be means, however, for lifting the frame from its conveyor when the wheels are applied—usually an overhead hoist. Maxwell and Packard both have very good schemes for lowering the car onto its own wheels, the former lowering the whole thing to the floor level, whereas Packard runs the car onto an incline that engages the wheels while the conveyor truck drops below and out of the way. Paige might be mentioned as a good example of the method where the wheels are applied half way of the assembly journey and carry the car on to the end. An electric hoist picks the chassis, sans wheels, from the truck, lowers it to a wheel-attaching platform, and after these are in place, drops it through a chute to the floor below where the vehicle begins the last part of its journey on its own tires. Hudson utilizes cleverly a freight elevator for removing the car from the assembly truck. This does the work without damage.

Chassis-Painting Difficulties

Chassis painting presents some difficulties for the chain assembly. When the frame, axles, springs and other parts are put in place, they are minus paint, yet the chassis meets the body with its enamel baked on and dry. Thus the chassis is first painted and finished by inclosing a length, or sev-



Paige-Detroit chain system in which the body and chassis run along parallel lines on separate conveyor systems allowing of easy transference of bodies to chassis



In spite of big production schedules manufacturers are not neglecting to test every unit. Shown above is the dynamometer room of the Cadillac Motor Car Co.

Some of the 32,000 workmen which help to make the Ford production of 2000 cars a day a possibility

eral lengths, of the chain and track within a baking oven of sufficient length that the enamel, sprayed on just before the chassis enters this part of its journey, will be completely dry when the chassis emerges at the other end of the oven.

Drying Oven Takes Space

These drying ovens fill a great deal of the conveyor length, but they are proving a saving wherever used. In some cases there are several sections of oven between which are stationed men who spray the chassis ready for its next drying in the oven following. Packard has a very elaborate system of doing this, first applying the ground coat, then passing the chassis through a 120-ft. oven, following which a color varnish is sprayed on and then another oven 130 ft. long again dries the chassis as it moves along. Emerging from this heat, the chassis gets a clear varnish and is then conveyed on its assembly truck to a storage side track, where it waits usually about a day for complete drying before being placed on the final assembly chain. This, however, is one of the few plants where there is any wait between the time the frame first starts on the moving chain until the completed car comes off the opposite end.

Paige utilizes a 735-ft. conveyor on the top floor of its long main building exclusively for the assembly of the frame and axle parts and painting. Having added the axles, etc., the chassis gets its first priming coat in 2¼ min., and then consumes 1¾ hr. to pass through an oven 134 ft. long that is kept at a temperature of 180 deg. Still moving, it emerges from this first oven and the space between this and the next oven of equal length is traveled in 36 min., which is sufficient time at the speed at which the chassis is moving, to allow complete drying and spraying with the next coat for entrance into the second oven. These two ovens take care of the chassis paint and it is then ready for its wheels. Somewhat similar to this are the series of ovens, open spaces and spraying stations used by the Hudson company. Maxwell is an example of still another modification, the chassis receiving one thorough spraying coat and passing for a distance of 100 ft. through a single oven.

Speed of Conveyor Systems

To give some idea of the extent to which the moving chain assembly has been developed, the following data on systems in several of the well-known plants may be of interest.

Some Data on the Chain Conveyor Systems

PACKARD

Total length of moving chain, 1200 ft.
Speed of chain, 12 ft. per min.
Axles, motor and chassis paint, conveyor chain, total length, 792 ft.
Final assembly chain, 408 ft.
Capacity, final assembly chains, 40 cars at one time.

MAXWELL

250 cars in 9½ hr. per assembly track.
Length of conveyor, 800 ft.
Capacity at any one time, 100 cars.
Time for completing car from start to finish, 3 hr. 15 min.
Time for fitting a spring, 1½ min.
Fitting rear axle, 3 min.
Speed of chain, 40 in. per min.

PAIGE

Frame Conveyor

Speed, 18 in. per min.
Length of conveyor, 735 ft.
Load pulled by conveyor when full, approximately 75 tons.
Capacity at 18 in. per min., 150 complete cars in 10 hr.

Return Truck Conveyor

Speed, 20 ft. per min.
Length of conveyor, 760 ft.

Ovens

Three.
Length, 134 ft. each; width, 18 ft.; height, 6 ft.
Temperature, 180 deg. Fahrenheit.
Heated by steam.
Temperature can be raised or lowered to suit conditions of production.
Total chassis and final conveyor speed, 24 in. per min.

Double Body Conveyors

Speed, 10 ft. per min.
Length, 350 ft.

New Magneto Very Simple

No Wires on Armature—Aluminum Die Cast Parts Produce Light Weight Machine—No Carbon Brush

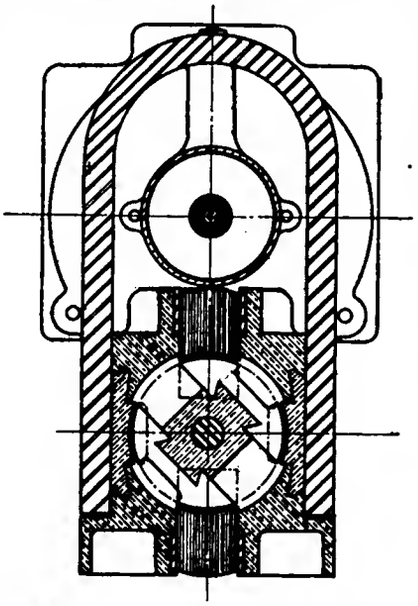
THERE are many different ways for making successful magneto machines and a new type just introduced by the Berkshire Magneto Co., Pittsfield, Mass., has a number of features differing from the ordinary.

Firstly, one of the principal claims made for this instrument is that while it gives a strong spark at low speeds and thus insures easy starting, the fierceness of the discharge increases at a lesser rate than the speed. It is, of course, possible to have too hot a spark. If the high speed discharge is very intense it has a destructive action on the points of the spark plug and the breaker points and puts an undue strain on the condenser and insulator.

Big Low-Speed Spark

Owing to the peculiar magnetic circuit of the Berkshire instrument it is claimed that the discharge current reaches one-half of its maximum amount at 50 r.p.m. while at 150 r.p.m. it has attained 80 per cent of the maximum intensity. This means that the spark produced at 150 r.p.m. is practically identical with the spark at 3000 r.p.m. or over.

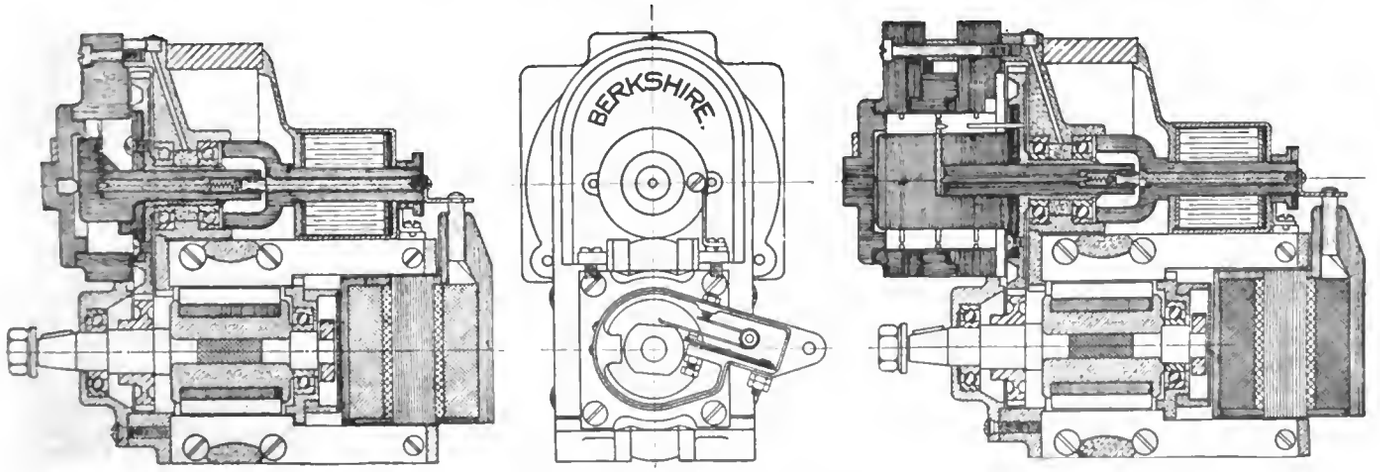
The reason for this action is not easy to explain, but some idea of the action may be obtained when it is stated that the magnetic circuit in the instrument is such that increasing magnetic flux caused by increasing speed meets with an automatic opposition. The action may be likened to that of the endeavor to force water through a length of pipe. The resistance to flow through a small pipe is such that above a certain speed the amount of extra pressure required to increase the flow is very great indeed. Another way of regarding it is to think of an electric condenser which can only hold a certain amount of electricity. With any condenser there is a limit of charge which cannot be exceeded. Similarly in the Berkshire magneto an increase in speed of 2000 per cent increases the flux through the armature by only 25 per cent.



Section of Berkshire magneto showing unwound armature construction. The two main pole pieces seen right and left, and the laminated, supplementary poles top and bottom are locked together by being cast integral with aluminum alloy

In the Berkshire magnetos there are no windings, either low tension or high tension, on the armature. In fact, the only revolving member which carries electric current is the internal portion of the distributer. The horseshoe magnet has two poles and two supplementary poles of soft iron are placed in the mouth of the horseshoe being magnetically insulated by aluminum. In the transverse section drawing of the instrument it can be seen that there are four deep grooves in the armature which means that the four iron portions of the armature correspond to the pair of main poles and the pair of supplementary poles in the field magnet. The iron parts of the armature are held together and magnetically insulated also by aluminum, the driving shaft and the armature pole pieces being locked together in a die casting process.

Returning to the magnets the supplementary pole pieces which are made of soft iron laminations are also die cast into their aluminum cases and it can be seen in the lengthwise section that the laminations are brought a good distance back of the horseshoe. It is between the ends of these projecting supplementary pole pieces that the coil unit is placed. This consists of a soft iron core having a low tension and a high tension winding, so there is a magnetic circuit from one of the supplementary pole pieces through the core of the coil and back via the other supplementary pole. When the armature is in position the magnetic circuit passes from one main pole through a segment of the armature to one of the secondary poles, thence through the core of the coil unit and back via the second supplementary pole, opposite armature segment and south main pole.



Left—Section of two-spark model of Berkshire magneto for four or six-cylinder engines. Right—Section of a four-spark model for twelve cylinders. Center—View from rear end with coil unit removed and breaker box cover taken off

Left and Center—Four-spark, twelve-cylinder Berkshire magneto. The left view shows the way the coil unit and breaker mechanism can be removed. Right—A two-spark pattern for four cylinders

It is now possible to explain the condenser effect of this circuit. When the armature is rotating the passing of the iron portion across the faces of the pole pieces sends a series of magnetic "charges" into the projecting portions of the supplementary poles. Through the air surrounding the latter a certain amount of magnetic leakage can take place, so we may regard the upper and lower supplementary poles as the inner and outer coating of the condenser. The air gap provides a constant leak or discharge resistance so that the flux which passes through the core of the coil unit cannot be increased above a certain point.

This construction lends itself very readily to the four-spark system and the Berkshire company expects to make a number of this pattern. The four-spark machine, of course, runs at half the speed of the two spark type. It is slightly lighter than the two-spark model. The range of Berkshire machines includes a two-spark pattern for four-cylinder engines and for six-cylinder engines, while four-spark models are made for four-, six-, eight-, and twelve-cylinders.

Intensity Restrained at High Speed

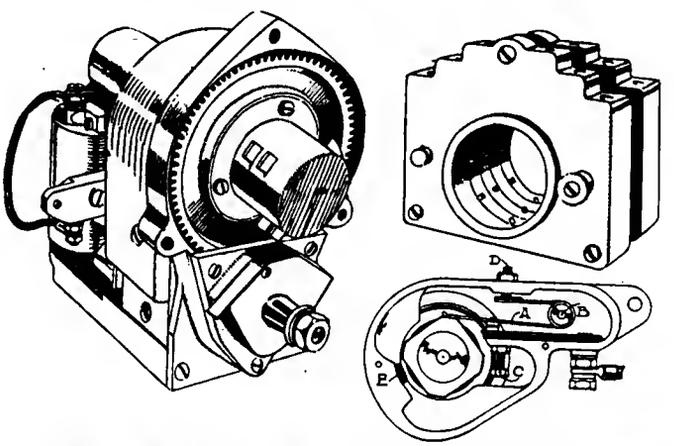
The makers point out that one great advantage of the four-spark system is that it provides a six-cylinder magneto with a very wide range of adjustment, 45 deg. being easily obtainable, this being 45 deg. on the crankshaft. The wide range coupled with the automatic limitation of spark intensity gives, in the Berkshire magneto, it is claimed, all the advantages of battery systems at low speed and of wound armature magnetos at high speeds with a practical elimination of the ordinary disadvantages of either.

Although they are making the two-spark type for use on engines already arranged of this kind of instrument, the Berkshire company believes very strongly in the advantages of the four spark. Fitted to a four-cylinder engine the four-spark machine only requires to run at half the speed of the crankshaft. With a six-cylinder engine at three-quarter crankshaft speed and at crankshaft speed with an eight, while the single magneto will fire twelve running 1½ to 1. The magnet used is a little larger and more powerful than would be required with a two-spark instrument in order to insure a strong spark at low speed but the self controlling action already explained allows the instrument to be designed for the slow speed spark since the possession of a hot discharge at 50 r.p.m. does not mean there will be an excessive current flow at 3000 r.p.m. or over. In every case the possible range of spark adjustment is doubled when the four-spark instead of two-spark machine is used.

Turning to some of the mechanical details of the machine this is made clear by the drawings and photographs. The breaker mechanism is rather interesting as the system of adjustment is somewhat novel. The spring *A* is one continuous piece of steel wrapping around the pin *B*, adjustment being provided at points *C* and *D*. The lower, insulated, platinum point is carried on a small strip of spring steel shown in the sketch, this being backed by a stout strip of red fiber. The upper screw *D* adjusts the tension of the breaker spring and the lower screw *C* controls the position of the breaker points. The whole breaker mechanism is easily removed for cleaning or adjustment. The coil unit can be pulled out by removing two screws and to have the parts in the condition shown in the photograph occupies something like half a minute.

Referring to the sectional drawings, it will be seen that a condenser is contained in a small round case and mounted on top of the upper supplementary pole piece, thence the high tension current goes to the central member of the distributer which carries a number of brass segments corresponding to the number of cylinders. In the outer part of the distributer are brass pins and between the pins and the rotating sectors there is no actual contact, the current jumping across a very small air gap. The safety gap is contained within the distributer and can be seen in the section of the twelve-cylinder magneto. The machines are characterized by light weight and extremely robust mechanical detail.

Electrically and mechanically the simplicity of the Berkshire magnetos renders them excellent manufacturing propositions. The solid, unwound armature, for example, can be made a close fit within the magnet without any difficulty, the coil unit is easy to wind and nearly all the non-magnetic parts lend themselves readily to die-casting.



The Berkshire magneto taken apart—A is one continuous piece of spring steel passing around the pin B, to the tension adjusting screw D. C is the breaker point adjustment and E a little wick lubricator which keeps the cam just greasy. The pins of the distributer are shown above and the sectors which spark to the pins in the view at the left

Peru Rear Axles in Two Styles

Easily Adapted to Car Makers' Needs—A Front Axle

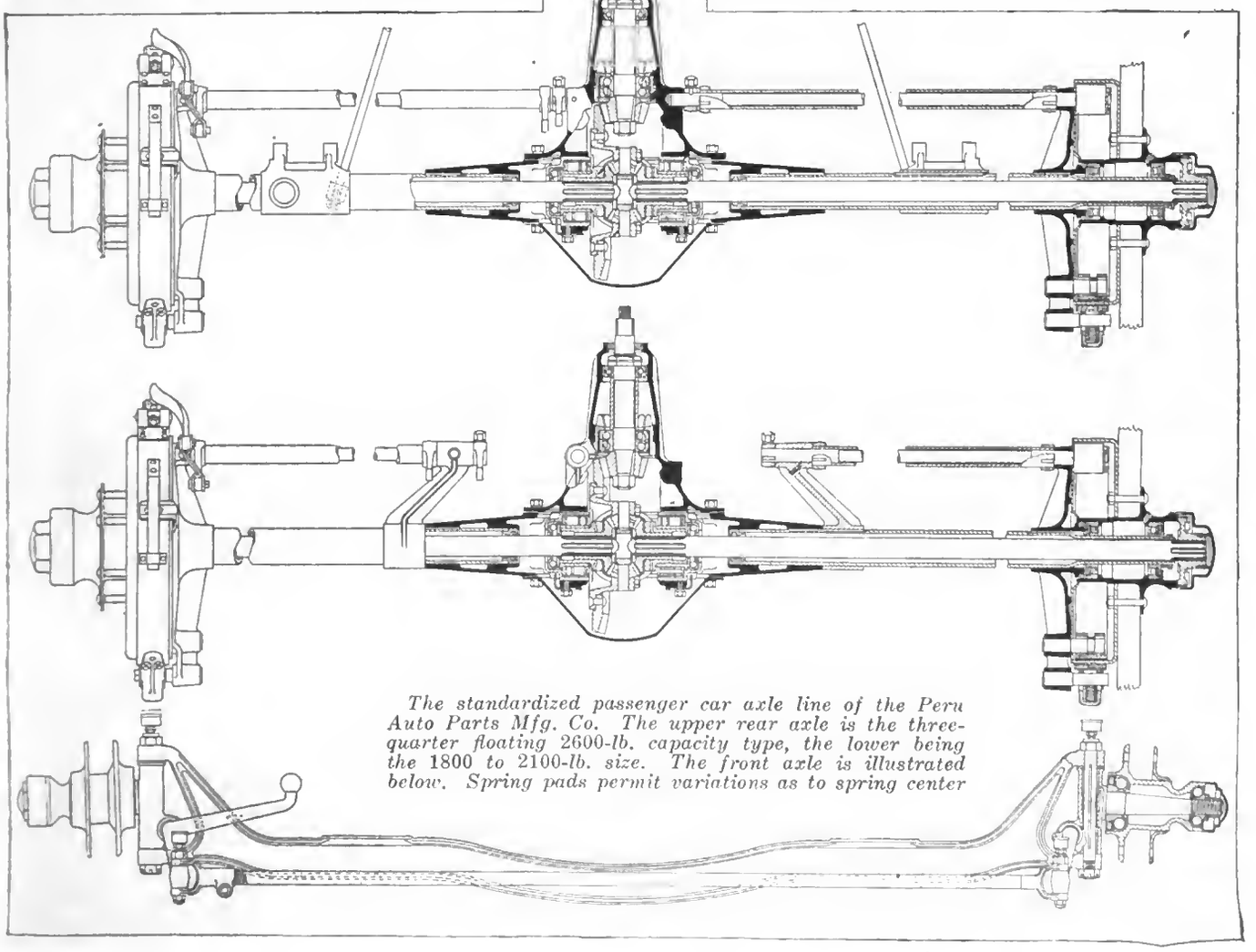
FOR current models the Peru Auto Parts Mfg. Co., Peru, Ind., is providing two styles of passenger car rear axle and a front axle. This is a standardized line, and, although fixed as far as fundamental design is concerned, can be varied to meet the fittings of different manufacturers as employed on their various models of cars.

The front axle is a conventional type, being a drop forged I-beam section from 1035 S. A. E. heat-treated steel. This steel has a carbon content of 0.35 per cent, from 0.50 to 0.80 manganese with maximum phosphorus of 0.045 and sulphur 0.05. The steering ball is forged integrally with the steering arm and cup and cone bearings are used in the hubs. The tie rod is of steel tubing having an overall diameter of ¾ in. and a wall thickness of 3/16 in. The spring pads are forged integrally with the front axle and they can be proportioned to accommodate variations in customers' requirements as to spring center.

The rear axles are made in two capacities; the 1800 to 2100 lb. size is the floating type and the larger, or 2600 lb. size, is a three-quarter floating. Both of these types are illustrated in the accompanying drawings. **The lighter axle, which is a floating design, has a malleable center housing with a pressed steel cover allowing for the removal of the differential as a unit without dismantling the axle or removing it from the car. A feature of this axle is that universal adjustment is provided for both differential and drive pinion. The wheels** are carried on roller bearings and the differential radial bearing is also of the same type with a ball thrust also provided.

As will be noted in the illustration, the pinion shaft is carried on a single row ball bearing at the forward end and on a double row ball bearing at the pinion. The reduction between the pinion and the ring gear is 4½ to 1. The differential is a four-pinion type and the ring gear is of heat-treated carbon steel. The drive pinion is nickel steel heat treated.

The side or driving gear of the differential are broached to take the standard S. A. E. six-spline axle shaft. Both these shafts and the pinion shaft are of high carbon steel heat treated to give them an elastic limit of 120,000 lb. The driving dog is of drop-forged steel which has specifications cor-



The standardized passenger car axle line of the Peru Auto Parts Mfg. Co. The upper rear axle is the three-quarter floating 2600-lb. capacity type, the lower being the 1800 to 2100-lb. size. The front axle is illustrated below. Spring pads permit variations as to spring center

responding to S. A. E. steel No. 1025. This is a 0.25 carbon content with 0.65 manganese, 0.045 phosphorus and 0.05 sulphur. This is pressed on to the axle shaft under hydraulic pressure and the drive is taken through six splines.

The brake drum is of pressed steel and has a diameter of 12 in. The brakes are double, having both an external contracting and an internal expanding set of 1¾ in. face width. A choice of connecting lever positions is provided, thus allowing for a wide range of variation in the actual mounting of brake linkage. There is also a wide permissible variation of possible spring centers as these are furnished according to the requirements specified and the type of spring hanger is also optional.

The construction of the axle leaves a considerable length of clean tube and it is this which permits of the variation in mounting of the spring pad. The tube itself is of heat-treated carbon steel and it is provided with thrust rods and diagonal brake rods to take care of the stresses which would occur in cars with long propeller shafts. The axle can be furnished for either a unit power plant, Hotchkiss drive or with flanges for rear axle transmission. When furnished for long propeller either a ball joint or a yoke connection can be provided as desired.

Grease Leakage Prevented

One of the features of this axle which should appeal to owners is the special provision made to prevent leakage of grease from the differential housing down along the axle shafts to the brake drums. There is a packing box located at the inner end of the tube which holds the lubricant in the gear well and any grease which should work its way past this would still be held separate from the brakes by the arrangement at the outer extremity and the provisions for tightness at the outer and inner bearing. The argument against the floating type of axle is that the bearing spread is often narrower than it should be. This objection has also been overcome by having the distance from center to center of these bearings quite far apart.

The three-quarter floating, 2600-lb. axle is similar in some respects to the smaller model as far as materials are concerned, although this larger axle is fundamentally a different design. There is a malleable center housing with a pressed steel cover and this arrangement, as in the smaller design, permits the removal of the differential as a unit without taking down the axle. There is also provision for adjustment of both the differential and the driving pinion, allowing wear to be taken up in any direction and to compensate for play between the gears after wear.

Roller bearings are used in the wheels. The differential radial bearing is a roller bearing also with thrust taken through a separate ball thrust bearing. The pinion shaft mounting is similar to that in the smaller axle as there is a single ball bearing at the forward or driving end with a double row ball bearing to take the load and thrust at the pinion. The ratio in this axle on the standard model is 4 to 1 and the differential is a four-pinion type.

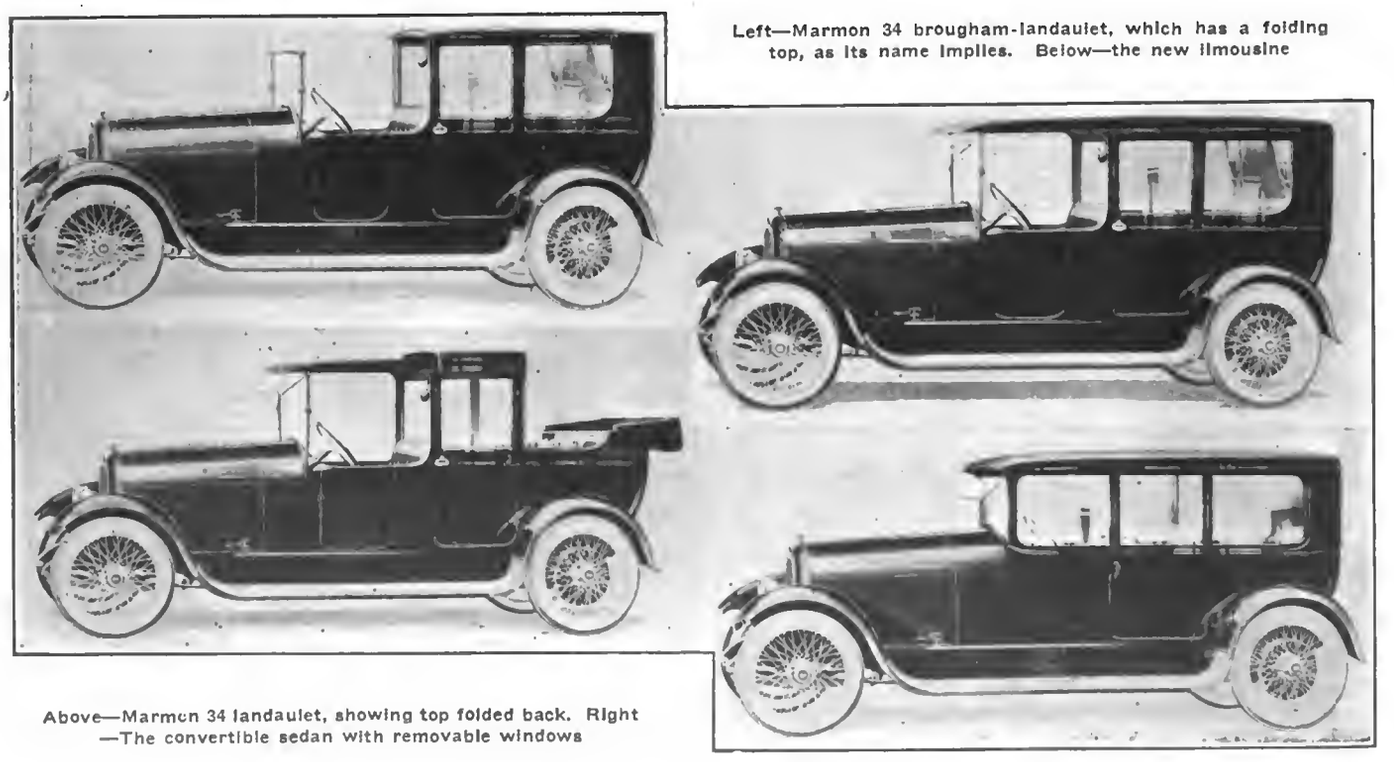
As regards materials, 3½ per cent nickel steel is used for the pinion while the axle shafts are of special chrome nickel steel made from hot-rolled, heat-treated stock. The pinion shaft is of high carbon steel, heat treated, and the axle tubes are also of carbon steel, heat treated. The side gears are broached to take the standard S. A. E. six-splined axle shaft and at the outer end the hubs are keyed to the axle shaft and drawn up on a tapered fitting. The brake drums are 12-in. diameter pressed steel with both an external contracting and internal expanding shoe. The face width of the shoes is 1¾ in.

Leeway for the Car Builder

As in the smaller axle, the designers have been careful to leave the car manufacturer as wide a limit as possible in mountings of springs and brake gear. The spring centers on this axle can have a variation within any reasonable limit and the type of spring hanger can be as the purchaser desires. The axle is provided with fittings for rigidity, having truss rods and diagonal brace rods for long propeller styles. The axle can be adapted to the unit power plant, Hotchkiss drive or rear axle transmission unit.

Marmon 34 in New Closed Body Styles

Left—Marmon 34 brougham-landaulet, which has a folding top, as its name implies. Below—the new limousine



Above—Marmon 34 landaulet, showing top folded back. Right—The convertible sedan with removable windows

The History of the Pneumatic Tire—11

Introduction of the Palmer Single Tube Tire—The Morgan & Wright Double Tube Hose Pipe—The First Puncture-Proof Types and Attempts with Pneumatic-Solids

The History of the American Automobile Industry—38

By David Beecroft

THE single tube tire, properly so called, was the Palmer type first made in 1892 and on the market in 1893 in which there was a homogeneous structure composed of a definite thickness of sparsely arranged cords or threads with the air tube inside and a thread outside with a valve for inflation. It possessed none of the characteristics of the hose pipe and its action under air pressure was to contract upon the rim and materially assist the same in folding it firmly thereto.

The Morgan & Wright Tire

The Morgan & Wright tire was what might be characterized as a double tube hose pipe, meaning that it was a hose-pipe tire in point of structure, with a slit 6 or 8 in. cut longitudinally on the inner side of the tire for the purpose of inserting a separate and separable air tube, said air tube having closed ends overlapping in the tire when in use. These two types last mentioned were the prevailing and mentioned constructions in use at this date with the so-called G. & J. clincher type of tires.

Between the years 1893 and 1900, Palmer tires or single tube tires and Morgan & Wright or double tube hose pipes were the accepted types in use on bicycles made in the United States, the Palmer occupying the high-grade field.

Quick Repair Methods Developed

Methods of quick repair were developed such as small syringes with needle points by which a thick gum could be introduced through a puncture and stop it by forming a wad on the inside. The tires were made of small diameter and therefore not likely to burst because the service was light and the inflation not great. So practically did these single tube tires perform their work that then as now the bicycle rider did not, as a regular thing, carry a repair kit.

Then, as now, however, to make security from puncture doubly sure, the protection strip of rubberized canvas between the air tube and tread portion of the casing was frequently suggested and was put on the market by the N. Y. Belting & Packing Co. in 1892, and Latulip of Syracuse used a strip of rawhide.

The self-healing tube made its appearance in 1892. The Luburg Mfg. Co. of Philadelphia brought out an air tube having an inner coating of viscous rubber which would close together after being punctured. This idea has been worked out in many forms since, some inventors putting this viscous rubber between two thicknesses of air tube material; others have rendered it better able to stop a large hole by mixing fibers of some kind, such as feathers, with this viscous material. The cost of this additional construction with its added weight was undoubtedly a considerable objection, and it seems not to have been common.

The First Puncture-Proof

The first puncture-proof tire to be publicly exhibited and to attract much attention was shown by Phelps & Dingle at a New York bicycle show in the winter of 1892-3. This consisted of an inner tube of printer's roll jelly which was elastic enough to close up an ordinary puncture so fully that very little leak occurred and which could be healed and permanently made tight by ironing it with a hot flat iron which would slightly soften the gum and join it together. The crowd around the Phelps & Dingle booth witnessing this wonderful solution inspired C. E. Duryea to do likewise and attract a similar crowd, which he did by pouring a half pint of pine tar disguised with citronella into a tire and inviting the puncture fiends to do their worst. Thus was invented the liquid self-healing device afterward patented by Duryea and used by the Buffalo Specialty Co., makers of Never-Leak, to control the self-healing business for 17 years.

The Pneumatic-Solid Type

In 1892 G. A. Burwell, afterward with the Lozier company, Cleveland, Ohio, invented a pneumatic tire, which, when deflated, served as a solid. This idea was frequently brought out and was exploited fully 10 years later by Munger for automobile use. Every attempt, however, met with failure because inventors would not recognize the unavoidable fact that the circumference of a tire is longer than its base. When deflated, the circumference rests on the part of the base prepared to receive it, but, being longer, there is an excess of material which must be gotten rid of and this can only be done by allowing the circumference to slip on the base or by folding in ridges.

The Rostrum

Likes Underslung Frame Design

EDITOR THE AUTOMOBILE:—Please publish an illustration of the Harroun heavy fuel carbureter, describing action, and give address of manufacturer.

2—The Mercer Automobile Co. built a car in 1915 similar to the previous model. Was it known as model M?

3—Is the Norwalk Motor Car Co. still in business? If not, when did they fail and where can parts be secured?

4—Why has the underslung principle been lost sigbt of by the prominent manufacturers? Was this construction more expensive or was there little demand for such a car? It did not appear freakish to me and was really as good looking as the best when on the market. It would appear that the present body designs could be carried out perfectly on the underslung car.

Anheim, Cal. R. E. H.

—The Harroun heavy fuel carbureter may be described as consisting of a type of carbureter baving the center of the mixing chamber inclosed in an exbaust jacket and thereby maintained at a very high temperature. THE AUTOMOBILE has no information regarding the details of the latest type. The manufacturer is the Invincible Mfg. Co., Pittsburgh, Pa.

2—M was a 1914 car. The 1915 models were radically different.

3—The Norwalk Motor Car Co. of Martinsburg, W. Va., is in a position to supply parts, altbough it has discontinued the manufacture of cars.

4—Tbe underslung principle has prohably failed to gain because it introduces considerable difficulties in design. Furtbermore, it does not actually lower tbe center of gravity. Tbe heavy part of the cbassis is the engine and this must he a certain distance above the ground to give proper clearance. This means that the center of tbe crankshaft is at a certain height and the driveshaft to tbe rear axle must be at the same beigbt. It is necessary to allow certain space for spring movement, so the position of the floor of tbe car relative to the ground is really settled hy the diameter of the flywheel. In the underslung car the frame is very low, the engine, transmission, etc., being high with respect to it and the body adapted to suit. With the ordinary car the engine and transmission stay in tbe same place wbile the frame is raised. It is easy to build an underslung car of the roadster type if the engine is well forward so that the flywheel is hidden bebind a sloping foot-board and room for the rear axle to move up and down is readily obtainable helow the rear deck. When the endeavor is made to work in the five-passenger body all sorts of trouhles commence.

Data on Dyneto Ford System

Editor THE AUTOMOBILE:—I have a Dyneto single-unit lighting and starting generator which was on a Ford. I want to use it to charge storage batteries using an electric motor to drive it. I will have some 12-volt and 6-volt batteries to charge. This being a 12-volt system, how will I reduce it to charge 6-volt batteries? Please give wiring diagram.

2—Where can I get a cut-out and an ammeter for this?

Nocona, Texas. R. A. F.

—It is not necessary to do anything to the Dyneto generator in order to charge 6-volt batteries. A dynamo which will charge a 12-volt battery will also charge any other battery of a lower voltage. In cbarging stations it is customary to use 50 or 100 volts to charge 6-volt batteries.

2—You can use the starting switch as a cut-out and you can obtain a suitable ammeter from the Dyneto Electric Co., Syracuse, N. Y.

Information on Horsepower Tests

Editor THE AUTOMOBILE:—Are all engines run at the same revolutions per minute when testing for horsepower?

2—At what speed did the model 75 Overland run to test out at 15.63?

3—Can you give specifications of the new four-cylinder Buick, and rated horsepower.

Helena, Mont. L. N.

—No. The engines are run with the maximum load at wide open throttle and the numher of revolutions per minute will depend on the characteristics of the individual engine.

2—The horsepower curve of the Overland model 75 was published in THE AUTOMOBILE for May 18 on page 903. This shows a brake horsepower of nearly 30 at 2100 r.p.m.

3—Tbe four-cylinder Buick runabout, known as D-4-34, and touring car, known as D-4-35, sell at $650 and $665, respectively, f.o.b. Flint, Mich.

The motor used is of the same overhead valve construction as the present six and is 3⅜ hy 4¾, developing 35 brake horsepower. Other specifications include: 106-in. wbeelbase, Delco ignition, Stewart vacuum fuel feed, 31 hy 4-in. non-skid tires, three-quarters floating rear axle, semi-elliptic springs on both front and rear, the front being 30 by 2 in. and the rear 48 hy 2. The car has three speeds forward and is geared 4 to 1 on bigh. Both the runabout and the touring car are huilt along the lines of the six and include practically the same equipment.

Charging a 1911 North East Unit

Editor THE AUTOMOBILE:—I have a 1911 North East motor generator taken from a Michigan 40 using an eight-cell battery. We wisb to use this machine to charge hoth 6-volt and 12-volt batteries, driving the macbine with a 1-hp. gasoline engine. This machine, as a generator, delivers only 5 amp. at 20 volts, which is not large enougb current for economical charging. Using the motor terminals as a series machine the amperage runs up to 15, whicb makes the load too beavy for the engine.

Can I use a rheostat to cut the amperage down or can the connections be changed in the generator so as to give the desired current?

2—Kindly publish this motor generator winding.

Pecos, Texas. R. E. W.

—Current regulation in this machine is obtained by means of a differential field winding, commonly known as a bucking field. Furtber regulation is obtained by introducing, at a predetermined speed, an external resistance in the shunt field winding.

By connecting terminals numbers 2 and 4 the starter gen-

erator will operate, in charging, as a differentially wound machine, the reverse current cut-out and the external resistance being short-circuited. By connecting the positive and negative leads respectively of the storage battery to be charged to terminals numbers 1 and 3 respectively of the starter generator, the charging rate can be regulated by varying the speed. A switch or reverse current cut-out should be in the battery circuit.

2—Fig. 1 illustrates the internal windings of this starter generator.

Testing Armature for Short Circuit

Editor THE AUTOMOBILE:—A Studebaker 35 with Splitdorf magneto runs perfectly on battery at all speeds, but will not run on magneto unless at 15 or 20 m.p.h. When the owner slows down for any purpose he must switch to the battery or the engine will die. I have had the armature out and the circuit is not open anywhere. Magnets have been recharged and everything done which should put it in good condition. I have concluded that one or more coils in the armature winding are shorted out and will produce current enough only at high speeds. If such is the case, what kind of instrument is used to test an armature for a short and where may I obtain one?

2—Please show me by sketch what points to cut in on for an ammeter on this car which uses the Wagner system.

Hickman, Ky. F. M. C.

—It is pretty difficult to diagnose a case of this kind, as there are many different conditions that could bring about the trouble spoken of.

First, the cam may be placed in reverse position, and this may be tested by rotating the armature just when it is ready to break away from the fields. This distance is about 1/16 in. At the same time the breaker must be in the advance position and the platinum points about to open. The proper distance between these points at full break is 0.031 in.

Although you state that magnets have been fully charged, it might be well to check this item over again. Inasmuch as you cannot throttle down below 15 m.p.h., it is possible there is a slight battery current passing through the armature winding. This would have a tendency to partially demagnetize the magnets.

One method frequently used in testing an armature for open circuit is to place a good armature in series with an ammeter and 6-volt battery. By closing the circuit, a reading can be obtained in amperes, and this would be a proper reading for an armature in satisfactory condition. Then place a defective armature in series with an ammeter and 6-volt battery and a higher reading in amperes would denote a defect in the insulation of the wiring. In other words, there would be less ohmic resistance in a defective armature than in a good one.

2—A method for installing an ammeter on this car is shown in the diagram, Fig. 2. You will note that this is placed between the leads *A* and the relay *Y*. Two long flexible cables No. 10 should be used in connecting the controller finger *A* and the relay *Y* to the ammeter on the dash.

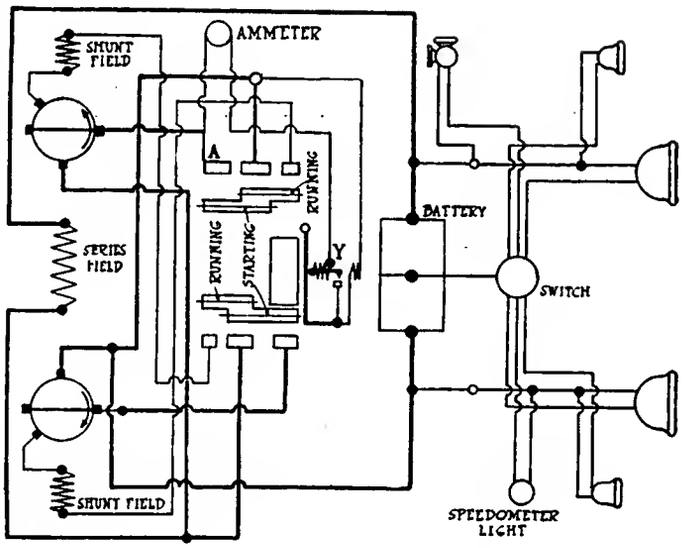


Fig. 2—Illustrating a method of installing an ammeter on the Studebaker model 35 between leads A and relay Y

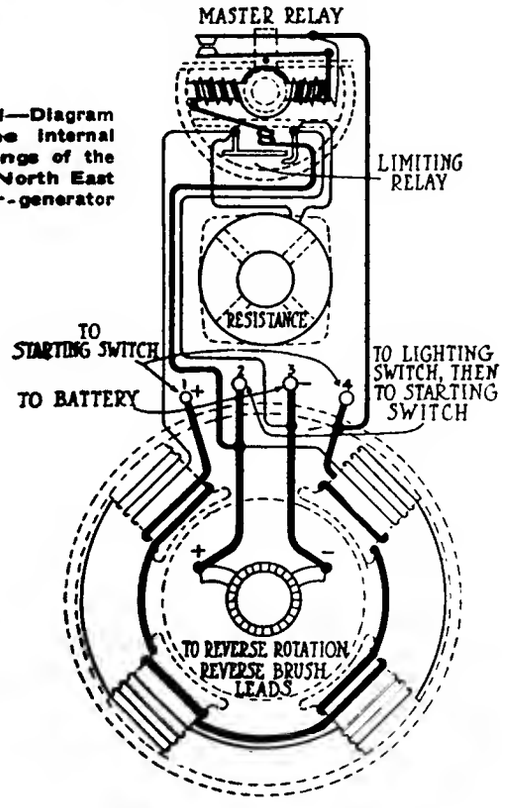


Fig. 1—Diagram of the internal windings of the 1911 North East motor-generator

Installing Starter on 1912 Hudson

Editor THE AUTOMOBILE:—Will it affect the operation of the Stewart vacuum gasoline system to put an air cock in the inlet manifold below the suction pipe running to the vacuum gas tank, said air cock to be operated from dashboard?

2—Kindly tell me the best way to install an electric starting and lighting system on a 1912 Hudson model 33.

3—Give names of several electric systems suitable for this car.

4—Will aluminum pistons decrease the vibration in this motor at high speed?

Lewes, Del. T. J. V.

—You might try the experiment, but unless the air cock is very small you will probably find that the vacuum tank will run dry every time you open the throttle wide.

2—The installation of the starting system on the Hudson model 33 will in no case be easy, which means that there is probably no particular system which would be especially suitable. A number of excellent inexpensive equipments are on the market and you would be best advised to apply to the best garage and repair shop in your district. They should be able to tell you the easiest system to fit from their own experience in applying equipments to other cars.

3—Answered under question 2.

4—It is doubtful whether aluminum pistons will make sufficient difference in the running of your engine for it to be worth while to make the change.

The Search for the Army Truck Wheel

(Continued from July 13, pages 60 and 61)

By Marius C. Krarup

USING the reference letters from Fig. 3, in the previous installment, it may now be shown that for steady running the advance of Q in Y is limited, though momentum may increase it usefully after a road shock.

If angle β is increased, l is increased but $R \sin \beta$ is also increased and the linear development of arc AC is increased. The general effect of increasing β from 45° to 60°, for example, which is near the limit where slippage of Q on Y may be feared, is ascertained by inserting the value of $\beta =$ 60° in the test formula. With $S_1 f_1 R$ and r unchanged l becomes 1.5 inch or 0.125 foot, and $\sin 60° = \sqrt{0.75} = 0.866$. Formula then gives:

$$t = \tfrac{1}{4}\sqrt{0.125} \times \frac{1000 \times 1.25 \times 0.866 + 260}{1000 \times 1.25 \times 0.866}$$

$$= \frac{2 \times 1.66 \times \pi \times 60}{360 \times m \times 1.466} \text{ second}$$

$$t = \frac{0.353}{4} \times 1.24 = 0.10943 = \frac{1.7467}{m \times 1.466} \text{ second}$$

The time for the fall of L has been increased from 0.08675 to 0.10943 second.

$$\text{As } m = \frac{2\ S \pi \beta}{360 \times t \times 1.466} = \frac{1.7467}{0.10943 \times 1.466} = 10.89 \text{ m.p.h.}$$

the velocity of the start has only been increased from 10.28 m.p.h. to 10.89 m.p.h.; indicating that this wheel system has a considerable range above the value of 45 deg. for β where vehicle speed on level ground cannot be strongly affected by speeding the engine, but this means also, of course, that acceleration and pulling power are similarly limited for any given design of the wheel and that it is useless to employ a motive power larger than required for maintaining Q at a position making β about 60 deg.

The relation of this power requirement to the value of L can be shown to make the weight of the load a smaller consideration than for normal driving wheels, provided the wheel dimensions and road conditions are such that f is not increased by the increase of the load.

On the other hand, acceleration and pulling power may be influenced largely by varying relations in the values for S, R and r, but such variations also affect the character of the wheel design. And the need of a design giving strength, compactness and lateral stability, as well as that independence of mud, sand and surface formations which goes with having S considerably greater than R and thereby raising the track for Q above the level of road troubles, imposes some limitations on design variations.

As acceleration depends less on ample power than on the ratio of L to $f \dfrac{(L + W + L_2)}{R \sin \beta}$, the weight moved can be very large if f is small and can be in form of a trailing load, T, making the total resistance $\dfrac{f\,(L + W + L_2 + T)}{R \sin \beta}$, and the suggestion is presented if this wheel type, with its relative independence of skillful manipulation of the clutch for starting, may not be especially adapted for the wheels of internal-combustion engine locomotives operating on rails with short trains of cars, as on feeder lines of railways, the traction being independent of slippery rails except in so far as the cause of slip in some cases also causes f to be increased.

To see how a minimum value for f affects starting and the conditions for acceleration, $f = 0$ may be used in the foregoing example, with $\beta = 60°$. The time for the unrestricted fall is here $0.353 : 4 = 0.088$ second, while $2S\pi\beta : 360 =$ 1.7467, and one has

$$m = \frac{1.7467}{0.088 \times 1.466} = \frac{1.7467}{0.128008} = 13.65 \text{ m.p.h.}$$

The change in the conditions for starting, as compared with the previous instance with $f = 0.20$ is not nearly as pronounced as it would be with normal wheels.

To a certain extent all these examples, and the test equation as well, represent an unreal condition, as in practice Q is brought to angle β by a gradual engagement of the clutch and has some angular speed when it gets there. Also, the vehicle begins to move as soon as the pressure of L passes beyond angle α, the angle of equilibrium with traction resistance. But the test formula furnishes a measure of the forces that influence operation without complicating the subject with inertia and acceleration.

The rate of acceleration for a perfectly uniform road condition is easily figured, but the maximum speed attainable is of course subject to many limiting factors in practice—such as tire resistance, air resistance—which it would be too difficult to introduce.

Taking it as unmistakable that the power transmitted from the engine by the rotation of Q takes effect as gravitation of load L at the point c, one has that the acceleration factor in the continuous tendency to falling, which the rotation of Q counteracts, is so much less than 32 ft. per second as $f \dfrac{(L + W + L_2)}{R \sin \beta}$ is smaller than L.

giving $g = 32\left(1 - \dfrac{f\,(L + W + L_2)}{L.\,R \sin \beta}\right)$

In the example, this makes $g_1 = 22.72$ ft. per second. But some difficulties are encountered in perceiving exactly how any value for g_1 can be applied to the vehicle speed, so long as it seems evident that acceleration must result in a gradual increase of β until power and resistance reach equilibrium and speed becomes uniform, and it may be sufficient here to note that the limits for acceleration seem to be determined by the power, if this is scant, but by the highest practicable value for β if the power is sufficient for making Q advance to the maximum angle, the load and the traction resistance considered.

The power required for moving $f\,(L + W + L_2)$ at the rate of $m \times 1.466$ ft. per second is

$$f\,(L + W + L_2) \cdot \frac{m \times 1.466}{550} \text{ horsepower.}$$

since 1 hp. raises 550 lb. 1 ft. per second.

And, with the values for the traction resistance factors used in the examples and a vehicle speed of 10 m.p.h. ($m = 10$), this gives one expression for the required power P,

$$P = 260 \times 10 \times 1.466 : 550 = 6.93 \text{ hp.}$$

It should be possible to figure the movement of Q representing the same horsepower and probably another formula representing the limitations of the system for application of power, giving the maximum as a function of load and other factors with a certain maximum β assumed. But so far the effort made for producing such a formula has run into complications, mostly due to uncertainty in grasping the exact mechanical nature of the work done by Q. Without attempting a formula, it seems plain enough that natural acceleration will permit considerable road speed if the engine power is sufficient to produce a large β, and that even a small β will produce vehicle movement under circumstances

which would require an exceedingly low gear with normal wheels as well as perfect adhesion in the road contact.

Rough roads, upgrades, downgrades, braking, slippery roads and interchangeability with normal wheels are factors which were mentioned before as representing other conditions which the composite wheel should meet if it is to be considered.

Little need be said about the effect of roughness of the road surface, as practical tests only will satisfy. While the composite wheel has more adaptation to roughness than the normal wheel and must tone down the horizontal component of shocks, it must also re-adapt itself to the running after a shock, and the total effect is not easily realized mentally. As in the case of normal wheels, road obstacles of considerable size and rising sharply from the surface can only be overcome readily by momentum. But the retardation in such cases will mainly affect the component Y, while the vehicle continues going forward and is liable to bring β momentarily to almost 90 deg., whereafter Y, with its small weight, probably will be readily turned over and carried along without any injurious impacts, provided the central device in the wheel (see Fig. 1) maintains steady contact between the two components.

The Action on Grades

The efficiency on upgrades is the worst operative feature in the wheel if speed is the requirement, because the grade reduces the leverage with which the gravitation of the load can operate to overcome traction resistance. But ability to get up, if only at a crawl and even if the grade is slippery, is the compensating advantage. If DA, Fig. 4, represents a grade of γ degrees, the maximum operating angle is reduced from β to $\beta - \gamma$, and the leverage is reduced from $R \sin \beta$ to $R \sin \beta - S \sin \gamma$.

On steep grades f is fortunately as a rule low, because sand of the kind producing a 20 per cent f does not stay on hills and moisture also is drained off. If the angle γ means a 15 per cent rise and the traction coefficient proper is 5 per cent, the f with which the total traction resistance on the hill must be figured, becomes 0.20, as in the examples relating to traction on the level, but the reduced leverage must make progress slower. In the tractors with propulsion of this type, which have been used for work of still more refractory nature, the special disadvantages on steep hills were overcome by making S little larger than R and r considerably smaller, but the result of this choice of dimensions

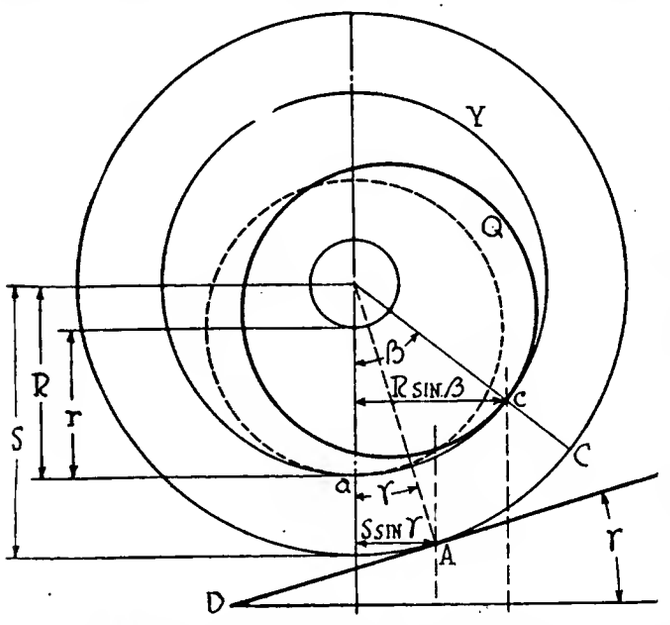


Fig. 4—Diagram of main factors coming into play with driving wheels of the composite type on road grades

was not a wheel but a special tractor-truck construction. As the system permits some rate of progress under conditions which stall ordinary motor vehicles, however, even if the proportions are consistent with the preservation of the mechanism as a wheel which can take the place of a normal wheel, and as conditions absolutely requiring different proportions to make sure of effecting progress are rare, there still seems to be room for experiments with the composite wheel type to arrive at dimensions and proportions suitable for those forms of military or civilian transportation work in which certainty of pulling through is more important than rapid acceleration and speed on hills, and for other work, such as quarry and excavating work or hauling of stone, gravel, sand, in which it may be an economical advantage to be able to use a small motive power and yet be sure of getting the work done. Immunity to slip where other wheels fail and the chance of perfecting a construction which by adjustment may be turned into either a wheel functioning normally or a composite wheel, naturally constitute weighty considerations in the same connection. The same may be said of the suitability of the type for traveling at good speed on fair roads.

Fig. 4 may be looked upon as representing downgrade travel as well as upgrade, by reversing the supposed direction of travel, and if any difficulties can arise which are not the same as those occurring in uphill work and due to the shortened leverage with which the power operates, they must be traced to the possibility of the vehicle running away from control by the power and the brakes. As the brakes operate on Q, to which the brake drum is secured, and Q runs on a guaranteed friction surface in Y—its tracks—and as it is of smaller diameter than a normal wheel and can be blocked more securely by brake action, if necessary, the chance of Y carrying Q beyond its slipping angle can scarcely be perceived as actual.

If the vehicle is to be held at rest on a grade, Q will naturally be brought to its lowest position in Y, but Y will at all events be prevented from rotating more than a few degrees if Q is held, and in starting uphill after the stop the conditions are not materially different from starting on the level, except that Q must advance to a larger angle before vehicle movement begins. In this respect the advantage seems to lie with the composite wheel type, and in the applications for which it is suited it might furnish the opportunity for doing away with one of the two sets of brakes now usually employed, since one set can readily be made to act as service brake and emergency brake combined. If it were to be expected that trouble with the system might arise through very careless operation—as when allowing the vehicle to run wild downhill—a dragbrake could conceivably be developed which would furnish the needed security and would be unexceptionable for the class of vehicle for which it could be wanted.

In considering the possibility of Y slipping on a road which would cause slipping of normal driving wheels, the fact that the power is not applied at the road contact, but continuously tips Y around the point of road contact as a fulcrum, seems decisive. Slipping of wheels is indeed inconceivable so long as the frictional contact of Q with Y is intact, as any actual slip would bring Q in advance of the point of ground support, if it were not there before, and gravitation would thereafter necessarily take effect to turn Y and move the vehicle forward. Only if $(S - R)$ were extremely small and Y a substance having no mass could it be conceived that Q in its rest position, contacting with Y immediately above its point of ground contact, could by its own rotation impart a stationary rotation to Y without changing its relation to Q. Even this remote possibility—with which reality has no better parallel than the immersion of part of the wheel in a greasy hole offering practically no friction to hinder the rotation of Y—is rendered remoter still when S is appreciably larger than R, so that Q's point of contact with Y when at

rest lies some distance above the point of ground contact of Y. On the whole, however, and with dismissal of far-fetched objections, the security against wheel slip lies practically in the impossibility of having any abnormal resistance to the first advance movement of Q in relation to Y, whereafter gravitation must take effect imparting a rolling movement against which a slippery road is harmless.

With slip and spinning of wheels impossible, skidding becomes improbable, as generally understood. And, with the frictional contact of Q with its track safeguarded by the materials used and by its elevation above the road level, the ordinary differential gear is made to operate properly without fail.

These properties of the composite wheel are apparently raised above reasonable doubt more securely than any other merits that might be claimed for it.

Interchangeability with Normal Wheels

When Q makes 1 revolution Y turns r revolutions divided by R, and to make the same vehicle speed as a normal wheel with the same height of axle by rotating Q with the same angular speed as the normal wheel, the radius S of Y in the composite wheel must be in the same proportion larger than R as R is larger than r, and $S - R + r$, being the height of the axle, must be equal to the radius of the normal wheel. These proportions are easily materialized if the eccentricity of the wheel components can be made large—as by having $r = 12\frac{1}{2}$ in., $R = 16\frac{3}{4}$ in. and $S = 22\frac{1}{4}$ in., to replace normal wheel of 36 in. diameter—but will make Y stand $8\frac{1}{2}$ in. higher than the normal wheel, necessitating a change in mud guards, if any are used. Better results might be obtained by allowing the composite wheel to raise the total gear ratio of the vehicle somewhat, since the higher torque of the lower gear can probably not be utilized anyway. But with the dimensions just referred to, or other ones in the same proportion, the composite driving wheel can built without departing from the general lay-out of construction features indicated in Figs. 1 and 2.

In order to make it practicable to transform a composite wheel into one operating on the normal plan—by incorporating an expanding element in Q by which it could be raised to concentricity with Y and braced against its tracks—a smaller eccentricity than that indicated in the dimensions referred to would of course be desirable. Probably nothing but experimenting can furnish the best compromise solution in the matter of dimensions.

To advance consideration of the type to a practical stage there are still lacking satisfactory formulas for (1) vehicle acceleration, for (2) the relation of β to vehicle speed and for (3) the maximum applicable power as a function of the load. To their production the writer will shortly devote as many hours as may be required for making the conclusions final.

Paragraphs on Current Topics

By Marius C. Krarup

Motto: Radical Thought, Conservative Action

News from the motor cars and trucks "somewhere in Mexico" may not be what the general public is yearning for most impatiently, but it is sadly amusing to reflect that it is delayed and mystified principally because the Japanese found concealment of military movements a good policy in the Manchurian campaign of 1905 and reduced the pristine war correspondent to a transmitter of rear guard small talk. The Balkan powers copied this innovation and enjoyed the resulting freedom for atrocities. And now, in Europe as in Mexico, although reconnoitering by aeroplane and transmission by wireless render the precaution futile—each belligerent knowing full-well and all the time what the enemy is doing at his front and 100 miles behind it—the precious phrase "somewhere in ——" has come to signify patient acquiescence in a secret-mongering method the justification for which has ceased to exist. Perhaps we should ask the Japanese how they would proceed now, when secrecy is effective only against friends at home, to turn the broadest kind of publicity to good account for war purposes.

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Between 11 and 12 o'clock last Friday night the sun threw on a screen right before the eyes of all New York and before millions of Americans in other States a stupendous moving shadow show of the war in Europe. And it was a show of the war operations of the following morning at dawn. Yet no poet has sung about it, and the newspapers called it an eclipse of the moon. Yes, the moon was the screen, and over it was moving in sharp contours the shadow of that edge of the earth where the sun was rising over renewed Russian assaults upon the German lines—those of Saturday morning, which were reported by cable 24 hours later. Thousands of American motor trucks with ammunition were lined up at the rear. Some of them were moving forward when caught by the horizontal rays of the star of day and projected in black against the luminous disk which we were intently observing. An aeroplane arose. A huge shell exploded. Pandemonium reigned. All became blurred. The shadows shuddered. Then quiet; the dawn had reached Poland where there is a solitude that they call peace. But no, the edge of daybreak runs northwesterly, and further South, in Bukowina, we suddenly see the outlines of Cossacks with their lances charging furiously over the crest of the hill. The show moved fast. Even war does not stop the earth's rotation or delay it a second. Somewhere the shadow passed over Wilhelm and his sheltered sons. Nothing was projected. They slept. There was an intermission of a half hour. The cosmic operator of the light was sweeping his tell-tale rays over the domains of the central powers where nothing stirred against the illuminated horizon. At last they passed into France. A glimpse of Verdun at sunrise. Only thousands of little black dots—a curtain of artillery fire—were leaping over the screen close to the edge of the earth's shadow. Then it was past 12 o'clock. The show was over. The rest of it missed the background until then providentially supplied and vanished into the universe.

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Only the lack of mechanical facilities for magnifying the optical dimensions of this wonderful spectacle, this marvelous feat in instantaneous news reporting, kept the public at large from witnessing it. Some day civilization will be prepared for such opportunities, but we think it a duty to record now exactly what so many might have seen with their own eyes. And incidentally we come to think of the many other excellent photographic illustrations of important realities which miss their usefulness entirely because they are printed too small—in our esteemed contemporaries, of course.

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If the Service Station is a permanent adjunct of the big manufacturer's sales department, an incubator for good will and repeat orders, and if it pays for itself in the large cities and aggregations, what is to be the means by which its benefits may be extended to minor towns and to the customers of smaller manufacturers? It is a unique institution with no parallel in any other industry; a distinct invention to

meet a want. So long as repairmen in general may not be confidently relied upon to handle each and every make of car or truck with full understanding of its peculiarities, with the assistance of ready access to spare part supplies and with a desire to do justice to the construction and the customer, the specialization of skill and facilities found at the service station must remain a great mutual advantage for maker and user. And it has found another mission in teaching maintenance methods for commercial motor vehicle installations. Nothing short of a comprehensive organization of repairmen, ready to co-operate with manufacturers in severalty, seems to be in sight for extending these benefits where they are now not enjoyed. As an introductory step perhaps the manufacturer's book of instructions for his customers could be edited more directly for the benefit of the repairman than it usually is.

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The exalted motive which keeps people from committing faulty mathematics occasionally may be respect for the science or it may be fear of being found out and declared a dunce, since mathematics and mathematical physics have a way of tracing the transgressor without leaving a loophole for escape. But this most stringent and conclusive form of reasoning will never be very popular and useful so long as it is held sacrosanct. Something that nobody dares to blunder in is not going to be practised extensively, and without frequent practice what is to become of the meager skill with which the graduate starts in his profession? Integration, a most useful mental process, is almost tabooed in discussions, killed by an overdose of reverence. If we could learn to laugh and joke in algebra, calculus would soon become a chummy companion of common thought. Even analytical geometry might begin to talk with human voice, showing its curves through the mask of its equations, and it might become a real sport to work out its secrets with arbitrary asymptotes suitable for a practical occasion—as might be very useful in designing mills for cutting gears or cams of special shapes. But first we must have many errors and many to point them out.

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According to a volunteer statistician 3217 women drove motor cars for pay in England a few months ago, and their number was increasing fast. As soon as cured of affectations of timidity they drive as well as men, it is said, but not quite so fast. That they should ever give up this occupation seems improbable. And similar reports come from Berlin. In a few years the example must take effect here. But the prospect has no problems. Everybody can apparently afford to await its natural development without impatience.

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The demonstrator salesman pulled his car up short near 14th and Broadway and his eyes swept over the swarm of motley humanity, mostly in stockings, that was hustling home to the tenements from the daily work. "Look at them," said he triumphantly to his prospect; "nearly every one of them will be taken 'as is' by somebody, to be supported for its natural life, and think of the upkeep. That's easy instalments for you. That's what it does. Anything goes on that plan. You don't have to make things right if you are going in for easy payments, and you don't, of course." The prospect very quietly said something about modern manufacture certainly being ahead of nature in the uniformity of the product, and the demonstrator took it for consent.

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Ethical, reformed advertising represents one of the latest patriarchal movements for the public's protection and the purely moral satisfaction of the protectors. A fine movement, for a change; for those who need the change. But the art of truth-telling is remarkably difficult. While "yielding to no one in veneration of veracity," one may yet have misgivings. A good advertisement is brief and the whole truth is long. Must the little doubts which are to result in next year's improvements be handed over by the concientious principal to the expert writer of advertising matter with injunction to cry about them from the housetops? Discrimination between facts which the public can understand and those which the majority would misunderstand raises a nice issue in casuistry and a problem in competence. Many among the public prefer the mental exercise of picking the winner in a spirited contest in plausibility, rather than surrendering their critical acumen and accepting instead a blind faith in the conversion of those advertisers who make it a point to subscribe to the purified creed. And a trusting public would delay progress. The longing for the near-millenium is also assuaged by reflecting on the enormous profits which No. 100 could garner by sophisticating skillfully now and them, if his 99 competitors had schooled themselves to a more complete frankness than the average individual is able to practice within his own mind. The agitation of the subject may be timely, but a guardianship for the public would be the saddest of all things, a serious burlesque.

□□□□

In the age of mergers and economies, both true and false, the theoretical publicist who has not grasped the force of specialization expects co-operative advertising will be more and more employed. What is it? We offer a sample (illustration omitted):

The modern Omar and his Thou pull up under that tree in a comfortable little 1917 *Arethusa* car,
Draw from the dainty *Beowulf* lunch basket with ice compartment ($5.22 at *Christopher's*)
A box of the celebrated *Dania kiks de seigle* (all grocers),
A gastronomic confection of stuffed dates from *Erk & Filford,*
And a *Thermos* bottle filled with delicious decanted *Chambertin* (Type) from *Gamache.*
Leisurely they nest their feet on the cushioned *strapontin-en-banc, Hustler's* patent.
And why shouldn't they be able to feel pretty cozy, especially as that book of verse is
The latest best seller, the *Ideocrat's Jodlings,* ($1.50) in *vers libre;*
That marvelous form of speech which is relieved alike of prosaic and poetic restriction?

□□□□

In the midst of war's horrors, reports *American Motorist* from the trenches, the high-spirited *poilu* has invented the word *tacot* to designate an automobile that is below par. Too late! *Tacot* antedates "ice-wagon" in the international dictionary of slang. The word grew whiskers, so to say, before the *poilu.*

□□□□

Let no tradesman be deceived if he hears that shark-absorbers are in great demand at New York and New Jersey seaside resorts.

□□□□

Be a gangster! Modern life is complex and subdivided. Its human unit is no longer the individual but the gang, a gang controlling a full assortment of abilities. Success and satisfaction are measured by capacity for association with others who supplement you. The commonest mistake is not loneness, but choosing for associates those who duplicate you. That does not make a gang but a mob. Don't be a mobster!

□□□□

This is in brief The Boundless Gangster Philosophy with regard to which we have been honored with an inquiry.

THE AUTOMOBILE

PUBLISHED WEEKLY

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THE CLASS JOURNAL COMPANY

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W. I. Ralph, Vice-President E. M. Corey, Treasurer
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Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - - - - - - - - - - Autoland, New York
Long Distance Telephone - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES

United States and Mexico - - - - - - - - - - One Year, $3.00
Canada - - - - - - - - - - One Year, 5.00
Foreign Countries - - - - - - - - - - One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

The payment of subscriptions will be shown by stamping the date of expiration—the month and year—on the wrapper that carries your paper each week. No other acknowledgment necessary.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Production

NO better proof could ever be asked of the quality of American passenger cars than the fact that although in 1916 we have only 99 factories as compared to 270 in 1911, yet the production for the first half of 1916 is 754,902 as compared to only 200,000 for the entire year of 1911. In other words, four times the number of cars have been made by one-third the number of plants in half the time.

What was good has survived and been improved upon, and yet the cars of to-day are 35 per cent less in price than they were 5 years ago. Better methods, better machinery, better factories and the more economic handling of labor have been the reasons for the combined facts of greater production and lower-priced cars. In some factories the overhead per car has been cut 200 per cent and more in 2 years. In others double the production has been secured from the same number of men.

Greater production has demanded higher efficiency in other departments. It has meant the creation of a bigger market with the ever-present demand of lower cost per car in selling. Less unit-cost is the story of the entire automobile business. It means less per car to make, less per car to sell and less per car to purchase, and the saving in each of these three fundamental departments has been reaped by the consumer who pays one-third less for his car now than he did 5 years ago.

Selling as a Science

THE World's Salesmanship Congress held last week in Detroit accomplished much if it did nothing more than impress on those salesmen present the deplorable lack of facilities for the preliminary training of salesmen. The congress has done more in that it has made a start towards placing salesmanship in the ranks of sciences, where it rightly belongs.

The young man who aspires to be a doctor or surgeon has within his reach medical schools in which he can take a complete course in medicine or surgery so that when he starts practice he is scientifically prepared for the work. He is a graduated physician.

So with the profession of law, those who aspire to its ranks have schools for preparing themselves, and who would think of beginning the practice of law without first having absorbed the known principles of the law.

In engineering circles the same rule applies, our leading engineers are schooled in the sciences at our universities before they attempt the work of design and construction, a knowledge of fundamentals of engineering principles being essential for any person attempting to succeed in the engineering field.

But turn now to salesmanship, that great essential of this ultra-commercial age, and we are lacking in those great institutions for the scientific education of the salesman. Too many of our salesmen start into their profession as laws unto themselves, without previous education in the essentials of the profession, and perhaps without definite knowledge of the fundamentals of salesmanship. The large manufacturers or industrial houses do not care to place the sale of their commodity in such hands. The Salesmanship Congress has recommended in favor of such educational work and such a movement deserves the united co-operation of the automobile industry.

Recognition

AFTER all the valuable work of standardization accomplished by the Society of Automobile Engineers it is no surprise that the army and navy should look to the society to carry out the aircraft standardization which is so urgently needed. None the less, the holding of an S. A. E. meeting in the Bureau of Standards at Washington, the home of national standardization, unquestionably marks a stage in the development of the society, and will cause July 18, 1916, to be a memorable day to all those who have been leaders in the S. A. E. since its inception.

When the government authorities found the vital need for standards of dimension in aeroplanes the S. A. E. appealed to them as being the natural and proper body to carry out the work. Aided by the accumulated experience of automobile standards, supported and assisted by the army, navy and Bureau of Standards, the new aeronautic division of the S. A. E. committee ought to find that very rapid progress is easy.

S. A. Wants American Cars

Beecroft, After 10-Weeks' Trip as U. S. Delegate, Reports Big Field

NEW YORK CITY, July 18—David Beecroft, directing editor of THE AUTOMOBILE, has returned from a 10-weeks' trip to South America, where he went as a delegate of the United States Government to investigate trade conditions in Argentina with special regard to the automobile industry in that country. Mr. Beecroft was a member of the Argentine Return Visit Committee, the visit following a similar one made by delegates from the various countries in South America in 1915 as representatives of their respective governments.

While in South America Mr. Beecroft traveled extensively through Argentina, and also Uruguay and Southern Brazil, and reports that the U. S. A. automobile has been meeting with greater success in these countries during the past 18 months than ever before in its history. The sale of expensive European cars has practically been at a standstill for 3 and nearly 4 years, but the American car has demonstrated that it can stand up in the country districts where roads are not to be compared with those in this country, and as a result there is a great demand among dealers in all three countries for agencies of lower-priced American machines.

An exhaustive series of articles on the automobile, automobile accessory, motor truck and motor tractor situation in these South American countries will follow from week to week in THE AUTOMOBILE. This will be the first opportunity the automobile reading public of the United States will have had of so extensive a series of articles dealing with all the problems directly connected with the automobile industry as existing since the opening of the European war. The first of these articles will appear next week.

—

Neville Co. Absorbs More-Room Steering Wheel Co.

DETROIT, MICH., July 14—The Neville Steering Wheel & Mfg. Co., this city, has absorbed the Neville More-Room Steering Wheel Co. F. A. Vollbrecht, formerly general manager of the King Motor Car Co., is president of the new corporation, John V. Harding is vice-president and A. W. Webber secretary and treasurer. Harding is known in the trade through his 6½ years' work as special factory representative of the Motz Tire & Rubber Co., and later the Goodyear Tire & Rubber Co., in Detroit and the country at large. Webber was formerly of the General Motors Co. The new company has obtained fireproof quarters at 74 Congress Street West, Detroit, where it is now devoting its energies exclusively to manufacturing a full line of Neville More-Room steering wheels. William Langton has been appointed factory superintendent, and the factory is now producing its wheel in quantities to take care of both manufacturers and the jobbing trade.

—

Aland 16-Valve Four Coming

DETROIT, MICH., July 17—Organization plans are under way for the Aland Motor Car Co. of this city. According to R. C. Aland, chief engineer, the company is about to incorporate for $500,000 and plans to produce, starting in December, a lightweight car fitted with a four-cylinder sixteen-valve power plant.

—

Allen Offers New Model at $850

FOSTORIA, OHIO, July 17—The Allen Motor Co., this city, has announced a specially finished car to be sold at $850 f.o.b. Fostoria. This new car will be known as the Allen Classic with the standard Allen chassis and body, finished in brown with gold striping, black fenders and radiator. The upholstery is Spanish brown in color. The offering of this new model will in no way interfere with the production of the Allen 37.

—

Cars to Go on Tracks

MILL VALLEY, CAL., July 17—H. S. Johnson, a mechanical engineer at present with the Mt. Tamalpais & Muir Woods Railway, is forming a company to manufacture gasoline automobiles to operate on railroad tracks.

—

Armored Cars to Have King Chassis

DETROIT, MICH., July 17—The Armored Motor Car Co. has been formed to manufacture armored automobile bodies. The principals are at present in Washington, D. C., and plan to stage, soon, a test for the inspection of the government. The company plans to use King chassis.

—

Levy Takes Marion-Handley

CHICAGO, ILL., July 18—James Levy, the former Chalmers dealer in this city, has taken over the Marion-Handley car. The James Levy Motors Co., the name of the new company, will be located at Twenty-third Street and Michigan Avenue.

—

Bowler Is H. A. L. Sales Manager

CLEVELAND, OHIO, July 17—George H. Bowler has been appointed sales and advertising manager of the H. A. Lozier Co., this city, to market a new H. A. L. twelve.

Crew-Levick Co. Sold to Syndicate

New Yorkers Buy Out $5,000,000 Manufacturers of Perfection Oils, Etc.

PHILADELPHIA, PA., July 18—The Crew-Levick Co., one of the oldest major refiners and distributers of petroleum products, with refineries at Chester and producing properties at Titusville and Warren in this State, has sold out to a New York syndicate. The Crew-Levick Co. is chiefly known to the automobile trade as the manufacturer of Perfection oils and greases and recently has added a number of other petroleum products to its line, including grease tubes for quick filling of grease cups, Mistokleen, a body cleaner, as well as other products.

The company is capitalized at $5,000,000 and the sale price is approximately $125 per share. It was first rumored that the purchaser was allied with the Standard Oil Co., but this is denied by Crew-Levick.

—

Reliance Engineering Acquires Hercules Forge Co.

LANSING, MICH., July 8—The Reliance Enginering Co. has purchased the Hercules Forge Co., Indianapolis, Ind., the deal having just been closed. The Indianapolis concern sells equipment only and no real estate nor shop buildings were included in the sale. All equipment will be moved to this city and installed in the building formerly occupied by the foundry of the Seager Engine Co., which company has been taken over by the Reliance company. This building will be equipped for drop forging exclusively and the Hercules company equipment is for general extension of the Reliance engineering department.

—

Eubanks Resigns from Barley

STREATOR, ILL., July 13—It has been announced that P. J. Eubanks, sales and advertising manager of the Barley Mfg. Co., of Streator, has tendered his resignation, to become effective Aug. 1.

While no announcement has been made relative to Mr. Eubanks' future plans, it is believed that he will take a protracted vacation and much needed rest before again taking up active work.

—

Humphrey Joins Briscoe

JACKSON, MICH., July 14—S. H. Humphrey, formerly vice-president of the Chalmers Motor Car Co., has been elected vice-president and manufacturing manager of the Briscoe Motor Corp., this city.

Mr. Humphrey has been connected

with the automobile industry since its inception, starting as a mechanic at the Peerless factory in Cleveland. His first connection with the Briscoe Brothers was in 1908, when he went to the Brush company as works manager. For several years he was manufacturing manager of the Hupp Motor Car Co., leaving that company to become vice-president of the Chalmers.

—

Drexel Succeeds Farmack

CHICAGO, ILL., July 17—The Drexel Motor Car Corp. has succeeded the Farmack Motor Car Corp., and is issuing stock at $10 per share. It is capitalized at $2,000,000.

—

Gillett Buys Out Wilmo

CHICAGO, ILL., July 17—The Wilmo company, manufacturer of accessories, has sold its property, patent rights and good will to the Gillette Motors Co., Mishawaka, Ind. King C. Gillette is president.

—

G. H. Smith Mercer Sales Manager

TRENTON, N. J., July 13—G. H. Smith has been appointed sales manager of the Mercer Automobile Co., this city.

Mr. Smith has long been known in automobile trade circles, having been with the White and Peerless companies.

52 Saxons in 3000-Mile Relay

—

Sixes To Try for Transcontinental Speed Record—Will Carry Messages

DETROIT, MICH., July 16—Fifty-two Saxon six cars will relay from New York to San Francisco, by way of demonstrating what can be done with an automobile as the bearer of messages over long distances. They will race at top speed for stretches of about 75 miles each.

Starting Saturday morning from New York City, a Saxon car will enter the Lincoln highway, which leads from coast to coast, and will travel the first lap of the journey. A message from Mayor Mitchel of New York to Mayor Rolf of San Francisco will be handed the driver just before the start, which will be passed along the line and eventually delivered at the city of the Golden Gate.

—

Hood and Botterill Open Offices in Detroit

DETROIT, MICH., July 17—A new wrinkle as regards having permanent representation in Detroit so as to insure prompt shipment of cars, materials, accessories and other supplies has been worked out by at least two parties, one being Tom Botterill, distributer of Hudson cars for Utah and Colorado, with headquarters at Salt Lake City and Denver, and the other is the recently formed Wallace C. Hood Service Bureau. Mr. Hood was formerly connected with the Chalmers, Everitt and Empire companies.

The former differs from the latter mainly in the fact that Botterill's establishment of a Detroit office with A. S. Broadhead in charge, was done to seek closer touch with the Hudson factory only, while the Wallace C. Hood bureau is organized to help any manufacturer, jobber or distributer, acting as his representative in securing prompt shipments, following orders through production at any factory, and in fact assisting automobile manufacturers or distributers who have been working at a disadvantage through lack of representation in Detroit and Michigan.

—

Grossman Holds Sales Conference

BROOKLYN, N. Y., July 17—The annual sales conference of the Emil Grossman Mfg. Co., Inc., this city, took place July 14 and 15. The first conference opened at the executive offices of the company in Bush Terminal Building No. 20 on July 14 and adjourned for the second conference on July 15 at the Brighton Beach Hotel, Brighton Beach, L. I. Policies for 1917 were formulated at this

Big Dealers' Upheaval in New York

(*Continued from page* 85)

1826 and 1828 Broadway, in which are now being exhibited Overland and Willys-Knight cars, and also the establishment and equipment of a service station at 150th Street and Gerard Avenue, the Bronx, in a building of 60,000 ft. floorspace. It is the intention of the company to open immediately sales and service stations in Brooklyn and Newark.

The new building which is in process of completion is located on Fifty-seventh and Fifty-eighth Streets, between Tenth and Eleventh Avenues. This building is partially completed at the present time and when finished will have a floorspace of 300,000 sq. ft. and will represent an investment of about $1,000,000.

E. B. Jackson, formerly president of the Packard Motor Car Co. of New York, has become associated with the Willys-Overland company of Toledo in an executive capacity. He will make use of his experience and knowledge of metropolitan needs by devoting a large part of his time to the creation and development of an organization in this territory.

In reference to E. B. Jackson going over to the Overland organization, the Packard company in this city and Philadelphia have appointed new heads of these branches. E. S. Hare, recently appointed manager of sales of the New York Packard branch, and formerly vice-president of the Commercial Truck Co., Philadelphia, now becomes general manager of the Packard branch in New York City and L. J. Eastman becomes general manager of the Philadelphia Packard branch.

The territory which Mr. Silver will have is approximately the same as that which he has had during the last 6 years, taking in all New York City, Long Island, Staten Island, most of New Jersey and a part of Connecticut, with a branch in Bridgeport. He will also take care of the Atlantic seaboard on Chalmers parts.

C. T. Silver, Inc., as the new company will from now on be known, will handle 10 per cent of the Chalmers output, dating from Aug. 1, for the coming year. Business in Peerless, Chalmers, Overland and Willys-Knight cars is now going on in Silver's salesrooms. The last two will be on the floors until all sold, though the new Overland branch will probably take them over. The Silver organization has taken over the new Chalmers cars in stock at the former New York branch and a sale is being held on the second-hand machines.

Mr. Silver began his automobile career about 7 years ago, being first associated with the Koehler company in the sale of Buick cars in Manhattan. Then he went to the Buick branch in Brooklyn. Later he established an Overland agency in that city, after which one was established in New York City at Broadway and Forty-ninth Street. In 1914 he acquired possession of the Peerless Building, where he greatly enlarged his business with the Overland, Willys-Knight and Peerless.

The formation of the new Mitchell Motors Co. of New York is in keeping with the general Mitchell policy of expansion, the company planning to build 25,000 cars for 1917. Nearly 2000 Mitchell cars were sold in the metropolitan territory last year and it is hoped to double or treble this output next year. The new Mitchell Motors Co. of New York will have the entire metropolitan territory consisting of New York City, Brooklyn, Long Island, Staten Island, Westchester and Fairfield counties, including Bridgeport and three counties in New Jersey.

comparatively early date in order that the catalog and information for jobbers' catalogs may be placed in the hands of the jobbers by Oct. 1.

The conference was attended by Emil Grossman, president, who presided, Jos. N. Lowe, vice-president and Western representative; Lewis M. Crittsinger, vice-president and factory manager; Lewis M. Schwartz, secretary, who also acted as secretary of the meetings; Harry G. Wedler, Southern and Southwestern representative; W. M. Farans, Eastern representative; A. E. Rosenberg, Middle Western representative; M. S. Rosen, factory representative; Rudolph Cony, Chicago branch manager; F. B. Conner, purchasing agent, and Chas. Rottner, New York representative. A dinner followed the final conference.

Colt Is Cole Eastern Manager

NEW YORK CITY, July 17—W. L. Colt has been appointed eastern district sales manager of the Cole Motor Car Co. Mr. Colt will still retain the presidency of the Colt-Stratton Co., sole distributor in this territory. Capt. Harry Stratton will assume the duties of general manager.

Detail Improvements in Velie

Will Use Timken Axles—New Bodies in Seven Styles

MOLINE, ILL., July 15.—As far as the chassis is concerned the Velie "Biltwell" sixes for 1917, made by the Velie Motor Vehicle Co., this city, have undergone little alteration. Perhaps the most prominent mechanical alteration is the use of Timken axle equipment, though sundry little details have been improved, tending to enhance the value of the cars.

In the body line a good deal has been undertaken and one of the most striking of the new models is the four passenger roadster which is quite novel, having a sweeping side line running down to the rear deck. Internally there is all the accommodation of a four-passenger clover leaf of ample proportions and plenty of baggage space in the deck. This roadster sells for $1,085 as does the five-passenger touring body, which is also quite new, being both longer and wider than that fitted to the 1916 chassis. There is a two-seated roadster at $1,065, with a large amount of space for stowing baggage and a four-passenger coupé for $1,750. For special orders a range of other inclosed bodies is made, including a very neat little town job on distinctly French lines for $2,200, a touring sedan for $1,685 and a cabriolet roadster at $1,485. The manufacturers state that all these bodies are built very substantially and are upholstered in regular Velie style with the best quality of materials. All the bodies enumerated above fit the smaller chassis of 115-in. wheelbase. There is also a seven-passenger job on a larger chassis, this having a larger engine and a wheelbase of 124 in.

On both chassis the engines used are of Continental make, and both are sixes, the smaller 3¼ by 4½ in. and the larger 3½ by 5½ in. A taper frame is used.

Dry disk clutches are fitted to both cars, but the larger has a four-speed transmission while the smaller has three speeds only. The tubular driveshaft has a universal at each end, the long three-quarter springs taking both torque and drive.

Detroit Congress Plans Greater Sales Efficiency

(*Continued from page* 87)

on the Ethics of Salesmanship by the nation's leading executives. Monday morning, July 10, the formal opening in Arcadia Hall was addressed by President Woodrow Wilson; also by Secretary of Commerce William C. Redfield and Arthur Brisbane.

Monday afternoon there were further addresses on sales topics; Tuesday morning and afternoon general sales sessions were held in the Board of Commerce Building, which organization assisted in staging the convention.

Wednesday morning and afternoon departmental sessions were held in Hotels Statler and Pontchartrain, and that evening the visitors went for a boat ride on Lake St. Claire.

This morning the final session and the completion of the organization work was effected in the Majestic Theater and this afternoon the convention held a salesmanship circus at Bois Blanc, going by special boat.

Better trained sales managers were recognized as one of the industry's needs, in order that these men may become capable teachers of the salesmen under them.

Great applause followed every reference to a merchant marine, which was mentioned by President Wilson and Secretary Redfield. President C. Louis Allen of the Pyrene Mfg. Co., New York, struck a popular chord when he said the lack of popular support for a merchant marine was in part due to the failure of the ordinary man to appreciate what was meant. He said that the legislators and business men have been talking in the wrong language. "Everybody understands what is meant by freight car shortage," he said, "why not talk to them about 'ship shortage.' Then they'll know what is meant and will appreciate the value of a merchant marine."

Mr. Allen said the salesmen of the United States could become a power for the Government if their aid was enlisted in support of any desired propaganda such as that for a merchant marine. There are said to be more than 1,000,000 salesmen in this country.

Raising the standard of Sales Bulletins and making them of more practical value was advocated by V. L. Price, vice-president of the National Candy Co., St. Louis.

"Choosing men" was discussed by several speakers and a clinic at the Hotel Statler revealed the value of psychology in rating applicants for positions.

Among the industrial problems discussed were: "Selling Schools," Edward A. Woods, president, National Association of Life Underwriters, Pittsburgh; "Integrity," Frank Goeway Jones, Detroit; "Direction of Salesmen," M. B. Nelson, sales manager, Long Bell Lumber Co., Kansas City, Mo.; "Influence of Salesmen on Product," R. B. Goodman, Goodman Lumber Co., Goodman, Wis.; "Selling Schools for Manufacturers, R. H. Grant, sales manager, Domestic Engineering Co., Dayton, Ohio.; "Price Maintenance," George E. Watson, secretary, Southern Cypress Mfgr.'s Asso., New Orleans; "The Quota," F. H. Dodge, sales manager, Burroughs Adding Machine Co., Detroit; "Contests," Blaine S. Smith, sales manager, Universal Portland Cement Co., Chicago; "The Price-cutting Manufacturer," A. A. Breed, president, Crane & Breed Mfg. Co., Cincinnati; "Driving vs. Leading," Harry Tipper, the Texas Co., New York; "Making the Sale Produce a Profit," J. C. Walker, educational division, Burroughs Adding Machine Co., Detroit; "Salesmanship from the Standpoint of the Employer," Morris W. Ellis, Ellis Shoe Co., Nashville.

The selection of the next convention city was left to the executive committee, but an expression of sentiment by the convention seemed to favor Philadelphia, which was well represented by official spokesmen.

For their work before and during the convention Awards of Merit were given. These consisted of small diamond-set insignia for the lapel. The winners were Woodrow Wilson, Norval A. Hawkins, Hugh Chalmers, Harry M. Jewett, Lee Anderson, Harry W. Ford, D. M. Barrett, Joseph Mack, W. C. Standish and Walter C. Cole, the latter secretary of the Detroit Board of Commerce.

Kansas City Sales Gain 50%

Crops and Business Conditions Are Excellent—City Business a Feature

KANSAS CITY, MO., July 17—June was a record-breaking month in the automobile business in the Kansas City district. Branch houses, agencies and dealers report trade 25 to 50 per cent ahead of the same month last year, and the 6-month period to have shown a constantly increasing ratio of gain since Jan. 1.

"June has been 100 per cent better than any June in the past," said H. A. Clark, sales manager of the Missouri Haynes Co., covering Kansas, Oklahoma and half of Missouri. "The first 6 months of this year have been 50 per cent better than any previous first 6 months. More cars have been sold in the Winter and Spring months by 100 per cent than in previous years in this territory."

The gain is attributed to the constantly improving dealers' organization in the territory, Kansas and Missouri.

The Greenlease Motor Car Co., handling the Cadillac exclusively, in Northern Kansas and Western Missouri, also reports a 50 per cent increase in June, despite the handicap on the country business due to rains and floods. The gain was, therefore, chiefly in city trade.

Outlook Is Promising

There is a general expectation of increased trade for the future borne out in the report of the Federal reserve bank, for June. The rains that hindered sales, have brightened crop prospects for wheat, insect damage has not increased, and the total crop of Kansas looks nearer 100,000,000 bushels than 90,000,000, with the quality rather better than last year. The first alfalfa crops were heavy and of fine quality. There is an unprecedented stock of grain in storage. The corn has been seriously hindered in growth by wet weather—but hot days came just in time to give the crop growth. The labor situation is causing some uneasiness, both as to crop work and in the city, where strikes are holding up many buildings, some of them needed larger quarters for automobile and tire firms.

Kansas City's bank clearings gained nearly $230,000,000 for the first 5 months—a gain of $52,052,236 in June makes the total advantage of 1916, first 6 months, over 1915, $279,974,491. Postal receipts show a gain of well towards $200,000, for the 6-month period. The live stock industry is more prosperous for the time being than ever in its history, says the report of the Federal Reserve bank. Kansas City showed the largest gain in receipts, reports available later than that of the bank being that the gain was 30 per cent over June, 1915.

Bower Declares 15 per Cent Dividend

DETROIT, MICH., July 13—The directors of the Bower Roller Bearing Co., this city, met on Tuesday and declared a 15 per cent cash dividend as the regular quarterly dividend.

Material Prices Lower

NEW YORK CITY, July 17—Despite a shortage of raw materials for the manufacture of automobiles, prices are remaining for the most part unchanged or lower. The metals, especially, are lower, as is also rubber. The latter is now coming into this country in large lots.

Twenty carloads of crude rubber, a solid trainload, valued at $1,000,000, are on their way to this city from San Francisco via the Southern Pacific's Ogden route. This shipment, which came from Singapore, is the first consignment of rubber of such magnitude to go overland from the Pacific Coast. It was shipped here by the East Asiatic Co. on its steamer Bried. Exports of crude rubber to this country from Para, Manaos and Brazil, for the month of May, amounted to 5,693,929 lb.

The most important drop of the week in the metals was that of Bessemer Steel, which went down $2 per ton to $40 on Thursday.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.58	.58	.58	.58	.58	.58	...
Antimony, lb.	.15½	.15½	.15½	.15½	.15½	.14½	— .01
Beams and Channels, 100 lb.	2.67	2.67	2.67	2.67	2.67	2.67	...
Bessemer Steel, ton	42.00	42.00	40.00	40.00	40.00	40.00	—2.00
Copper, Elec., lb.	.26½	.26½	.26½	.26½	.26½	.26½	...
Copper, Lake, lb.	.26½	.26½	.26½	.26½	.26½	.26½	...
Cottonseed Oil, bbl.	10.50	10.70	10.75	10.60	10.55	10.50	...
Fish Oil, Menbaden, Brown, gal.	.55	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime, gal.	1.10	1.10	1.10	1.10	1.10	1.10	...
Lead, 100 lb.	6.40	6.40	6.40	6.35	6.35	6.35	— .05
Linseed Oil, gal.	.69	.69	.69	.69	.69	.70	+ .01
Open-Hearth Steel, ton	42.00	42.00	42.00	42.00	42.00	42.00	...
Petroleum, bbl., Kans., crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.92	.92	.92	.92	.92	.92	...
Rubber, Fine Up-River, Para, lb.	.68	.68	.68	.68	.68	.66¼	— .01¼
Rubber, Ceylon, First Latex, lb.	.59	.58½	.58½	.58½	.58½	.58	— .01
Sulphuric Acid, 60 Baume, gal.	3.00	3.00	3.00	3.00	3.00	3.00	...
Tin, 100 lb.	38.50	38.75	38.50	38.63	38.63	38.00	— .50
Tire Scrap, lb.		.05¾	.05¾	.05¾	.05¾	.05¾	.05¾	...

$3,000,000 Capital for Portage

New Financing Plan Adopted at Meeting of Tire Concern Stockholders

AKRON, OHIO, July 13—A new plan of financing with an increased capitalization was adopted by stockholders of the Portage Rubber Co. meeting in Barberton on Tuesday. The present capitalization of $1,250,000, of which $500,000 is in common and $750,000 in preferred, will be increased to $3,000,000, placing $1,000,000 in preferred and $2,000,000 in common.

Of the preferred $250,000 will be offered to the present stockholders on a pro rata basis. The stockholders also voted to amend the constitution of the corporation so that the present issue of a million preferred may be convertible into common shares up to July 1, 1917.

A common dividend has been declared of 2 per cent, quarterly, payable Aug. 15 to stockholders of record Aug. 5.

One million of common will be set aside for exchange purposes. Common stock in the Portage corporation pays 8 per cent and the preferred 7 per cent.

Overland Declares 10% Stock Dividend

TOLEDO, OHIO, July 13—The directors of the Willys-Overland company yesterday declared a regular quarterly dividend of 3 per cent in cash, placing the regular dividend on a 12 per cent per annum basis. The directors also declared an extra stock dividend of 10 per cent.

The cash dividend is payable Aug. 1 to holders of record July 24. One half of the 10 per cent stock dividend is payable Oct. 2 to holders of record Sept. 15. The remainder is payable April 2 to holders of record March 15.

After the meeting President J. H. Willys stated that orders received last week for immediate shipment amounted to over 10,000 cars. Business was never better than at present. During the 6 months ended June 30, 1916, the number of cars sold and delivered was 94,477, being two and one-half times the shipments in the corresponding period of 1915.

Geiger-Jones Offering New Issue of Preferred

LIMA, OHIO, July 13—The Geiger-Jones Co., which controls the stock of the Gramm Motor Truck Co. of Lima is offering for sale a limited amount of the ne wissue of preferred 7 per cent cumulative stock at 101. The issue was

authorized at a meeting June 17 by more than 80 per cent of the stockholders of record.

In the statement issued with the call for stock subscriptions, the company is shown to have had profits of $579,000 in 1915 after making deductions for depreciation and other charges. In other words the profits were sufficient to pay the preferred dividends and 66.4 per cent on the common stock outstanding at the end of the year. The dividends on the preferred are payable quarterly, in January, April, July and October. The stock is non-taxable in Ohio. The business of the company in 1915 amounted to more than $4,000,000

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Packard Motor Car Earnings Estimated at $6,050,000

DETROIT, MICH., July 17—The Packard Motor Car Co., this city, has just issued a statement of its earnings since 1909. The company that year earned $2,612,774 and it expects to earn for 1916 about $6,050,000.

The figures for the fiscal year of 1915-1916 contain a conservative estimate covering the last quarter of the year; and after paying regular preferred and common cash dividends and deducting the 10 per cent common stock dividend distributed Feb. 1, 1916, and the 50 per cent common stock dividend to be distributed Aug. 1, 1916, the balance in surplus account at the end of the year is expected to exceed $6,376,344. This is after deducting depreciation aggregating for 7 years more than $9,000,000.

Security Prices Lower

Chandler, General Motors, Chalmers and Firestone Stronger

NEW YORK CITY, July 18—Automobile securities on the New York Stock Exchange and the Curb were under attack yesterday by traders with a general decline. Overland went down 3 points, as did Maxwell, Chevrolet and Studebaker.

Some of the stocks, however, showed unusual strength, despite the bear attack. Firestone reached 915, or a gain of 35 points. This company has just issued a financial statement showing net gain in business of 38 per cent. General Motors, with a gain of 15 points for the week, was also strong. Chevrolet, however, which was subject to much selling during the week, dropped 34 points to 194.

The bearish action of the traders is unexplainable at the present time, as most of the companies are showing excellent earnings.

Initial transactions were made yesterday in the stock of the recently organized Mitchell Motors Co. The first sale was made at $67.50. Subsequently there was an advance to $68, followed by a 2-point decline.

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$5,000,000 Earnings for Canadian Ford

WALKERVILLE, ONT., July 15—The net earnings of the Ford Motor Co. of Canada, Ltd., for the current fiscal year of 10 months, ending July 31, show approximately $5,000,000, which would be equivalent to about $70 a share on the $7,000,000 outstanding capital. From these earnings, however, will be deducted the Canadian war tax.

The company has spent $2,750,000 in erecting four new assembling plants and other extensions to the Ford, Ont., plant, which additions give 162,000 sq. ft. more floorspace.

The new Canadian assembling plants are located at Montreal, Toronto, London, and Winnipeg.

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Firestone Sales Increase 38 Per Cent

AKRON, OHIO, July 17—Since 1910-11, when the Firestone Tire & Rubber Co. moved into the new factory, the sales have grown from $7,462,581.17 to $25,187,884.33, making a total increase of 257 per cent for the past 5 years. This past year, 1915-16, the increase to June 1 was 38 per cent over the showing of last year.

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Dividends Declared

Kelly-Springfield Tire Co.; quarterly of 4 per cent on common, payable Aug. 1, to stockholders of record at the close of business July 17.

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Ledwitch Joins Maxwell

DETROIT, MICH., July 13—C. J. Ledwitch, who has had extensive experience with the foreign trade, has joined the staff of the export department of the Maxwell Motor Co.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co. (new)	..	..	63½	65½	—1
J. I. Case pfd	70	79	82	90	..
Chalmers Motor Co. com	91	93	165	175	+8
Chalmers Motor Co. pfd	95½	98½	98	100	..
*Chandler Motor Car Co.	..	..	103½	105	+6½
Chevrolet Motor Co.	..	..	194	198	—34
Fisk Rubber Co. com	..	..	..	160	..
Fisk Rubber Co. 1st pfd	..	..	112	120	—2
Fisk Rubber Co. 2d pfd	..	..	112	120	—8
Firestone Tire & Rubber Co. com	506	512	915	930	+35
Firestone Tire & Rubber Co. pfd	109	111	111	113	—1
*General Motors Co. com	188	189	485	490	+15
*General Motors Co. pfd	104	105½	109½	113	— ½
*B. F. Goodrich com	50	52	72⅜	73⅛	—1⅛
*B. F. Goodrich pfd	104	105½	113½	113⅝	+ ⅜
Goodyear Tire & Rubber com	270	273	223	226	—2
Goodyear Tire & Rubber pfd	105½	107	106	107	+1
Grant Motor Car Co.	..	..	9	11	—2
Hupp Motor com	..	..	7	7½	— ½
Hupp Motor pfd	..	..	80	110	..
International Motor Co. com	17	19	7	9	..
International Motor Co. pfd	43	45	18	23	..
*Kelly-Springfield Tire & Rubber com.	155	157	68	69	—1
*Kelly-Springfield Tire & Rub. 1st pfd.	85	87	95	97	— ⅛
*Lee Rubber & Tire Corp.	..	..	42½	43½	—3⅛
*Maxwell Motor Co. com	36	38	73¾	74	—4¼
*Maxwell Motor Co. 1st pfd	83	85	84	85	— ½
*Maxwell Motor Co. 2d pfd	32	34	54½	55	+ ½
Miller Rubber Co. com	190	192	200	215	—25
Miller Rubber Co. pfd	103	105	104	106	..
Packard Motor Car Co. com	110	115	..	177	..
Packard Motor Car Co. pfd	96½	100	100	104	..
Paige-Detroit Motor Car	..	..	..	48	..
Peerless Truck & Motor Corp.	..	..	22	24	—2
Perlman Rim Corp.	..	..	..	..	..
Portage Rubber Co. com	35	38	113	115½	—4
Portage Rubber Co. pfd	92	95	115	117	—3
Regal Motor Co. pfd	..	..	17	22	..
Reo Motor Truck Co.	15	16	36¼	37	— ¼
Reo Motor Car Co.	29½	31	42½	43	— ½
Saxon Motor Car Co.	..	..	77	79	—2
Standard Motor Co.	..	..	5	6	..
Stewart Warner Speed. com	66	67½	98	100	—2
Stewart Warner Speed. pfd	104	106	..	..	..
*Studebaker Corp. com	81	83	124⅝	125	—8
*Studebaker Corp. pfd	99	101	109	110	—1
Stutz Motor Corp.	..	..	60	61	—3
Swinehart Tire & Rubber Co.	77	78	85	87	—1
United Motor Corp.	..	..	65⅜	65¾	—6
*U. S. Rubber Co. com	45	47	52½	53½	..
*U. S. Rubber Co. pfd	103	105	107¾	108¼	—2¾
White Motor Co. (new)	103	108	52½	53	—1¾
*Willys-Overland Co. com	137	139	64¼	64¾	—1½
*Willys-Overland Co. pfd	102	103	105	107	—2

Quotations furnished by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

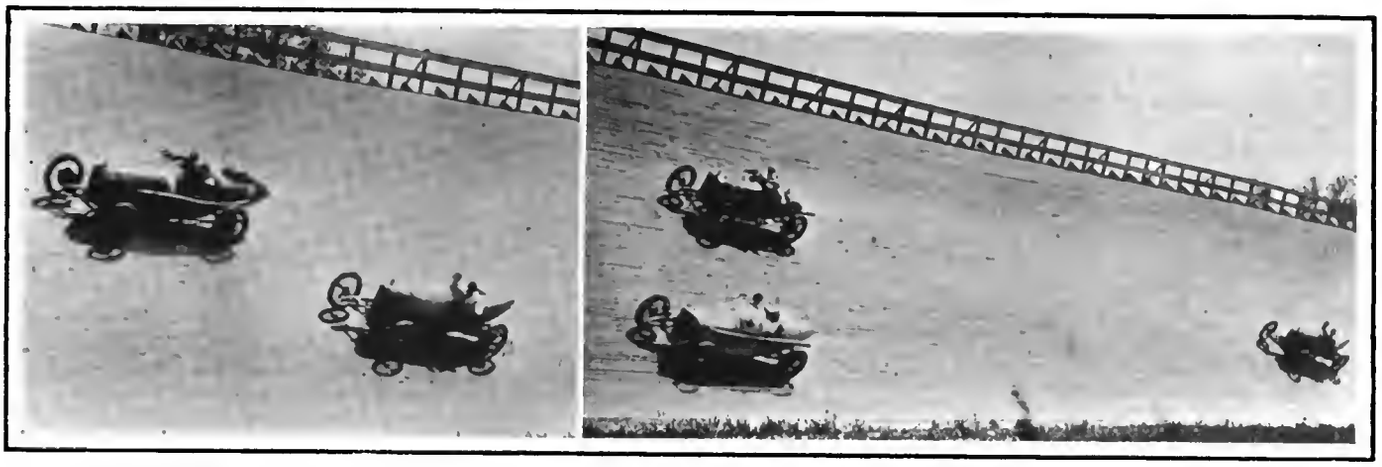
ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co.	..	..	..	37	..
Chalmers Motor Co. com	..	92	..	185	..
Chalmers Motor Co. pfd	94½	97	98	..	+2
Continental Motor Co. com	195	..	..	37	..
Continental Motor Co. pfd	82	84	9½	10½	..
Ford Motor Co. of Canada	1350	..	..	360	..
General Motors Co. com	187	192	480	510	+10
General Motors Co. pfd	104	105½	..	112	..
Maxwell Motor Co. com	36	38	73½	76½	—4
Maxwell Motor Co. 1st pfd	82½	84½	83	86	—1½
Maxwell Motor Co. 2d pfd	33½	36	53	56	—2
Packard Motor Car Co. com	110	115	..	178	..
Packard Motor Car Co. pfd	96¼	..	..	104	..
Paige-Detroit Motor Car Co.	..	..	..	50	..
*W. K. Prudden Co.	19½	21	44	46	+4
*Reo Motor Car Co.	30	31	42⅝	44	+ ⅛
*Reo Motor Truck Co.	15¼	16	..	37	..
Studebaker Corp. com	81	83	125	127½	—7
Studebaker Corp. pfd	99	101	105	..	..
C. M. Hall Lamp Co.	..	..	..	32	..

INACTIVE STOCKS

*Atlas Drop Forge Co.	..	26	..	40	..
Kelsey Wheel Co.	205	..	..	350	..
Regal Motor Car Co. pfd	..	25	17	..	..

*At close July 17, 1916—Listed New York Stock Exchange.



Left—Mulford's Peugeot and Vail's Hudson on the east turn in the 150-mile race. Right—De Palma's Mercedes, Hughes' Delage and D'Alene's Duesenberg sweeping around the same turn

Resta Wins Omaha 150-Mile Race

His Peugeot Averages 99.02 M.P.H., a Record—DePalma Takes 50-Mile at 103

150-MILE RACE

Car	Driver	Time	M.P.H.	Prize
Peugeot	Resta.	1:30:43.88	99.02	$3,000
Peugeot	Mulford	1:31:56.24	98.39	1,000
Duesenberg	Milton	1:32:32.25	97.30	600
Maxwell	Henderson.	1:40:06.27	90	400

50-MILE RACE

Mercedes	De Palma	29:02.47	103.45	$1,200
Maxwell	Rick'nb'her.	30:01.65	99.89	600
Maxwell	Henderson	30:07.16	99.61	400
Crawford	Lewis.	31.37.10	94.89	300

OMAHA, NEB., July 15—Under the hottest sun that has shone on a race in many years, Dario Resta drove his blue Peugeot to victory in Omaha's second annual automobile derby, nosing out Mulford, who had been looked upon as a likely winner until almost the end of the race. His time for the 150 miles was 1:30:43, an average of 99.02 m.p.h., a record for 150 miles on a 1¼-mile track. Mulford finished 1 min. and 13 sec. later, averaging 98.39 m.p.h. He also won the $100 prize for the fastest lap.

Don Columbo, mechanic for Franchi in the Peusun, was killed when they went through the safety wall in front of the grandstand.

Resta jumped into the lead in the first lap but was crowded close by Mulford and Rickenbacher, Mulford heading Dario before ten laps were made. The Omaha track has not stood up as one would expect. The 2 by 4's have split and there are many ruts, some as much as 2 in. deep.

On his tenth lap Franchi tore down the homestretch at 100 m.p.h. or more. Immediately in front of the pits he struck the ruts in the track, the front of his car swerved toward the grand stand, he tried to right it, then the rear end turned clear around and the whole car hit the wall broadside, tearing down 100 ft. of the wall and dropping 15 ft. into the space between the track and the grandstand. Had the car been stood on one end and a pile driver put on the other the damage to it hardly could have been worse. At a casual glance it was hard to tell the front from the rear, so badly was it damaged.

Flying planks and splinters injured a few slightly in the stands and the track was literally covered. The course was exceedingly dangerous for the other drivers but the debris was cleared away between the passing of cars.

At 20 miles Mulford led, Resta was second, Rickenbacher third, Gable fourth and Chandler fifth. The toll on tires was terrific. Mulford was forced to stop many times toward the end of the race, when seconds counted. Many of his changes were made in 20 to 25 sec.

Resta led at the end of the first hour, his speed being 101.37 m. p. h. He and Milton were the only ones who made no tire changes.

In the seventy-sixth lap Jack Gable drove the Burman Special, the same car in which Burman was killed at Corona last April and which is being campaigned for Burman's widow, through the fence and into the infield. The car turned over three times, but Gable and his mechanic, Harry McGraff, were thrown out on the first impact and escaped with a few bruises.

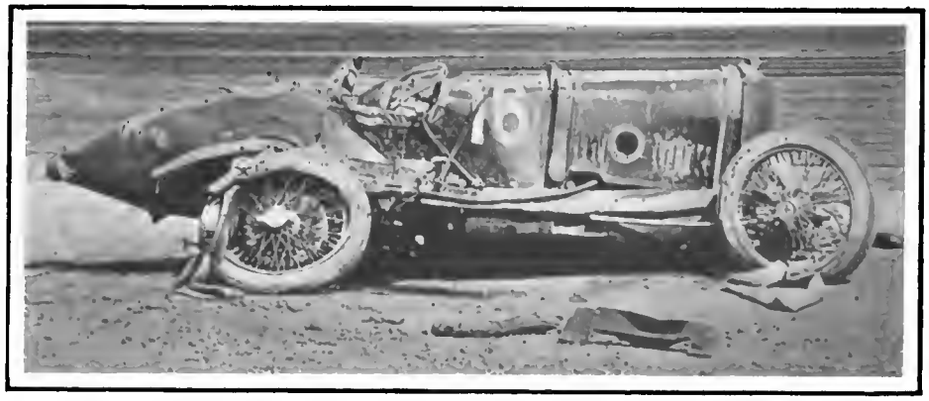
Before the race Mulford refused to let the Hudson Super-six go in. This left Vail without a mount, but Ralph finally was won over and Vail took the car. His ignition wires caught fire once, he changed mechanics once when his first mechanic was overcome by the heat, and then Vail used up all the tires he had and had to withdraw.

Rickenbacher went out at 101 miles with valve trouble. He was in third place at that time. De Palma was forced to withdraw soon after Rickenbacher came in, Ralph's trouble being a broken valve cap.

Seven Running at Finish

Only seven of the seventeen cars that started were running at the finish. They were Resta, Mulford, Milton, Kline, Muller, Henderson and Stringer.

In the 50-mile free-for-all that followed 30 min. after the finish of the big race, seven cars started, De Palma heading them all and winning at a speed of 103.45 m. p. h., his time being 29:2.47. Rickenbacher was second, Henderson third, Lewis fourth, Stringer fifth, Milton sixth and Rawlings' Duluth Special went out in the twenty-third lap with a



Wrecked Burman special, which turned over three times without injuring Gable or his mechanic. Bob Burman lost his life in this car at Corona in April

broken crankcase. Mulford's Hudson withdrew at the end of twenty-four laps with a burned-out bearing.

De Palma took the lead at the start of the race and showed much speed to the end. Rickenbacher put up a game fight but the Mercedes had plenty of reserve speed and held its own.

15,000 Spectators

About 15,000 people witnessed the races. The infield was thick with cars and the prejudice which resulted from the meager field of last year, when the date given Omaha was one day following Sioux City, where several cars were put out of the running to the disappointment of Omaha, was not in evidence today. Many predicted a repeat victory for Rickenbacher, but he did not make good.

The qualifying speeds of the different cars were exceedingly high. Ten of them were over 101 miles per hour.

Nearly every driver was exhausted from the excessive heat which registered over 104 deg. all afternoon. Resta could speak only with difficulty when he was helped from his car. The track was as hot as a stove and the pitch boiled out of it.

Resta's Big Lead

Winning to-day's race gives Resta 2,400 points toward the speedway championship and the $13,500 in money and a cup offered by Goodrich and Bosch. His lead is fairly safe at this time. De Palma would have headed Resta had he won to-day's race. To date he has made 1670 points with Rickenbacher third with 770 points.

The exact standing of competitors follows:

Driver	Points	Driver	Points
Dario Resta.	2400	C. J. Devlin.	90
R. De Palma.	1670	B. Oldfield	80
Rickenbacher.	770	Mel Stringer	55
Ralph Mulford.	595	George Adams.	55
J. Christiaens.	540	Earl Cooper.	55
W. D'Alene.	510	H. Wilcox	40
Pete Henderson	432	Billy Chandler.	40
J. Devigne.	320	Bert Watson.	35
John Aitken.	320	M. Sorenson	35
Thomas Milton.	260	Chas. Johnson.	30
Ira Vail.	220	Jack Gable	30
E. O'Donnell.	185	F. McCarthy.	25
Dave Lewis.	110	Ora Halbe	20
F. Galvin.	100	W. J. Muller.	20

Line-up for start of 150-mile race at Omaha July 15. Resta and Mulford are in front with their Peugeots with De Palma's Mercedes and D'Alene's Dusenberg and the rest behind

A view of the pits, showing how Resta protected his tires against the 104-deg. temperature before the race. He did not make a single stop for tire trouble

Elgin Road Race Postponed

Chicago Speedway May Get Aug. 19 for American Speedway Grand Prize

CHICAGO, ILL., July 17—Now that the Elgin road races for this year have been called off, it is practically certain that racing fans of the Central West will have an opportunity to experience the thrills of speed on the date set for the Elgin road races, Aug. 19. David F. Reid, president of the Speedway Park Assn., has wired to the American Automobile Assn. contest board for the Elgin date when the local speedway will stage the American Speedway Grand Prize, and it is practically certain that the request will be granted as such a promise is said to have been made by the contest board in case the Elgin races did not materialize.

A gold cup already has been ordered for the American Speedway grand prize and the entry blanks which have been printed will be sent out this week. Cars to qualify must average 100 m.p.h. or better, and the prize money will total $10,000 divided as follows: $5,000 for first, $2,500 for second, $1,250 for third, $750 for fourth and $500 for fifth. The conditions of the race are an innovation in speedway competition. Five heats, 20 miles each, and a 50-mile final will be run. The winner of each heat will qualify for the final and as soon as a driver wins a heat he steps aside, being assured a piece of the prize money even though he does not start in the final, since there are five prizes and cannot be more than five to start in the final dash. The cup will have to be defended each year.

Plans are under way for putting on a contest for the Elgin National Cup on the day following the American Speedway grand prize, but whether or not this will be done is a matter of conjecture at this time.

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Fourteen Tacoma Entries to Date

TACOMA, WASH., July 14—The Tacoma Montamarathon race to be held Aug. 5 on the Tacoma Speedway will be for a distance of 300 miles, with a purse of $10,000 for the one event.

The track has already been placed in the best possible condition, a new guard rail completed for the entire course.

Entries are now coming in, and those who have signed blanks to date, are as follows:

Driver	Car
Rawlings.	West-Duluth
Chandler.	Crawford
Lewis	Crawford
Johnston	Crawford
D'Alene	Duesenberg
Milton.	Duesenberg
Unnamed.	Duesenberg
Devigne	Delage
Franchi	Delage
Moore	Hudson
Duray	Omar
Barsby	Hudson
Rickenbacher	Maxwell
Henderson	Maxwell

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To Enlarge Dodge Bros. Club

DETROIT, MICH., July 16—It has been intimated by John F. and H. E. Dodge that a new building is soon to be erected for the benefit of Dodge Brothers' Recreation Club, where the club may broaden the scope of its work and provide a permanent source of recreation for Dodge Brothers' workmen.

Factory Miscellany

To Make Exhaust Heater—David Reyam of Wilmington, Del., has invented and had patented a device for using automobile engine exhaust in heating the car space used by occupants in winter. While it can be applied in various ways, the chief thought is to heat the entire interior of a closed car, while in cars that are not entirely enclosed, the source of heat is to be at the feet of the occupants, coming up under blankets or such other covering as they may have for protecting their limbs from the cold.

The device does not take the direct heat of the exhaust, but has it passing between coils containing air, which, after being heated, is discharged in the car at the points desired. It is claimed to be so adjustable that the temperature can be regulated to any heat desired, also that the heat can be quickly generated.

It is the intention, Mr. Reyam says, to manufacture the device in Wilmington. He says it is economical in cost and maintenance and is durable.

Stafford Still Making Parts—The Stafford Motor Car Co., Kansas City, Mo., which in 4 years made 500 cars, ceasing manufacture 2 years ago, continues to make parts, at its factory; the plant, however, is chiefly occupied with a large volume of repair work for all kinds of cars, the calls upon the equipment being largely in excess of the capacity.

Tire Plant for South Bend—South Bend, Ind., is to have a new tire plant. The International India Rubber Corp., incorporated last fall for $1,000,000, is to erect the plant, in which tires and tubes will be manufactured. P. E. Studebaker is president of the company, and the other officers are: Vice-President, E. H. Schwab; treasurer, T. W. Slick; secretary, G. W. Odell. The company is establishing branches in various parts of the country.

Chevrolet Assembling Plant in S. W.—The Chevrolet Motor Co. of Texas, Fort Worth, will build an assembling plant. The site which has been under consideration for several months is a 7-acre tract west of Trinity Park and south of the Arlington Heights Boulevard. The building plans provide for a structure of three stories, the foundation of the building measuring 275 by 375 ft.

Splitdorf Engine Co. Formed—The Splitdorf Engine Co., Augusta, Me., has been incorporated to deal in motors and generators, with a $200,000 capital, by R. S. Buzzell, president; L. J. Coleman, treasurer, and C. L. Andrews.

200 Canadian Fords a Day—Production of the Ford Motor Co. of Canada is now running at the rate of 200 cars a day and plans are under way to increase the daily output to 250 cars in the next few months.

From Oct. 1, 1915, to the middle of June, this year, the company produced 31,500 cars. The current fiscal period will include only 10 months, as the company's year has been changed to begin Aug. 1 instead of October. Next year's production is estimated at 60,000 cars.

The company has spent about $2,750,000 in erecting four new assembling plants, extensions to the Ford, Ont., plant, additions to the power plant at that place, a new machine shop, office buildings and installation of new machinery.

Auto Body to Increase Force—The Auto Body Co., Lansing, Mich., which now has about 750 men on its payroll, expects to employ at least 1400 within the next 30 days, when additions to the plant will be completed.

The working force of the Gier Pressed Steel Co., this city, is to be increased from 500 to about 750.

Hester Tire to Build—Three acres of land, lying between the C. H. & D. tracks and Jefferson Avenue, Lima, Ohio, have been obtained by the Chamber of Commerce as a site of the new factory to be built by the Hester Tire & Rubber Co. Plans for the main factory building, 60 by 150 ft., and a power house, 60 ft. sq., are nearing completion. According to the company officials work will be started on the buildings within a short time and machinery will be installed before early fall.

The Hester Tire & Rubber Co. is a $100,000 concern, incorporated under the laws of Delaware and at present doing a general rubber jobbing business. One hundred men and girls will be employed at the start, and the force will be increased later, it is said.

The Automobile Calendar

ASSOCIATIONS

Sept.—Indianapolis, Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.
Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.
Dec. 2-9—Electricians' Country-wide Celebration.

CONTESTS

July 22—Kansas City, West Speedway Race, Kansas City Speedway Co.
July 22—Oriskany Falls, N. Y., Hillclimb, Auto Club of Utica.
Aug. 5—Tacoma Speedway Race, Tacoma Speedway Association.
Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12—Portland, Ore., Track Race, Hiller-Riegel Co.
Aug. 18-19—Elgin Road Race, Chicago Auto Club.
Aug. 26—Kalamazoo, Mich., 100-Mile Track Race.
Sept. 1-2—New York, N. Y., Sheepshead Bay Speedway, 24-Hour Race, Trade Racing Assn.
Sept. 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.
Sept. 4—Cincinnati, Ohio, Speedway, Cincinnati Speedway Co.
Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.
Sept. 4—Indianapolis Speedway Race.
Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 16—Providence Speedway Race.
Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.
Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30 — New York City, Sheepshead Bay Speedway Race.
Oct. 7 — Philadelphia Speedway Race.
Oct 7—Omaha Speedway Race.
Oct. 14—Chicago Speedway Race.
Oct. 19—Indianapolis, Ind., Race Indianapolis Motor Speedway.
Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

SHOWS

Aug. 2-9—Hollywood and West End, N. J., Show, Atlantic Exhibition Co.
Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.
Sept. 4-11—Indianapolis, Ind., Show, Indiana State Fair, Indianapolis Automobile Trade Assn.
Sept. 10-16 — Milwaukee, Wis., Show, Wisconsin State Fair, Machinery Bldg.
Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

TRACTOR

July 17-21—Dallas, Tex., Tractor Demonstration.
July 24-28—Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4—St. Louis, Mo., Tractor Demonstration.
Aug. 7-11—Fremont, Neb., Tractor Demonstration.
Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.
Aug. 21-25—Bloomington, Ill., Tractor Demonstration.
Aug. 28-Sept. 1—Indiana Tractor Demonstration.
Sept. 4-8—Madison, Wis., Tractor Demonstration.
Sept. 11-16 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Automobile

Vol. XXXV
No. 4

NEW YORK, JULY 27, 1916

Ten cents a copy
Three dollars a year

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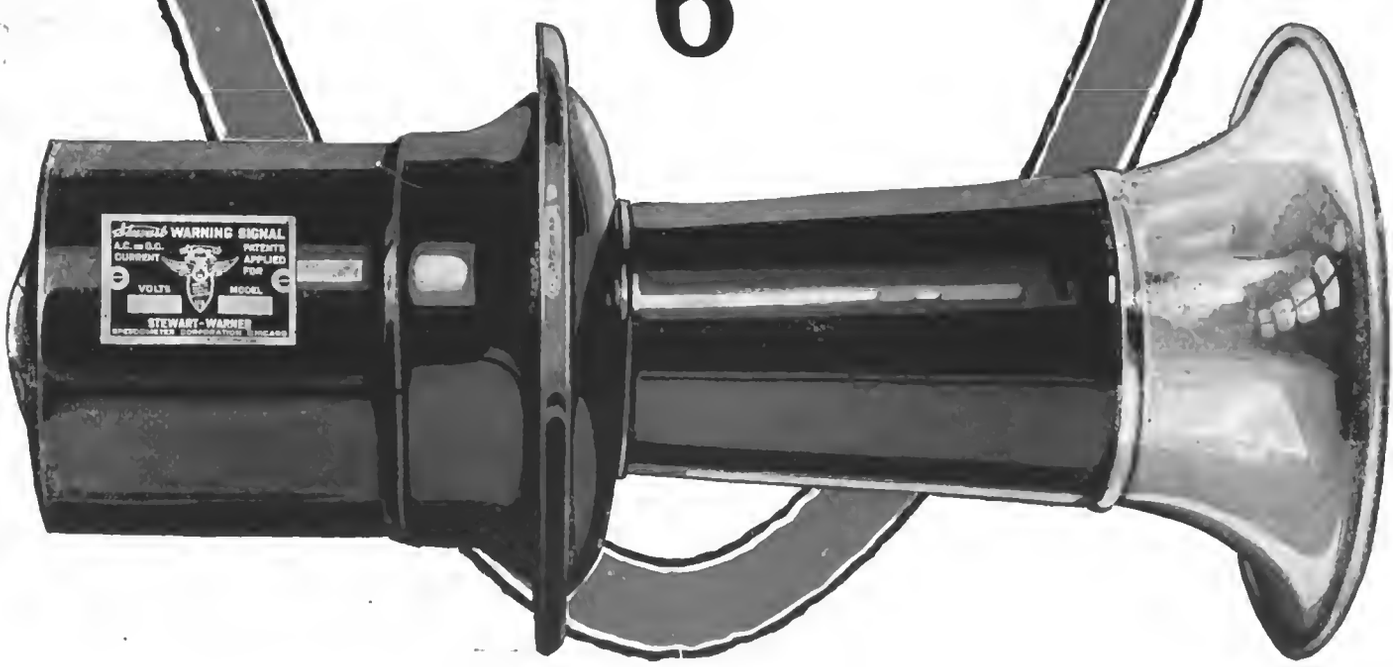


The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, JULY 27, 1916—CHICAGO NO. 4

Stromberg Under New Control

Allan A. Ryan and Banking Syndicate Charter New Company

ALBANY, N. Y., July 22.—A charter has been granted to the Stromberg Carburetor Co. of America, under the control of Allan A. Ryan & Co., and a syndicate of prominent banking interests in New York City, which recently incorporated the Stutz Motor Car Co. The directorate of the new company includes William Rand, E. F. Meniken and K. R. Howard, the first two being connected with the law firm of Jerome, Rand & Kresel, 37 Wall Street, New York City.

The company has issued 50,000 shares of no par value and will do business with $250,000.

The stock has been listed on the New York City curb and was traded last Thursday on a "when issued" basis. On the turnover of 1500 shares in this issue all but 100 shares changed hands at the subscription price of 42. Before the close of trading it was announced that the stock had been oversubscribed.

—

Hall Resigns from Olds

LANSING, MICH., July 22—J. B. Hall, sales manager of the Olds Motor Works, this city, has resigned. Mr. Hall has conducted the selling of Oldsmobiles for a number of years and is a well known figure in the industry. His future plans have not been announced, nor has his successor yet been appointed.

—

Baker Visits United States

NEW YORK CITY, July 22—Fred W. Baker of the Baker Rim Co., Ltd., Stourbridge, England, manufacturer of the Rebak rim for automobile wheels, arrived on the Baltic to-day and expects to spend a month in this country investigating the automobile rim business. Mr. Baker has made several previous trips to this country visiting our automobile shows.

—

Waldon Resigns from Cadillac

DETROIT, MICH., July 24—Sydney D. Waldon, vice-president in charge of engineering of the Cadillac Motor Car Co., has resigned. His future plans are not given out but it is not believed that he will again enter the automobile industry actively. Mr. Waldon has had a wide experience in the automobile business, relinquishing his position as vice-president of the Packard Motor Car Co. to go to the Cadillac company about a year and a half ago.

—

Hinckley Heads Chalmers Production

DETROIT, MICH., July 22—Following the resignation of S. H. Humphrey, as production manager of the Chalmers Motor Co., C. C. Hinckley, chief engineer of the company, has taken over the production department in addition to directing the engineering work of the company.

—

Hackett Four at Under $1,000

JACKSON, MICH., July 21—Following the change in name of the Argo Motor Co., Inc., to the Hackett Motor Car Co., as reported last week in THE AUTOMOBILE, comes the announcement of a new model to be known as the Hackett four. While none of the details have been made public, it is stated that the car is built to look like a speed boat and is sturdy of construction, light in weight and beautiful in design. The price will be under $1,000.

—

200,000 Cars in Illinois

SPRINGFIELD, ILL., July 22—The 200,000 mark has been passed in car registrations in Illinois.

French Makers Plan Cheap Cars

$50,000,000 Company Being Formed to Produce These in Quantity

PARIS, July 12—There are indications that immediately after the war some of the leading French automobile manufacturers will endeavor to get into the low-priced car trade and produce an automobile for the European and Colonial markets capable of competing with Ford on a price basis. Arrangements are in hand for the formation of a $50,000,000 company at Lyons to produce cheap cars only. It is declared that Renault and Berliet, two of the leading automobile manufacturers of France are interested in this concern. A Lyons body builder is interested in the body section of the new factory and is about to visit America for the purpose of getting information and arranging for the purchase of machinery for producing bodies on a big scale.

Popular report credits other manufacturers with the intention of going into the cheap car business. Among the names mentioned is an important firm which had specialized in gearcutting before the war and has since increased its staff from 3000 to 15,000. Factory development during the war has been phenomenal. One typical case is that of a well-known manufacturer who just before the war completed a new factory and laid plans for additions to be added during a period of 15 years. In the 2 years of the war he has attained the maximum he hoped to reach in 15 years and has had to buy new ground. As all French automobile and kindred factories have increased since the war from 30 to 300 per cent, there is an impression that the possible output of cars will be

considerably above the demands unless fresh ground is struck. There is a great danger of over-production when the new munition factories return to their ordinary work, and in some cases arrangements are being made to abandon automobiles for other branches of engineering. Marine engines, particularly Diesel type, are looked upon as a good field, and are said to be attracting some automobile manufacturers.

Ford's European Plants

The French Ford Co. has purchased land at Bordeaux on which to build an erecting factory, knock-down chassis from the Detroit factory will be assembled here as soon as possible. It is well known, however, that Ford has secured a big tract of land at Southampton where all cars for the European market will be produced. The English factory will then supply Bordeaux with units, and the Ford will enter France as a British car.

—

Suit Against Faw Dismissed

NEW YORK CITY, July 24—A patent infringement suit for a bulb reflector, brought by Nelson J. Quinn against J. H. Faw, Inc., has been dismissed in the United States District Court. The patent is No. 1,099,715. The construction in question is that of half the bulb being covered by a silver coating. The Faw device is a detachable metal covering, and not a coating upon the glass. The element of adjustability also entered into the question.

—

Fire in Gibson Plant

INDIANAPOLIS, IND., July 22—Fire which was caused by defective electrical wiring last night burned out the third floor of the Gibson Co.'s plant. This contained motor car parts and some accessory stock. The loss is approximately $85,000. Business, however, was not at all delayed. The company opened as usual this morning, adjusted itself to conditions, and its service system continued to operate as usual. Manufacturers assisted the jobbing company greatly by expressing a duplicate of the stock that was damaged, and this, with the reserve stock in warehouses, served to overcome the difficulty.

—

Sells Out Ziola Carbureter

MADISON, WIS., July 24—Henry A. Ziola, Madison, Wis., an inventor of electrical and carbureting devices for internal combustion engines, has sold all rights to the Ziola kerosene carbureter to a syndicate of St. Louis capitalists, headed by James B. Lloyd. It is said that Ziola received $30,000 for his patents. He is the inventor of an X-ray machine now being manufactured at Madison.

Europe Establishes Standards

—

England Has Standard Truck Design—Cars and Aviation Engines Affected

LONDON, July 12—Automobile standardization has been developed to such a degree that England is now prepared to produce a single type of truck in all factories for the use of her own and allied armies. Drawings and jigs will be supplied by the central authority to all the factories required to build trucks, and these factories will be obliged to build to this design, to the exclusion of their own models. A big series will go through immediately, and, it is declared, the output will be so great there will be no further need for American trucks.

The new design is a 3 to 4 ton model with four-cylinder engine of 5 by 6 in. bore and stroke. It has a four-speed gearbox and final drive by overhead worm. Hotchkiss drive is not incorporated. Ignition by high-tension magneto only is fitted; it is no longer considered necessary to have a secondary ignition by batteries. All-metal wheels are employed, both of the cast steel and pressed steel types. It has been necessary to adopt the two types on account of the big output contemplated.

Nothing Freakish in Design

In designing this truck everything freakish has been avoided and only features which have proved satisfactory under actual war conditions have been incorporated. The 5 by 6-in. four-cylinder engine gives a bigger piston displacement than is usually considered necessary for a 3 to 4-ton load under either English or French conditions. It is intended, however, that the new truck shall be as suitable for Russian service as for work on the French front, hence the more powerful engine. The design has been developed by an engineer who has had experience of all makes and who has enjoyed exceptional opportunities of observing the defects of trucks under war conditions. Obviously engineers with vested interests find much to criticize in the new design, but the authorities override all their objections and insist on everybody producing the one type of truck.

Standardization has not been confined to trucks. One firm having been very successful on aviation engines has been ordered to devote the whole of its plant to the production of these engines and to hand its touring car drawings and jigs to a rival firm of lesser importance. Such a course does not meet with the approval of the more important firm, for it is obliged to give away all its secrets to a concern which will be a rival after the war.

Germany has also realized the advantage of standardization. For a considerable time now she has specialized on two types of aviation motors, Mercedes and Benz, built in every available factory. In each case the motors are six-cylinder vertical water-cooled with valves in the head. The only exception to this scheme is the Oberursel, a copy of the French Gnome, used on Fokker scout machines.

German water-cooled aviation engines Mercedes and Benz, are all fitted with an indicator by means of which the pilot can ascertain the temperature of the cooling water. The Daimler-Mercedes Co. states that the maximum temperature of the water at the outlet from the cylinders should be 75 deg. Ordinary thermometers have not been found satisfactory and use is now being made of an electric telethermometer made by Hartmann & Braun, of Frankfort-on-Main. The apparatus consists of a metal piece immersed in the cooling water, and within this piece a spiral receptor of the temperature. Just in front of the pilot's seat is a galvanometric indicator connected to the temperature receptor by a suitable wire cable. The needle and the scale of the galvanometer are very clearly marked, the apparatus is entirely automatic and is not influenced by vibration.

Current is obtained from a small storage battery or from dry cells with interrupter. The thermometer portion of the appliance consists of a platinum spiral within a metallic armature. The apparatus is based on the principle of the ohmmeter. A water temperature indicator has proved of immense value in the aviation service. A large number of accidents have been traced to overheating which was not observable by the pilot until too late. Such an instrument is particularly valuable in the case of planes with more than one engine.

—

McComb Resigns from G. V.

NEW YORK CITY, July 22—H. C. McComb has resigned as engineer of the General Vehicle Co., Long Island City, to take up other engineering work and has opened offices at 1414 Times Building, this city.

—

N. A. C. C. Meets at Christmas Cove

CHRISTMAS COVE, ME., July 25—Officers and directors of the National Automobile Chamber of Commerce, Inc., are enjoying their annual sojourn here as the guests of Samuel A. Miles. The chamber is holding its summer meeting here as usual, business at the directors' meeting held to-day being mostly of a routine nature, although plans for the national automobile shows were discussed

and various schemes for decoration, etc., talked over. The patent situation also came in for a share of attention.

The party is combining pleasure with business, holding fish fries, clam bakes and general sports.

The directors and guests in attendance included President Charles Clifton, C. C. Hanch, H. H. Rice, John N. Willys, Wm. E. Metzger, J. Walter Drake, Windsor T. White, George Pope, H. M. Swetland, Alfred Reeves, Thomas Henderson, S. A. Miles, Charles E. Thompson, Wm. M. Sweet, John C. Wetmore, A. G. Batchelder, Thomas J. Wetzel, R. D. Garden, Charles Thaddeus Terry and Frank R. Nickerson.

—

Alvord Succeeds Hendee

NEW YORK CITY, July 26—J. F. Alvord, head of the Torrington Co., has succeeded George Hendee as president of the Hendee Mfg. Co., motorcycle manufacturer in Springfield, Mass.

—

Sulzberger Changes Name to Wilson

CHICAGO, ILL., July 20—Sulzberger & Sons Co., this city, maker of curled hair for automobile upholstery, has changed its name to Wilson & Co.

—

Newton Joins Hollier Maker

JACKSON, MICH., July 20—F. L. Newton, assistant sales manager of the Jackson Automobile Co. for the past 5 years, has resigned to become general sales manager for the Lewis Spring & Axle Co., Chelsea, Mich., manufacturer of the Hollier eight.

—

Pennington Joins Brunswick-Balke

MUSKEGON, MICH., July 25—A. J. Pennington, who for 6 years was general superintendent of the Lee Tire & Rubber Co., of Conshohocton, Pa., has been made factory superintendent of the Brunswick-Balke plant at Muskegon according to an announcement made yesterday by J. E. Duffield, sales manager of the new tire concern. He will assume charge of the Brunswicke-Balke plants on Aug. 1.

Brunswick-Balke will triple the output of tubes and casings originally planned.

—

McBride and Conlon Promoted

DETROIT, MICH., July 22—V. K. McBride, who has been in the sales department of the Federal Motor Truck Co. for over 2 years, has been appointed assistant sales manager of the company. H. A. Conlon, formerly a special sales representative of the Federal company in England, has been promoted to the position of field sales manager.

—

Acme Joint to Build

KALAMAZOO, MICH., June 20—A new factory building, 76 by 201 ft., will be erected for the Acme Universal Joint Co., which will cost about $20,000.

Kelsey and Herbert in Merger

Form Kelsey Wheel Co., with $13,000,000 Capital—John Kelsey President

DETROIT, MICH., July 22—The consolidation of the Kelsey Wheel Co., with plants at Detroit and Memphis, Tenn.; the Kelsey Wheel Co. of Windsor, Ont., and the Herbert Mfg. Co., Detroit, practically has been completed, the new corporation to be known as the Kelsey Wheel Co., Inc., with a capital stock of $13,000,000, composed of $3,000,000 of 7 per cent accumulative preferred stock and $10,000,000 of common stock.

John Kelsey is to become president of the new corporation, but the rest of the officers have not yet been determined. Control of the new organization will remain with Mr. Kelsey and associates.

Few realize the magnitude of the Kelsey interests, both here and in the South. At the main Kelsey plant in this city, twenty-five sets of wood wheels are produced daily, complete with rims. In the making of automobile rims the Kelsey company now ranks at the top and utilizes 150 tons of steel per day for this product alone. The Herbert Mfg. Co. makes 500 automobile bodies per day, besides finishing and trimming a large proportion of them. This plant is also a very large producer of a variety of steel stampings required in the manufacture of motor vehicles. The Memphis, Tenn. plant of the Kelsey company represents an investment of $500,000 and is the factory at which the hickory used in the manufacture of the wheels is concentrated. It is here worked into spokes and felloes, the completed wood wheels then being sent to Detroit where they receive their steel rims. The Kelsey company located in Windsor, Ont., is a separate corporation, but includes most of the same stockholders. It is the Canadian car manufacturers' main source of wheel supply. The Detroit Kelsey company has an authorized capital stock of $1,500,000, all of one class, and $900,000 of this is outstanding.

The preferred stock of the Kelsey combination is underwritten by Sachs, Goldman & Co., New York bankers, and the common is said to have been oversubscribed. In the organization plan their is provision for retiring to preferred stock at the rate of $90,000 per year. It is proposed to make the consolidation effective from Jan. 1, 1917.

—

Falls Machine Under New Control

MILWAUKEE, WIS., July 22—A well-defined report from Sheboygan Falls, Wis., says that the Falls Machine Co., Sheboygan Falls, manufacturer of small, high-speed gasoline engines for car builders, has passed into the control of a syndicate represented by Andrews & Co., bankers, Chicago. It is stated further that the company will be reincorporated as the Falls Motors Co., under the laws of Virginia, with a capital stock of $1,500,000. The company has made extensive additions during the last 8 or 10 months and at this time is still further enlarging the capacity. One of its largest contracts is that for all motors for the Grant Six.

—

Ferguson Resigns from G. M.

DETROIT, MICH., July 20—D. M. Ferguson has resigned as consulting engineer for the General Motors Co., and his plans have not been announced. Previous to his connection with the General Motors, Mr. Ferguson was chief engineer for the Studebaker Corp.

—

Walker Becomes a Chandler Engineer

CLEVELAND, OHIO, July 24—Hiram Walker has been appointed assistant engineer of the Chandler Motor Car Co., this city. He was previously connected with the Enger Motor Car Co., Cincinnati, Ohio, in the same capacity.

—

Moss Joins Thomas Truck

NEW YORK CITY, July 26—J. L. Moss, M. E., has resigned as designing engineer of the International Motors Co., and has joined the Thomas Auto Truck Co., this city, as chief engineer.

—

Jehle with Aluminum Castings Co.

CLEVELAND, OHIO, July 22—Ferdinand Jehle has resigned as laboratory engineer of the Automobile Club of America, New York City, to assume the position of service engineer with the Aluminum Castings Co., this city.

—

Horning and McKinley Councillors

NEW YORK CITY, July 24—In the list of new S. A. E. nominations giving the officers of the coming year there appear the names of Harry L. Horning, Waukesha Motor Co., and Charles W. McKinley, Willys-Overland company, who are nominated as councillors to serve for 2 years.

—

Martin, Burd Ring V.-P., Retires

ROCKFORD, ILL., July 22—A. A. Martin, vice-president and sales manager of the Burd High Compression Ring Co., this city, and who organized this company, will retire from that concern Aug. 1.

—

France Orders 600 Moreland Trucks

LOS ANGELES, CAL., July 20—W. L. Moreland, manager of the Moreland Motor Truck Co.'s factory, this city, announced to-day that the War Department of the French Republic had cabled an order for 600 Moreland trucks.

South America

U. S. A. Cars Selling Well in Country—Big Gains in Last Year

Argentine Farmer Shown Our Cars Can Stand Up Where Roads Are Poor—European Car Business at Standstill

By David Beecroft

MEDIUM and low-priced U. S. A. cars are selling in Argentina, in parts of Brazil, in Uruguay and Chile in steadily increasing quantities. This selling movement started approximately 1 year to 18 months ago at a time it was least expected that U. S. A. cars would sell. The war had started, in general South American finances were in a deplorably bad condition, as such European countries as England, Germany, France, Italy and Belgium had stopped supplying the money that they had been supplying for 45 to 55 years. Further: It was at a time when these countries were in the second or middle stages of a financial crisis that started 2 years before the war, to be exact, in 1911, and which was only augmented because of the war.

A still further fact with regard to the starting of sales of U. S. A. cars was that it began at a time when every dealer in European cars had his salesroom and warehouse filled with European machines which had practically ceased to sell. The sale of expensive European cars stopped practically 4 years ago, and there are many salesrooms to-day filled with the cars they contained then. With the cheaper European cars it has been different: They have sold, but none has arrived to take their place since the war started, with the exception of Italian cars which were shipped in large quantities from the opening of the war until 1 year ago, when Italy became embroiled in the struggle and had need for all her machines in her own land.

Within the last 2 years the entire attitude of Argentina, parts of Brazil, Uruguay and Chile, and it may be other countries in South America, have changed toward the low and medium-priced U. S. A. cars. True, before that time we had sold cars in Argentina and Brazil. We have had agencies of U. S. A. cars continuously in Buenos Aires for 14 years. One dealer has had the Cadillac continuously for that time. Scores of our different makes of all prices are there, but with few exceptions they were not popular and did not sell on a scale to be compared with cars from France, Germany, England, Italy and Belgium.

Europe had the market almost entirely within its own grip. France, Germany, England, Italy and Belgium seized the market 15 years ago. When we were running our first Vanderbilt Cup race in Long Island these countries had already invaded Argentina and Brazil and such cities as Buenos Aires, Rosario, Cordoba, Mendoza and Tucuman had already learned of the automobile. Buenos Aires shows in its ancient cars older European machines than can be found in U. S. A. I visited one dealer's museum of automobile antiques to see a Benz made before the front axle was used, each front wheel being carried in a huge bicycle type of front fork. There are old Mercedes of nearly the same vintage, and very ancient Panhards, De Dions, Renaults, etc. Europe, for one reason or another, was earlier with its cars in South America than in the U. S. A. Perhaps this was due to the large investment of capital in these South American lands and the controlling interest that European capitalists had in nearly all of the large public utilities such as railroads, trolley systems, telephones, telegraph, factories, etc. Gen-

South American Series

THIS is the first of a series of articles on South America that will appear from week to week in THE AUTOMOBILE. *David Beecroft, Directing Editor of* THE AUTOMOBILE, *has just returned from a 3 months' trip through Argentina, Uruguay, and Southeastern Brazil, where he studied automobile conditions. Mr. Beecroft went as a member of a United States Government committee appointed for the purpose of developing more friendly trade relations between South American countries and the United States.*

While in South America he traveled extensively through the different countries, visited a majority of the concerns interested in the sale of automobiles and accessories, and made a comprehensive study of the possibilities of wider use of American automobiles, accessories, motor trucks, and farm tractors in these three countries of South America.

Additional articles will appear from week to week, taking up in detail the different factors entering into South American trade.

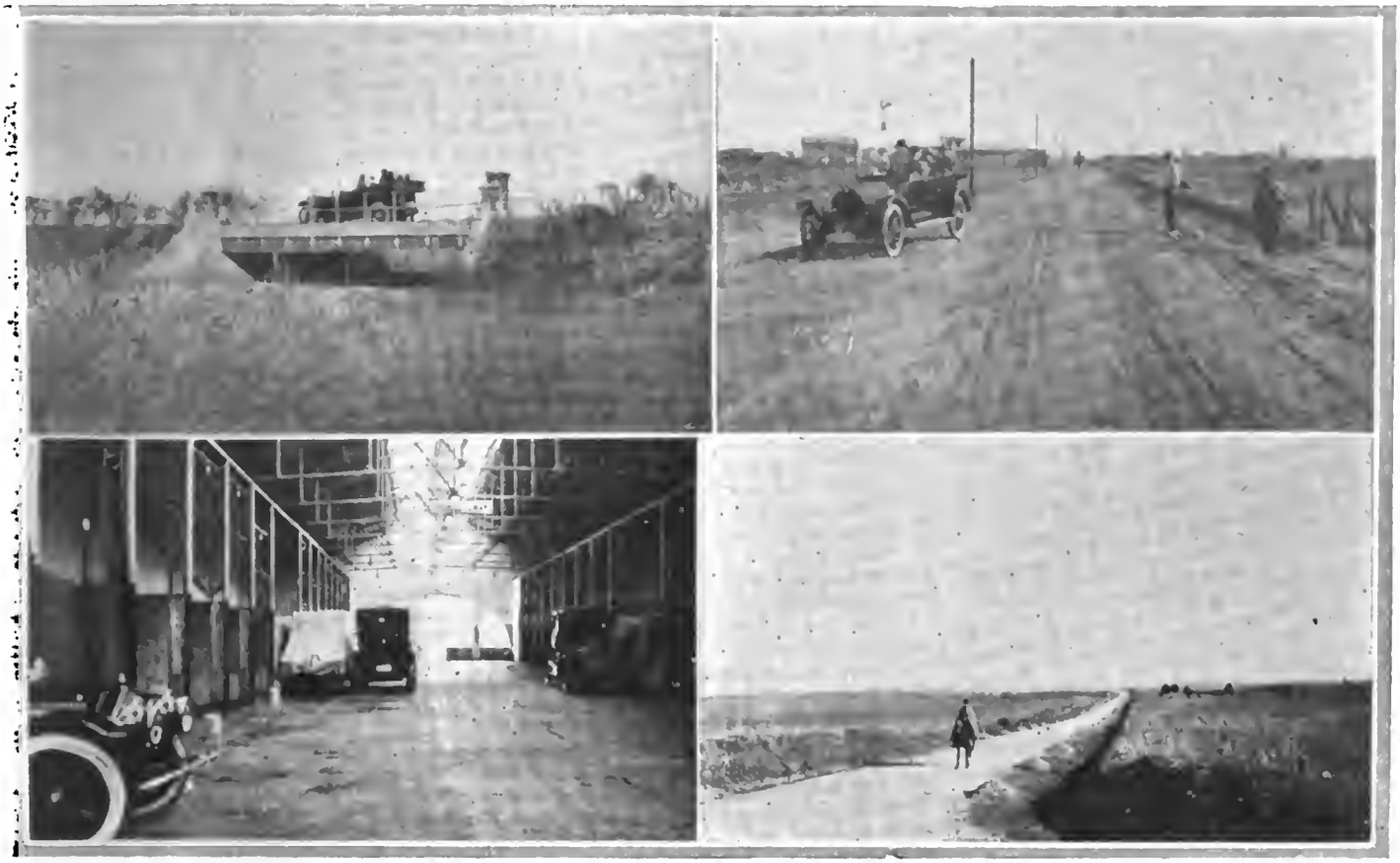
IF your conception of South America is from the maps you saw in your public school geographics, it will be well to revamp such. South America is not quite so large as North America but it has one country, namely, Brazil, which in area is about the same as the U. S. A. when Alaska is left out. Brazil, U. S. A., Canada, Australia and Europe are all about the same size, namely a little over 3,000,000 square miles. Keep in mind that Brazil is a huge country, and there they speak of the United States of Brazil just as we speak of the United States of America.

Argentina is smaller in area, but approximately the same as that of the U. S. A. east of the Mississippi River. At present Argentina and Brazil are the great possible market for U. S. A. cars, and the smaller countries like Chile and Uruguay are taking them in goodly quantities. In the other countries the advent will be slower as social and physical conditions are not so favorable. The east coast is naturally a more attractive selling field than the west coast, which is very narrow and generally hemmed in between the lofty Andes Mountains and the sea. There is a 2000-mile stretch on the west coast which is practically rainless. Immediately in from the west coast the land is from 10,000 to 12,000 ft. above sea level and, naturally, this high altitude has held back European settlement much more than in the great agricultural and grazing territories along the east coast.

Scenes of Country and City in South America

Typical landscape in Argentine farming and grazing country where U. S. A. low and medium-priced cars are selling so well at present. The country is level and very fertile. Argentine is one of the greatest stock raising countries in the world

Upper left—Street scene in Sao Paulo, Brazil, a city of 500,000 population, showing taxicabs lined up in center of street. The cabs are well distributed all over the business section of the city. They are all European, Berliet and Fiat being leaders
Upper right—Argentine has few roads. Here is a new stone block one 60 miles in length between Buenos Aires and the City of La Plata. This city is very modern, is a growing port and is capital of the Province of Buenos Aires. Armour and Swift packing plants are located in La Plata
Lower left—The heavy stone foundation used in the Buenos Aires-La Plata road, which was built by a French engineering company and will be completed in August, 1916, the work being rapidly advanced toward completion throughout its length
Lower right—A passenger dock in Buenos Aires for river traffic. Note wide, well-paved areas around the dock. This is general throughout the city, which in many other respects exhibits up-to-date characteristics and applications of modern ideas just as found in many cities in the U. S. A.



Upper left—Typical concrete and brick bridge on Buenos Aires-La Plata road. There are nearly two dozen of these very modern bridges in the 63 miles

Upper right—graded section of Buenos Aires to La Plata road ready for stone foundation on top of which is laid the stone block surface

Lower left—Type of public garage in Buenos Aires with individuat stalls for cars. Each car is literally in a separate garage of its own

Lower right—Type of new national roads being built in Uruguay, one of the smallest countries in South America. Nearly 130 miles of this road has been built in one stretch and short stretches in other places. In 2 years a road of this character will span the country from Montevideo to the Brazilian boundary on the north. Roads such as these should prove marvelously efficacious as educational aids to dealers in U. S. A. cars in their efforts to render these cars popular in South America and the roads movement is rapidly growing stronger

***Typical** view of the country in Uruguay where U. S. A. low and medium priced cars are selling in goodly numbers. The country has very few roads and not enough bridges, but the government has planned a large road scheme and much progress has been made in the tast 2 or 3 years*

One of several examples of the high-class bridge construction being used on the new motor roads in Uruguay. This country is very ambitious in its road problems and hopes to make its roads the greatest touring fields of South America

erally England and Germany had their largest manufacturing interests of all kinds largely represented in South America and when the automobile started coming into prominence it did not require much extra effort to market the car, as they were generally sold by large houses that handled myriad lines of machinery either electrical, hydraulic, agricultural, mining or other kinds.

Progress from 1900 to 1911

Before going further into the present rapidly increasing sale of U. S. A. cars in South America look for one moment at the progress made from 1900 to 1911, when the financial crisis arrived, in the sale of European cars. To-day in Buenos Aires, Rosario, Cordoba, Bahia Blanca and other Argentina cities, in Montevideo, in Uruguay, and in Rio de Janeiro, Santos and Sao Paulo, in Brazil, you see thousands of all makes of European cars in use, the most expensive makes generally in greater quantities than the cheaper ones.

Buenos Aires has finer European cars than New York, Boston, Philadelphia and Baltimore. You see every known French, German, Italian, Belgian and very many English makes in all the cities mentioned. There are scores of makes scarcely heard of and rarely if ever seen in the U. S. A. Take Italy, for example, and such cars as S.P.A., Scat and Itala, some of which have never been seen in New York or Boston, the U. S. A. hotbeds for European cars some years ago, are seen in large quantities in Buenos Aires, Rio, Montevideo and Sao Paulo, and the natives speak of them with greater familiarity than of many of our popular cars selling under $1,500. There are such German makes as Adler and Horsch, never seen in the U. S. A., such French makes as Gregoire, Berliet, Peugeot, Alcyon and other names such as N.A.G., Lloyd, Pipe, F.N. and many others unknown in the automobile fraternity in the U. S. A. Not only has Buenos Aires these makes in quantity but she is literally filled with the more popular European makes such as Renault, Panhard, Clement-Bayard, Delaunay-Belleville, DeDietrich, Benz, Mercedes, DeDion, English Daimler, Rolls-Royce, Napier, Wolseley, Fiat, Isotta Fraschini, Metallurgique, Martini and every other European name known in the U. S. A.

Let it be repeated again that Buenos Aires and Rio have finer cars than New York City. Stand near Florida (Floor-e-da) the fashionable shopping street of Buenos Aires on which no vehicles are permitted between 4 and 7 and you see an array of limousines and landaulets, touring cars and open types grander than on Fifth Avenue. The cars are generally the last word in body design and fitting. Many dealers had all their bodies built by Van den Plas, Rothschild and the best European builders. The Argentine is fond of externals. Parade attracts him. He wants the best in automobiles; no matter what the chassis is, the body has to be the best. The limousines are large, hundreds are finished interiorally in the best cabinet woods with delicate inlaid work and they are as immaculate today as when first purchased. The automobile is a great criterion of social status not only in Buenos Aires but in many other South American cities. No car is too good for the wealthy Argentine. To-day his chauffeur and footman are better groomed than those seen on Fifth Avenue, New York, Commonwealth Avenue, Boston, or Michigan Avenue, Chicago. They, too, like the car, are immaculate.

Why European Cars?

The cities are literally filled with such cars. They are not the exception but the rule. In these cities the wealthy classes have, previous to the war, been spending their winters in Europe. Not one winter or an occasional winter but every winter. Paris, London, Rome and Berlin were their Meccas. They spent 3, 4 and 5 months there. They had no ties binding them with New York, Boston, Chicago or our other leading cities. Our language was different from theirs. We had nothing in common. It was but natural that European automobiles and European cars only should find a market, and it was further natural that Argentina and Brazil should buy the

best that Europe had. Argentines had the money and the time. The luxurious car naturally was ideal for a people that take a peculiar delight in appearances and that find an added delight in satisfying this desire in Europe, which still is to all South America finality in art, in dress, in style, in manners and fashions.

After this lengthy digression in attempting to paint the picture of the European car in South America and the South American desire for it, let us revert to the U. S. A. car that for years rapped more or less determinedly at the trade doors of South America, but which has only in the last year or so found a responsive and growing market. In analyzing why the U. S. A. car is advancing in leaps and bounds in the last 12 months, bear in mind first of all, that it has started into a different field in South America than where the European car was sold. The U. S. A. car got its start in the country and that is where it is to-day selling in rapidly growing quantities. The European car sold very largely in the cities. The Argentine rarely thought of using it in the country.

The word country is rarely if ever heard in South America or Argentina. It is the *camp*. Camp not only means the country in which all kinds of grains are cultivated and large areas where cattle, sheep and horses are fed in the open, but includes the cities, towns and villages as well. Practically everything outside of Buenos Aires is camp. When a traveler goes for a selling trip he is said to be out in the camp.

U. S. A. Cars for Country Work

The U. S. A. car started selling in the camp and that is where it is selling most to-day. Our cars were not fashionable enough for the city. There the taste was for Renault, Benz, Rolls-Royce, DeDion, Mercedes, Fiat, Panhard, English Daimler and Napier. The opinion of the U. S. A. car was that it was not grand enough for the city and that it would not run in the camp. There were no roads there, and if there were the U. S. A. car was not robust enough, according to Argentine standards.

To Ford must largely go the honor of exploding this Argentine theory. The Ford car has accomplished it in the last 2 years. It required about 1 year of terrifically intense education and demonstration, and only 10 months ago did Fords start selling in quantities in Argentina, Chile, Uruguay and parts of Brazil, Rio not included. Previous to August, 1915, Fords were selling at approximately 100 per month total in Argentina and Uruguay. Suddenly they jumped to 300 and 375 per month, and since then this average has been maintained, and everywhere you find the dealer 2 to 3 months behind in delivery. Ford must get the honor of conquering the camp.

Dealers Want U. S. A. Cars

Two years and even 15 months ago the low and medium-priced U. S. A. car did not appeal to the Buenos Aires dealer who counts all Argentina an area as large as U. S. A. east of the Mississippi, and with 8,000,000 population, as his territory. Our automobile factory representatives traveled South America but often could not get an audience. They peddled their cars from agency to agency, and more often left without a representative than with one.

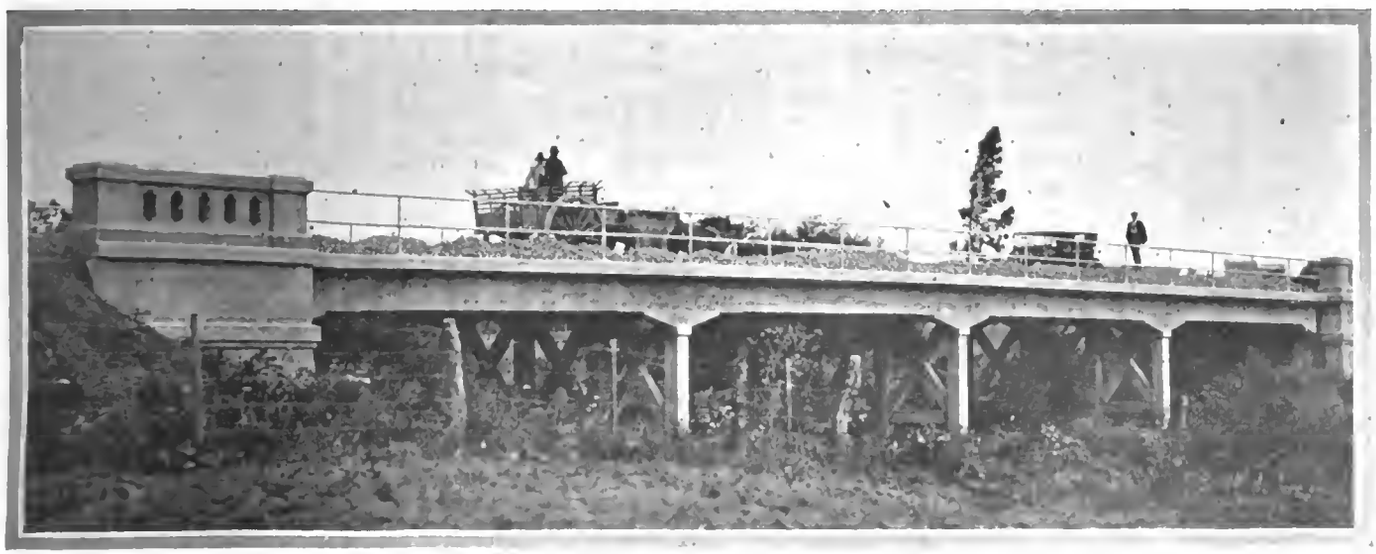
To-day it is all changed. Now the Buenos Aires, Montevideo and Sao Paulo dealers are after U. S. A. cars.

To-day our representative has the choice of five or six possible agencies. It is now a problem of selecting the most suitable, not a problem of discovery.

There never was a time when Argentine agents were more anxious for U. S. A. cars.

They are coming to the U. S. A. on nearly every steamer to look the field over carefully, visit the factories, inquire into the financial standing of the building companies and make a careful selection.

The Buenos Aires and Rio dealer does not like to make changes. He may be a little slow to tie up with a U. S. A. factory, but when he does, he hopes to make it permanent. He rarely changes. This is a characteristic of substantial South American business men.



Typical example of bridge construction on the government roads now being built across the country from Montevideo, the capitol on the south coast to the Brazilian boundry on the north

For the last 3 months there has been nothing short of a stampede in Buenos Aires for U. S. A. agencies. The same is true of Montevideo, Sao Paulo and such Argentine cities as Rosario, Cordoba, Bahia, Blanca and Mendoza, only to a much lesser degree. The same is also true in many smaller cities and larger towns scattered up and down the camp of Argentina. In every city visited during May and June, and there was nearly a score of them, the one inquiry was for U. S. A. agencies and information on U. S. A. factories and U. S. A. cars.

Many Agencies Placed

During those months agencies were placed for Maxwell in Buenos Aires and several other cities. The Dodge representative established his first agency in Buenos Aires, Montevideo and some other cities. The Chandler representative was making his preliminary plans. The Jeffery was placing agencies in Montevideo, Sao Paulo and other places.

Such makes as Ford, Cadillac, Overland, Studebaker, Hupmobile, Buick, Chalmers, Hudson, Oakland, and Scripps-Booth were already placed, some of them established years ago and others but a few months. Nearly all have taken on new life and are profiting by the stimulus given the U. S. A. car by intensive salesmanship. Ford and Studebaker are using the same well-organized sales systems as are being used in the U. S. A.

Naturally following in the wake of this newly found car business are some of our largest tire houses, several of which are taking prompt advantage of the inability of France, England, Germany and later Italy to supply tires. They are making unexpectedly rapid sales. In Buenos Aires the United States Tire Co. was just starting and its stock had not arrived. Goodyear has been under way for several months. Goodrich, the oldest, was established several years ago. Firestone and Fisk have been on the ground a short time but are doing well and several other smaller U. S. A. makes are being pushed.

Intensive Salesmanship Won

Dwell next for a moment on how this turn toward U. S. A. cars within the last 2 years was accomplished.

Virtually it was by the sweat of the brow. There was no royal road to success. It was not an order-taking program but an intensive salesmanship one.

Two handicaps had to be overcome:

1—There was the inherited dislike, if it may so be called, for U. S. A. cars.

2—There was a deeply founded belief that no car would prove satisfactory in the camp without improved roads and frequently without any kind of roads.

In making first sales in the camp the policy of one agent may be taken as a criterion. One of the most successful was a young Texan, O. P. Harris, who learned his lesson in salesmanship in U. S. A. He invaded the stronghold of the Argentine in the province of Pampa Central, one of more recent settlement and naturally a poorer field than the province of Buenos Aires, which is the oldest and best settled section of Argentina. He went to the camp with the Ford, the one he demonstrated with and sold. He called in the morning on the big land owner known as the Estanciero (E-stan-see-air-o). He did not get an audience. He was turned away. There was no use for U. S. A. cars. He was back before night, perhaps to be again turned down. He always came back. He got an audience. He got the Estanciero in his car. That was his aim.

Once seated in the car the sale was as good as made. Harris went everywhere on the huge farm or Estancia (Es-stan-see-ah). No trail was too rough. The demonstration lasted hours; sometimes 2, sometimes 3 and often 4 to 6. Harris took the wife of the estanciero and perhaps the children and another demonstration started. He had to prove his car and prove that the camp could be conquered as well by the car as it had been by the picturesque cowboy, gaucho (gow-cho) they call him in Argentina. It was now or never. Harris knew there was no second chance. He had to make good. He made good. His demonstration accomplished its object. He sold cars. He sold 125 in the one province in a few months.

So were the first seeds of the U. S. A. cars sown in the Argentine camp.

The Movement Grows Fast

Once started, the movement spread fast. One Estanciero told another. The car was a utility vehicle and not a part of social life as it had been in Buenos Aires.

One fact which greatly aided the introduction of the low and medium-priced U. S. A. cars in the Argentine camp was the high price of wheat and corn due to the war, and also to the great demand for Argentine beef, mutton and pork. The rising prices for these gave ready money to the Estanciero just as similar conditions caused unexpected streams of gold to flow into our own—Minnesota, Kansas, Dakotas and other wheat States. This ready surplus was freely invested in cheap cars, giving great impetus to a movement that otherwise might have struggled along much slower for several years. Success was crowded into a few months that might have needed years to achieve under ordinary circumstances.

Demand Is Spreading

It is argued to-day in Argentina that were it not for this situation the U. S. A. car might still be where it was before the war. Without disputing this part the fact remains that the U. S. A. car has sold, that it is selling and that there is a steadily growing demand among dealers for it.

This introduction of the U. S. A. car into the camp in Argentina, and we can similarly say into the camp of Uruguay and Chile and in such a rich State as Sao Paulo, in Brazil, is doubly interesting to U. S. A. makers when still further handicaps under which it was introduced are studied. There are several of these:

1. The price of gasoline in Argentine has constantly risen since the war. Previous to the war, England was the great supplier of gasoline, naphtha

as it is called in South America. To-day U. S. A. supplies practically all the gasoline. But the rise in price has been due to the same causes that have been active in North America, namely, scarcity of crude and tremendous demands for gasoline from Europe.

Fuel at 70 Cents a Gallon

But you must add to this the enormous increase in ocean freight between New York and Buenos Aires or Rio or Montevideo. Nearly all gasoline going to South America goes in sq. 5-gal. cans. Two 5-gal. cans are crated together and form a case. Before the war freight amounted to 20 cents a case, it rose as high as $1.70, an eight-fold increase, and the average rise was $1.20, or six times the normal rate. To-day gasoline sells as high as 70 cents in U. S. gold per gallon, in many places in the camp where U. S. A. cars are selling in quantities. In several cities the price is sufficiently high to compel quite a few owners of high-priced cars to store them in garages.

In spite of this handicap the U. S. A. car got its start and is selling in surprising quantities.

2. Perhaps a greater handicap of the selling of U. S. A. cars to-day is the question of freight. For some months freight has been $1 per cu. ft. between New York and Buenos Aires or Rio. It was as low as 20 to 35 cents. Last August the freight rise started and kept steadily on until May 1 when the apex was reached. To-day it is easier. Because of the freight rise, prices of U. S. A. cars in many cases were raised all through South America. On May 1 Ford prices went up from $1,750 up to $2,050, Argentine dollars or pesos (pay-sos). Many other increases were on a like scale, but this did not stop selling, although it did not come in the Argentine selling season.

3. A third handicap to the selling of U. S. A. cars is the unfavorable exchange rates between Buenos Aires and Rio and New York. Exchange is a problem little known of in much of our home automobile business, but is on the lips of everyone in South America. One automobile business man in Sao Paulo, Brazil, told me of losing $150 U. S. gold on one payment he made in New York on cars. The rate of exchange was unfavorable on that day. He had waited several days for it to improve, but it went from bad to worse.

Gasoline, Freight and Exchange

Gasoline, freight and exchange are the three great factors making it hard to sell U. S. A. cars in South America.

But if it has been a task to sell U. S. A. cars in Argentina, Uruguay and Brazil it has been impossible to sell, too, the expensive European cars. They stopped selling in 1911 when the financial crisis arrived. You see to-day salesrooms filled with the same cars they had in 1911. You ask a dealer how many cars he has sold since the war started and he answers not a single one. Some have not sold one for 3 years, and a few for 4 years, in other words, since the crisis of 1911 there are a score of dealers filled up with old European models.

You ask how can these dealers stand the financial strain of not selling a car for 4 years and having a showroom filled with them. The answer is brief: Those who were exclusively dealers and sold cars only did not stand it—they went broke. But there were few exclusive car dealers. The majority of dealers were large machinery houses with whom automobiles were a side line. They sold farm machinery, electric machines, hydraulic machinery and machinery of all kinds. Thus not having all their eggs in one basket, they withstood the crisis and are still able to carry the automobiles.

It was these large houses who 2, 3 and 4 years ago would not get interested in a U. S. A. car. They had a deaf ear for all U. S. A. car representatives who went to Buenos Aires and Rio, Montevideo and Sao Paulo for agents. They had had enough of selling automobiles. They had overbought and were caught. We could not interest them in U. S. A. cars.

Within the last 18 months these business houses have seen 2 or 3 makes of U. S. A. cars start selling in the camp. They see chances of coming back into the automobile industry. They see attractive chances of making more money out of U. S. A. cars than perhaps they ever made out of European cars.

Here is the keynote together with other numerous reasons that there is to-day a great and growing demand for U. S. A. cars and accessories in Argentine, Brazil, Uruguay, Chile and perhaps all west coast cities as well.

Why a Throttle Lever?

FIVE years ago there were many cars still being built without an accelerator pedal, and the latter, when put on, was an addition to the hand control and not a substitute. In Europe at the same period many cars had accelerator pedals only and no hand throttle whatever. Actually there is no need for both because the driver invariably uses the pedal when it is provided and the function of the hand throttle lever is simply to set the throttle in the proper place for idling or starting.

An accelerator pedal alone, without any hand control has the drawback that the proper throttle position for the slowest idling varies from day to day owing to the temperature and other variations. This means that some adjustment is needed which will alter the exact point to which the pedal returns when the foot is taken off it. Now, it is easy to provide a dashboard lever which will perform this feat without anything like the same number of parts required to connect a lever above the steering wheel with the carbureter.

Furthermore, controls passing down the inside of the steering post are always liable to rattle, and it would be easier as well as a little cheaper to make steering gears with only one internal control tube. The clearance could be doubled and the chances of rattle reduced in proportion. There is also no doubt that a single lever above the wheel looks much neater than the conventional double quadrant. There seems good reason to think that if some prominent manufacturer would make the move the industry would be quick to abandon the old-style throttle lever.

No doubt many of the old-time drivers who were used to the hand throttle before the days of the accelerator will disagree with this view, they still use the hand control or think that they do. Let it be remembered, however, that these men are but a very few among a vast multitude, and the newer motorist makes practically no use at all of the hand throttle lever.

Less Weight and More Power for New Franklin

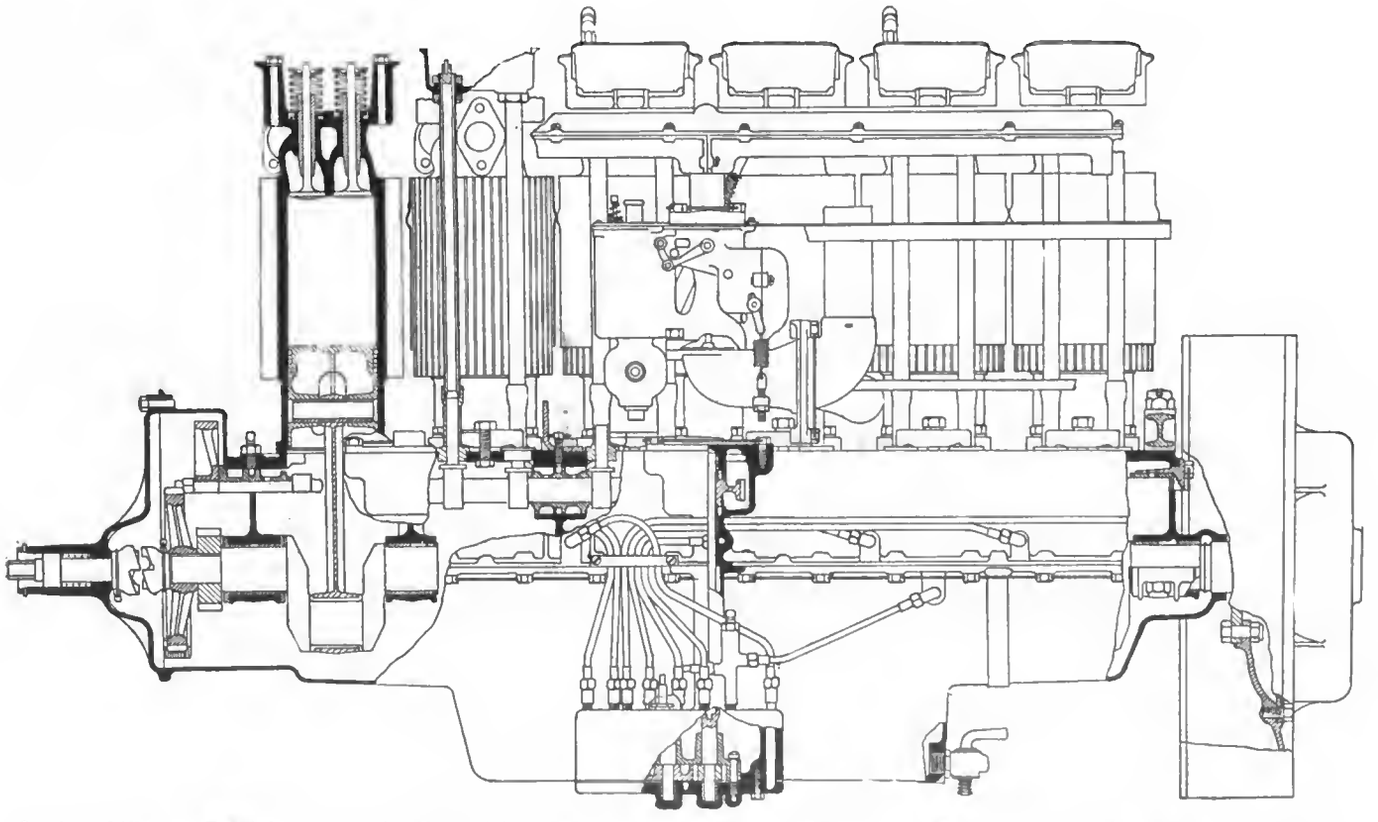
Has Smaller Engine of Higher Hp.—Weight Just Over 1 Ton—Appearance Improved—Price Reduced to $1,850

THAT the H. H. Franklin Mfg. Co., Syracuse, N. Y., had a new model in preparation was known to a few over a year ago, which means that the chassis now announced has had a very great amount of work put into it and has been tested with especial thoroughness. The results of this careful preparation are quite remarkable, for the new car is a very considerable advance on previous Franklins, good though the latter undoubtedly were.

400 Pounds Saved

The 1916 Franklin has been generally accepted as the lightest comfortable touring car of its capacity in the world, this low weight being obtained by scientific design, careful choice of material and elimination of every superfluous pound of metal. That as much as 400 lb. could be trimmed off it without depreciating performance or comfort was a surprise even to the Franklin engineers, but this has been done and both performance and comfort are improved thereby. This large amount of weight has been saved without making the car smaller. The new engine in lighter, being a trifle smaller in the bore, the gearset has had several pounds cut out and both axles are lighter. All the petty details have been examined with a microscope, so to speak, and ounces cut here and there; more forgings and fewer castings are used and aluminum takes a bigger part than ever.

The general lines of the chassis remain almost unchanged. The air-cooled engine, now 3¼ by 4 in., is externally similar to the old 3⅝ by 4 in.; the wood frame, full elliptic springs front and rear, and the amidships gearset are all retained, in fact, it needs a close examination of the chassis to find the changes. Externally the finished car has been improved in appearance very greatly. The sloping hood has had rounded corners substituted for the square ones, and it is wider, making a flush joint with the cowl all the way around. The bodies have also been rendered smoother and every one in the whole range of types is as good looking as another, the closed styles being, perhaps, especially distinctive. Also a new design of four-passenger roadster, which is not a clover leaf, is likely to prove popular, as it has all the close-coupled effect and is much easier to enter. There are divided front seats and a back seat in just the same relationship as in a clover leaf, but the doors are almost double as wide as usual. When open the door allows entrance to be made to either front or rear seat. Still easier entrance to the rear seat can be had if desired, by tipping the front seats, both of which are hinged so as to fold forward.



Section of the new Franklin air-cooled engine 3¼ in. by 4 in. This is on much the same lines as the former type but is a little smaller, though producing slightly more power. Atwater Kent ignition has been substituted for the magneto and the use of a Stewart vacuum feed allows the carbureter to be placed higher

The sedan and brougham bodies have been altered by the substitution of a V-fronted windshield for the flat pattern and the lines of sides, front and roof have been blended in a particularly happy way. It is not too much to say that the whole closed car range resembles the best class of custom bodywork. Great care is taken with the detail finish of all the bodies, and one noticeable point is the solid way the doors close; in fact, the bodies all give the impression of weight and massiveness; it needs an examination of the unfinished shell to realize how very opposed to the truth this impression is actually, for they are light as well as strong.

The principal car of the Franklin series is, of course, the five-passenger touring job, which sells for $1,850. The four-passenger roadster costs $1,850 also, and there is a two-passenger roadster at $1,000, this having a very big boot under the rear deck which would hold enough baggage for a 3 months' tour. The sedan costs $2,750 and the brougham, which is merely a smaller sedan, $2,700. In addition to these cars, there is a limousine for $3,000 and a very smart town car at the same price, while the eighth model is a cabriolet selling at $2,650.

Franklin expects to make 10,000 cars in the next 12 months, of which about 7000 will be the touring car and 1000 roadsters for two or four passengers. Of the sedan 1000 will be made and the other closed types will complete the schedule. It is thought probable, however, that the demand for the four-passenger roadster will exceed this estimate, judging by the orders now being placed by dealers.

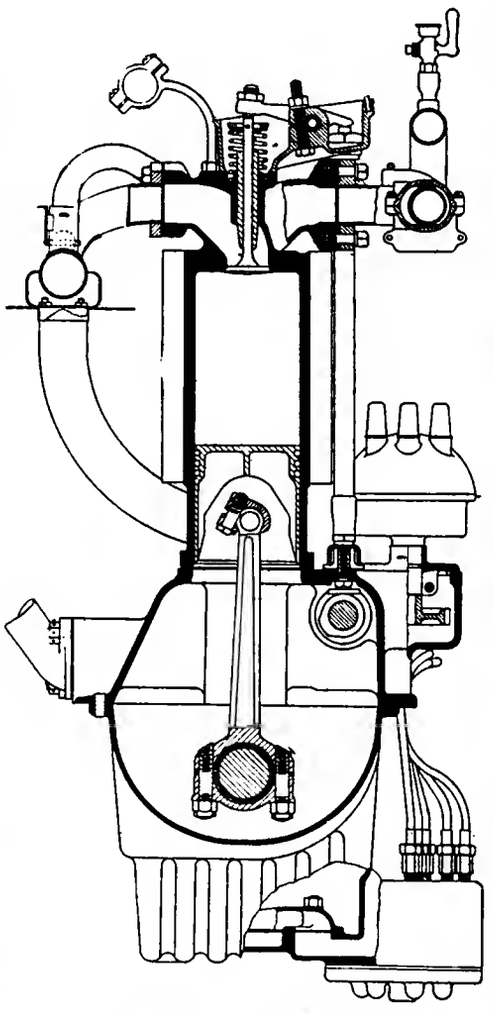
Engine Not High-Speed Type

Although it produces its maximum of 31 hp. at a higher speed than the maximum of the older motor the new engine is hardly a high speed design, the peak of the power curve coming at about 1700 r.p.m. The maximum torque is 112 lb. and occurs at a little over 1000 r.p.m. It is a small engine, the 3¼ by 4 in. dimensions for the six cylinders, making the total piston displacement 199 cu. in. and the formula horsepower is 25.3. On high the gearing is 3.9 to 1, the wheels being 32 in., which means 1950 revolutions of the engine per mile, or a total displacement of just under 390,000 cu. in. per mile. Since the weight is under 2300 lb., this gives a large ability, which is evidenced on the road by rapid acceleration on high. The maximum speed of the car is 50 m.p.h. or over. That is to say, 50 m.p.h. is reached easily and more under favorable conditions.

The engine is 150 lb. lighter than the old power plant, but, apart from the reduction in bore, it is little changed. The air-cooling system is exactly as before, save that the flywheel with its multiple blade lower construction is now an iron casting instead of being built up. Vertical steel fins are made integral with the individual cylinder castings by having the iron poured around the strips of steel and very light aluminum jackets guide the air draught downward from the heads of the cylinders.

The overhead valve mechanism has been lightened in detail, so that there is less inertia in the operating parts and the point of contact with the rocker on the valve is so shaped that the action of the rocker cannot put any side stress on the valve stem, so causing wear on the guide.

The most marked change in the engine is the substitution of Atwater Kent ignition for the magneto. The Franklin engineers consider that this battery system gives better results at low speeds and equal results at high rates of revolution, while it is again an opportunity for saving weight. For control of the ignition point the Atwater Kent automatic advance is used, there being no spark lever on the steering wheel. Lighting and starting are performed by a Dyneto single unit machine driven by silent chain and located at the front right end of the engine; it is very accessible and the wiring is also simplified to the last degree. All the important junctions, fuses, etc., are carried on a panel in the cowl board and the spare bulbs for the lamps are also held in sockets on the same panel, so that they are perfectly protected and always accessible in a hurry. The carbureter is the standard Franklin design, with which the various economy runs have been made. It has been raised considerably and now has a Stewart vacuum feed from a rear tank.



Cross section of the Franklin engine

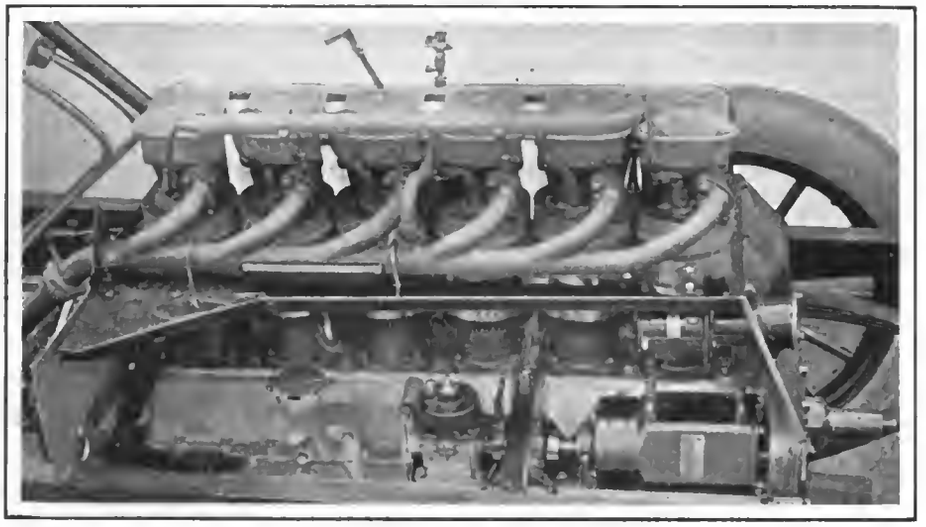
Incidentally, it is stated by the manufacturers that the new model with its reduced weight will be able easily to break all previous economy records, and that the average man using the car in the average way without taking any special care for economy ought to get well over 20 miles per gallon. This, of course, being a minimum and not a maximum. In other words, the economy is improved in the same proportion as the weight is decreased.

New Aluminum Piston Type

Seeing that the normal working temperature in the Franklin engine is distinctly high, the makers were not very ready to believe in the aluminum piston, but they have now adopted it as stock practice and consider that the better mean effective pressure of the new engine is largely due to the improved piston cooling obtained. At first there was a little trouble from wear on the skirt; it was difficult to get a close enough fit to insure absence of slap without abrasion. The trouble was overcome completely by turning a shallow, square groove of screw thread form from the bottom of the skirt to just beneath the lower ring. This holds oil securely and allows a smaller clearance than is possible with a plain piston.

There is an interesting lubrication system employed, individual oil supply being sent to every point. The oil pump, which is a conventional gear pattern, is mounted on a large plate, and the delivery from the pump is distributed to a number of oil leads by means of passages in the plate. Actually the plate is die-cast aluminum with distributing grooves, and these grooves are made into closed passages by putting a piece of thin sheet copper over the face. This gives direct pressure feed to all bearings on the crankshaft and to various other points.

Bearings, and details on the underpart of the engine are now more accessible because the boot or under cover has



Franklin engine, showing mounting of motor-generator, tire pump and horn

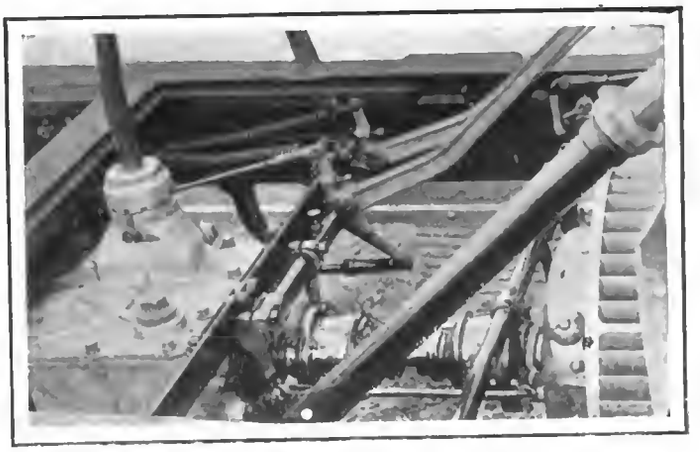
been abandoned, the sides of the crankcase being now joined to the frame sills by sheet aluminum guards, leaving the bottom of the crankcase exposed. The elimination of the under cover also aids in reducing the weight.

Gear-Shaft Location Changed

The previous Franklin gearset appeared remarkably light, but the new design is still lighter. Instead of being side by side the shafts are now one above the other and the square shaft has been replaced by a splined one. Three speeds are provided and it is noteworthy that the second gear is very quiet in operation, probably owing to the stiffness caused by the short shafts and very compact case. The gear shift lever is housed on the top of the case, working in an adjustable ball joint; it is a tube with solid ends brazed in, thus being very light though stiff. The emergency brake lever has been removed from its central position and is now on the frame at the driver's left, where it lies well forward and out of the way. It does not obstruct the entrance from the driver's side, and its absence from the middle position makes more foot room. There is no intermediate linkage for this brake, as the pull rod goes direct from the lever to the rear axle. The clutch is unchanged, and the foot brake is still on the back of the gearbox, operating with great power and smoothness.

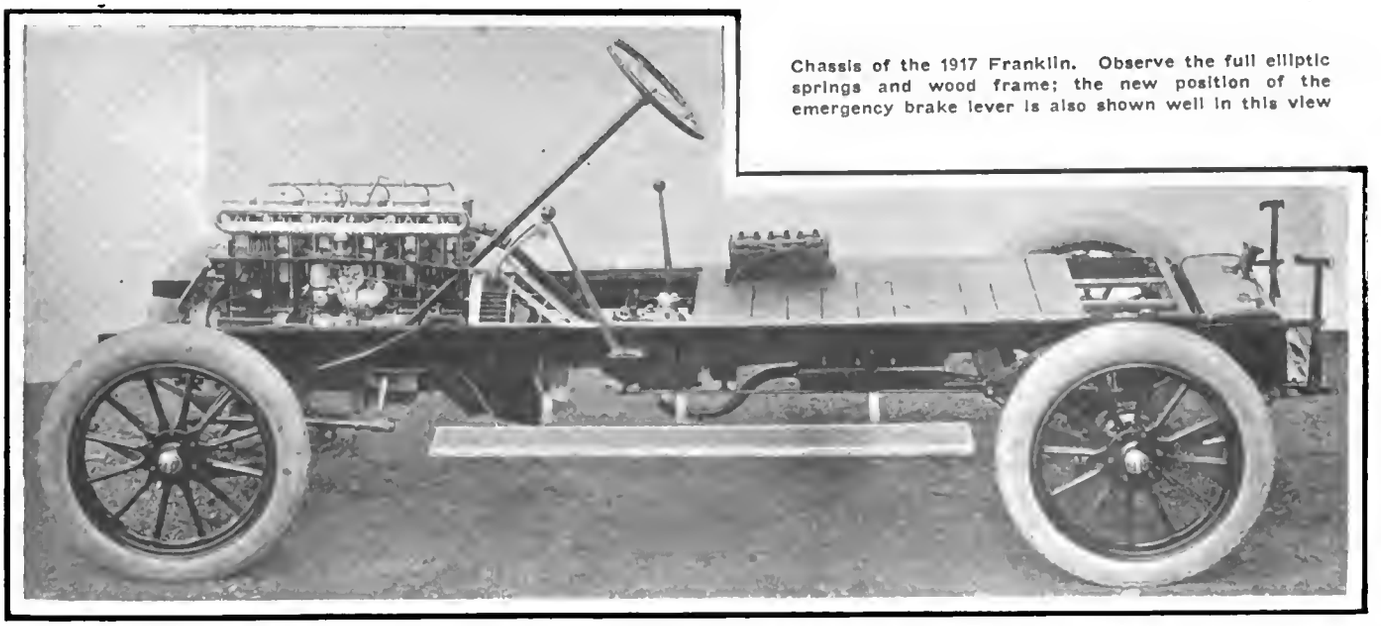
Despite the smaller weight and also despite the fact that the springs are shorter, the new car rides much better than the last series. A really rough railroad crossing can be taken at 20 m.p.h. without shaking a passenger off the seat. The explanation of this is in the axles, whence a large amount of weight has been taken. From the rear axle 25 per cent of its original weight has been removed, and from the front axle 30 per cent. This is due to the use of finer forgings and the elimination of some redundant parts.

Another effect of the small weight is to make the car so easy to steer that the first impression on taking the wheel is that something has come undone. The effort required to move the wheel is so slight that a child could steer the car easily, and a woman could drive all day without tiring her arms. There are no cars made anywhere in the world that steer more easily and extremely few that are as light to handle. The facility of control extends to the clutch, brakes and gearshift, all of which move without effort.

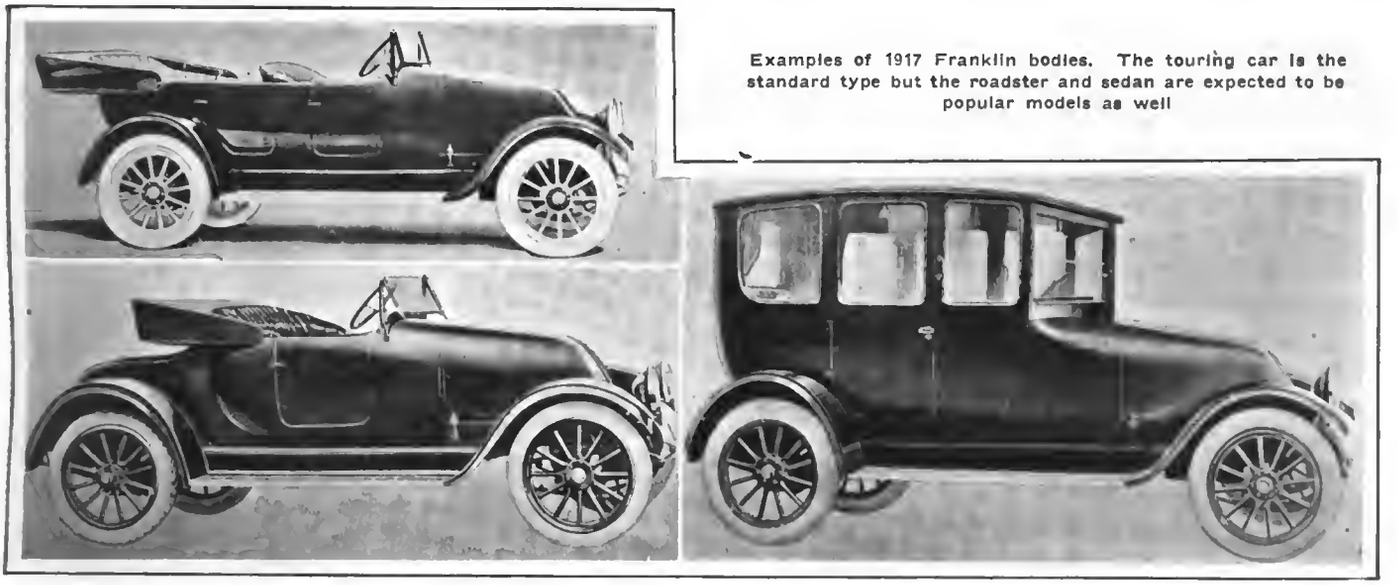


Centrally placed gearbox on Franklin showing the pedal assembly

There is no need to itemize the fittings. All the customary



Chassis of the 1917 Franklin. Observe the full elliptic springs and wood frame; the new position of the emergency brake lever is also shown well in this view



Examples of 1917 Franklin bodies. The touring car is the standard type but the roadster and sedan are expected to be popular models as well

equipment is given, and all of it is of good quality in keeping with the character of the car.

In regard to equipment, the cowlboard has been well arranged, the clock and speedometer both being under the driver's eye, while the carbureter control and the switches are ready to his right hand. The horn button is mounted on the side of the door, where it can be operated either by the hand, or by side pressure of the knee, and a complete tool kit is contained within the upholstery of the door, each tool being in a special clip. The compartment has a lock.

A single tire carrier is built in conjunction with the gasoline tank brackets, and provision has been made for attaching luggage at the front of the left running board. Strap loops are mounted to retain the straps which secure trunks or other luggage, and on the inner edge of the running board stops are properly placed to hold the trunk in position. The luggage space accommodates a two-suit-case trunk, 10 in. high and 15 in. wide, and 30 in. long. Tires on the open cars are 32 by 4 in. and 32 by 4½ for the closed models, to allow for the different body weights.

Shortcomings of the Conventional Lifting Jack

WHEN it is necessary to raise a wheel off the ground to change a tire the inadequacy of the conventional form of tool used for the purpose becomes apparent. Lifting jacks as a rule are ingenious and so far as the actual lifting gear is concerned there is no criticism to offer. It is, though, rather remarkable that no automobile manufacturer has yet seen fit to provide any definite place on the axle where the head of the jack will take a firm, square seat.

No Firm Contact Point

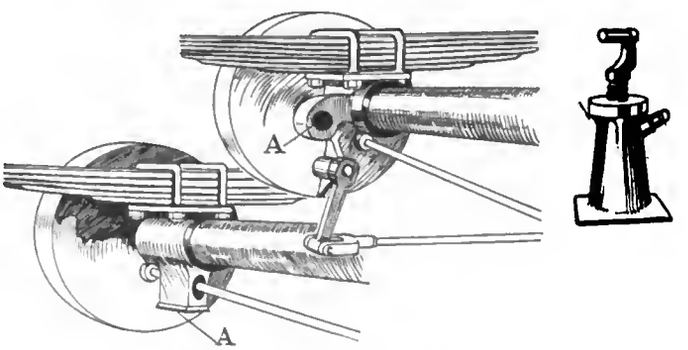
On the rear axle it is sometimes positively difficult to find a place near the end where the head of the jack will go at all, because of the various protuberances on the brake bracket and because of the tie rod stay. Thus the car is often none too secure and stable when resting on the jack.

When it is a front wheel in question there is certainly a place to put the jack, but one generally finds that the jack has to be set much lower to go under the front axle than it needs to be at the rear, which means that the jack cannot be kept in the kit so set that it is ready to lift either front or rear axle with the minimum of strokes and in the minimum of time.

A Special Bracket Possible

It would cost nothing and would be quite easy to have some special place on one of the brackets at each end of the rear axle designed to give a firm contact for the jack. All that is needed is a downwardly projecting lump of metal which would clear the tie rod and all other projecting parts. The sketch, Fig. 1, shows this idea. It would be easy also to have the distance from the jack abutment on the rear axle to the ground the same as from the underside of the front axle to the ground, so that the same setting of the jack would suffice for either axle.

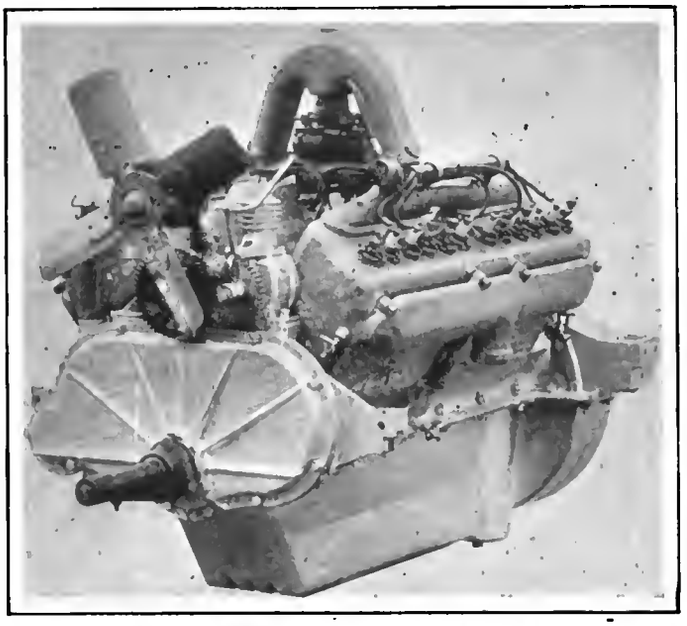
Carrying the idea a stage further, instead of a flat abutment on the axle there might be a lug with a hole through it, as sketched in Fig. 2. The jack would then need a special form of head which would hook into the hole in the lug. This would mean a special jack for all axles of the same make, but it would provide perfect security. A car could not fall off such a jack as long as the base of the jack rested upon firm ground. The second suggestion was made by a correspondent in *The Autocar* (England) as long ago as 1913, but the idea never found any supporter among British manufacturers. It seems difficult to understand why something of the sort could not be done as the convenience would be very real. Every car has to have its tires changed many times during its life, so why not make the job as easy as possible?



Left—Fig. 1—Suggested provision for jack contact. Above—Fig. 2—Fitting for special jack shown at right

Five Bodies for National Twelve

Detail Refinements Make Car More Accessible—High, Narrow Radiator Adopted—New Four-Passenger Clover-Leaf—Seating Layout Rearranged, Giving More Comfort for Passengers



National twelve engine, showing outside arrangement of the valves. High-tension magneto ignition is a feature

A NEW series of National Highway twelve-cylinder car is just going through production in the Indianapolis factory and incorporates several changes over the model marketed last season. This is a companion car to the National Highway six which is being continued. Following the general trend, prices are higher this year on the twelve-cylinder model than last, the increase being $130 per car, making the price now $2,150. This includes extra seats, however, while last year these seats were sold at $30 extra.

A number of detail improvements have been made throughout the entire car. In the first place the touring body has been increased in size and now instead of being a six-passenger job, it has a full seven-passenger capacity. Although the improvements are numerous, for 1917 the same general chassis layout on the 128-in. wheelbase will be adhered to. Instead of an option of 34 by 4½ or 36 by 4½ tire, the regular equipment will be 34 by 4½ which was the choice of the majority of buyers during the last season.

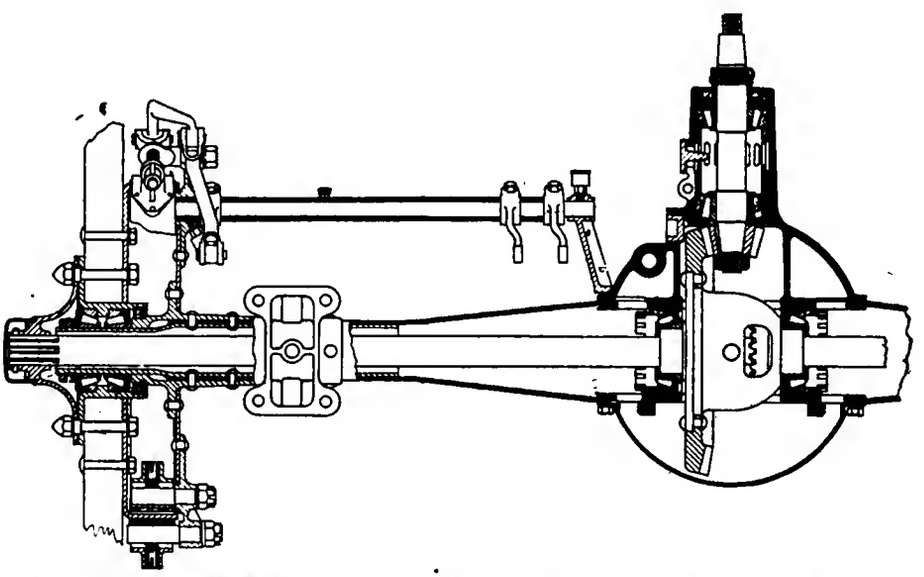
Many Detail Improvements

Probably the most notable change on the new National Highway twelve-cylinder car is in the seven-passenger touring body design. Although the chassis is the same length, the new body is 3 in. longer. It has a center cowl and there is an aisle between the two front seats. In the tonneau under the center cowl are two locked package compartments. The front seats are larger in every dimension and there is also more room in the driver's compartment. The body is wider than in the former series and there is more carrying capacity under each of the three seats. In addition there is a tool compartment in the left front door as on the former models.

Five Body Styles on Twelve

The new Highway twelve cars are furnished in five different body styles. In addition to the seven-passenger touring car there are a four-passenger touring car, four-passenger roadster, five-passenger all-weather sedan of the Springfield type and a three-passenger coupé. In the open models there is a new design of side curtains and these are fitted to the doors and so arranged as to permit the curtains to open with the doors, thus giving a closed car effect which is very useful in rainy weather.

The arrangement of the extra seats has been carefully worked out so that the tonneau floor is smooth and the folding seats and their supports are fitted flush with the floor when the seats are folded. A new and specially designed tire holder in the rear has the advantageous feature of requiring but one strap and provision is also made that the spare tires can be locked if so desired. Another feature of convenience is that the gasoline tank filler has been moved over to the right side near the right fender. It is now provided with a hinged cover which is held in place with a wing nut. This gasoline tank cover cap is easier to open than the old one and by being hinged it is impossible to loose it. A change which alters the appearance of the car somewhat from the older model National is that the radiator has been altered so that it is now 2 in. narrower and 2 in. higher than before. This gives a proportionately higher hood and has necessitated somewhat the change of the customary National



National floating rear axle in section. Taper roller bearings are used. The axle is light but strong

radiator emblem, as far as size goes. The shield design, however, is still maintained in spite of the change in size.

A study of the exterior of the car will reveal some other minor differences which may be particularly noticed in the fenders which are an inch wider and of new design in the rear and also the slanting windshield, the straight side of body instead of the tumble-home type formerly used, the flush doors and the necessary alteration in general lines to coincide with these changes. In equipment also a few alterations have been made, particularly on the dash, where a new oil pressure gage with a unique dial design has been installed and also a new combination ignition and light switch which is locked by a special key. The keys for these locks are not interchangeable.

Four-Passenger Clover-leaf

The clover-leaf design which was marketed last year as a three-passenger body has now been made into a full four-passenger job. This has been accomplished by increasing the body all around and by moving the rear seat back 4 in. The back of the rear seat is higher, making it fully as comfortable as the front seats.

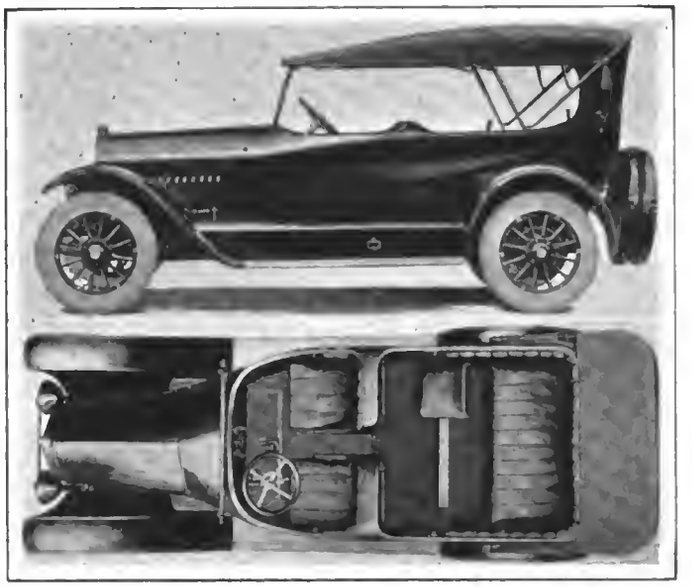
Outside Valves for Accessibility

The National Highway twelve motor is a product of the National company's own shop. It has a piston displacement of 338.5 cu. in. and a bore and stroke of 2.75 by 4.75 in. It is a high-speed type throughout and is particularly distinguished by the use of outside valves which make it very accessible. The electrical apparatus and other motor accessories are located between the arms of the V where they can be easily reached.

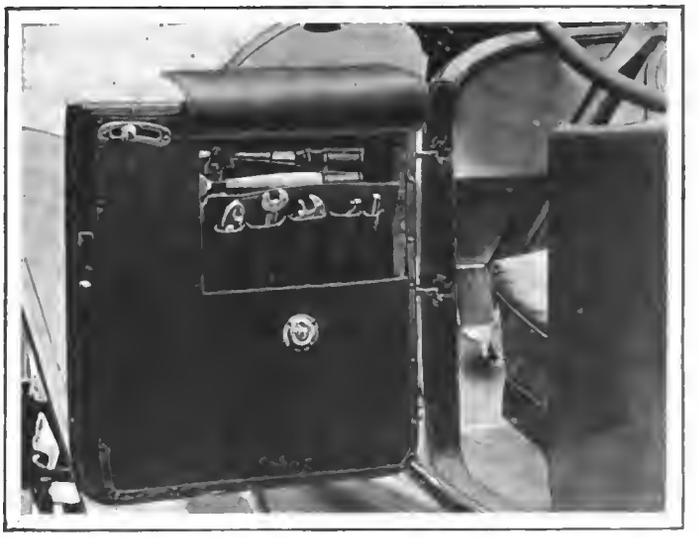
Two separate blocks of six cylinders each are used, both L-head type and with two independent camshafts. No effort has been necessary to install synchronizing means for the two valve actions as they are altogether independent. The timing gearset is quite similar to that used on the ordinary T-head motor, and the drive for the auxiliary apparatus in the center of the V is taken off the right camshaft by a silent chain.

Pressure Oiling System

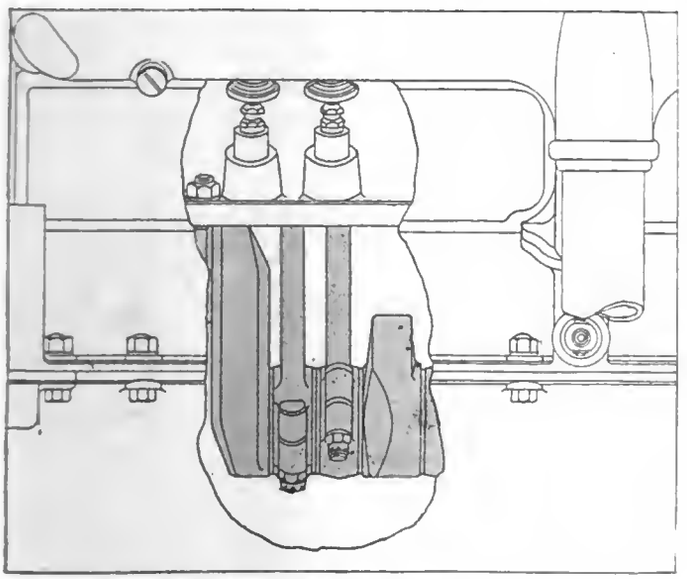
In working out the lubricating system the feed is practically all under pressure and is regulated by the output of the gear pump which is located in the oil base having a large screen on the suction side and also a gauze strainer in the form of a tray covering the whole top of the oil pan, but there are no dip troughs as the crankshaft is fully drilled and



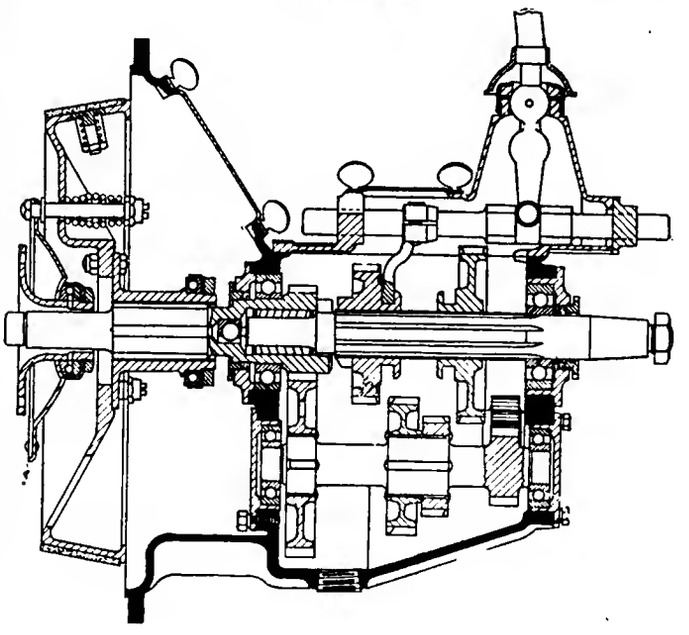
New National Highway twelve-cylinder seven-passenger touring car, selling for $1,750, showing the new seating arrangement

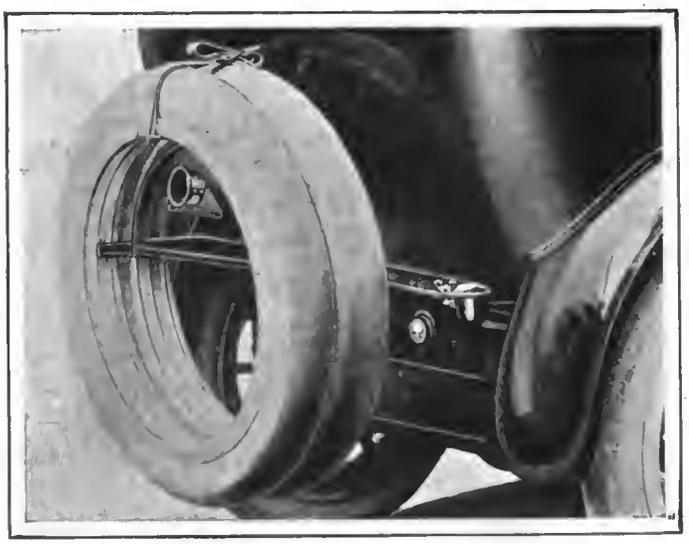


All tools for the National twelve-cylinder cars are conveniently carried in the locked compartment of the front door on the driver's side



National twelve side-by-side connecting-rod mounting and section through the three-speed gearbox used on this car





New tire carrier on National twelve, which requires but one strap as the holder fits firmly inside the demountable rim. Note gasoline tank filler and gage

the oil from the main bearings finds its way to the connecting-rod lower ends.

Oiling the Wristpins

Separate pipes lead to the timing gears and to each of the camshaft bearings while the piston pins are oiled by an inversion of the usual method of fully forced lubrication systems. As a rule the connecting-rod serves to carry the oil to the wristpins and then to the cylinders, but here the oil feeds to each cylinder at a point about 1⅛ in. from the bottom and reaches the wristpins through tiny holes drilled in the aluminum pistons. The latter have a V groove cut near the bottom, which is used to lift oil into the cylinder, as the absence of splash troughs in the body of the crankcase cuts down the amount of spray present. As to the oil pressure, this is not very high, the relief valve blowing off at 25 lb. per square inch. When the engine is idling the pressure is about 10 lb., and it rises gradually with the engine speed.

There is only one water pump, but this is duplex internally, the rotating member carrying two sets of vanes. One set feeds directly upward into the block of cylinders on the right and the other half of the pump delivers through a passage cast in the aluminum of the crankcase to the left block. This cuts down the piping materially and makes for efficiency and simplicity.

A few other facts about the engine that are interesting may be given, as, for instance, the weight of the piston, which is 8 oz. without rings. The valves are 1 5/16 in. diameter and the left is ⅜, giving a quite large opening, while the mushroom tappet provides a quick lift and descent, giving a slightly better valve diagram than the roller type. It is probable that the fan has some effect as a damper to the crankshaft, though it is doubtful whether any such aid to elimination of vibration is needed, but the short belt drive, when kept tight, provides a flywheel just as the Lanchester device, with a slipping possibility. Of course reaction from the fan would be cushioned a good deal by the belt and then the chain, but it is an undoubted fact that the presence of a fairly high speed fan does often have a steadying effect on an engine.

Flat Cantilever Rear Suspension

The clutch is an aluminum cone with leather face and the unit gearset provides three forward speeds, all shafts therein running on annular ball bearings. The propeller shaft is tubular and bears two universals, and the rear axle is floating. A flat cantilever rear suspension is employed and it may be noticed that the center bracket has the swivel pin located beneath the spring instead of above it, as is more usual. The springs are 51 in. long and 2½ in. wide with eight leaves each and their action is extremely satisfactory. The front springs have no noteworthy peculiarity, being 38 in. long by 2 in. wide, but special precautions have been taken in laying out the steering and the use of large ball thrust bearings for the front axle swivels makes the steering control very powerful.

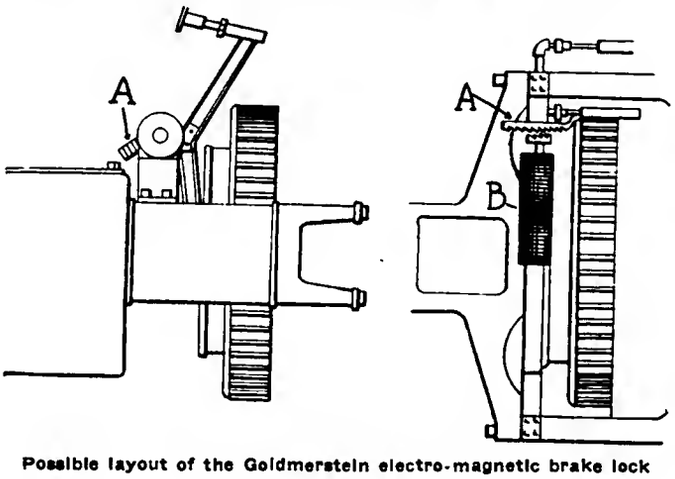
Superfluous Weight Eliminated

Throughout the rear axle taper roller bearings are used, and the type is floating, very strong steels being used so as to cut the weight as much as possible. This statement applies to the whole chassis which has few redundant parts and very little dead weight in any portion. Drive is by spiral bevel and the direct gear ratio is 4.4 to 1.

An Electro-Magnetic Lock for Brakes

LEON GOLDMERSTEIN, who will be remembered as having recently read a paper on aeroplanes before the Metropolitan Section of the S. A. E., has entered the accessory field with a novel form of automobile lock which prevents motion of the car by holding the brakes in position. The inventor points out that this will not only prevent the car from being stolen, but will prevent it from rolling down hill after the brakes have been applied and locked.

The device is electro-magnetic in operation, consisting essentially of a commutator switch and a solenoid which carries a bolt and locking device at the end. Application of the switch causes the coil to become energized, moving the core backward and carrying with it the bolt. By means of a slot arrangement in the cap of the solenoid which acts in relation to a groove in the core the device has been made jolt-proof. Another provision which has been made is that the brake can be locked regardless of the amount of wear on the brake band. The solenoid is made armor clad to increase its magnetic efficiency and mechanical strength and it is carried on a bracket. It can be made to engage with either the service brake or the emergency brake although it is recommended that it be fitted to the service brake, except in instances where the clutch and service brake are combined. A possible layout is illustrated, the pedal having a ratchet A attached to the lever. The solenoid is shown at B and when energized the ratchet seen on the end of the solenoid core is brought into engagement with the ratchet A, thus holding the brake so that the pedal cannot return.



Possible layout of the Goldmerstein electro-magnetic brake lock

The History of the Pneumatic Tire—12

Pneumatics Which, When Deflated, Served as Solids Tried Out and Found Impracticable—Inclosed Types—Origin of the Tire-Filling Business—Palmer's Early Work

The History of the American Automobile Industry—39

By David Beecroft

ATTEMPTS to devise a practical pneumatic tire, which, when deflated, served as a solid met with two difficulties. Sometimes the excess material caused by the deflation slipped on the base and sometimes it folded in ridges, but both were equally destructive. A short run would damage the tire beyond repair. The attractiveness of the idea seemed to warrant a large market if the device could be made successful, and it is certain that this can be done if the supporting surfaces which carry the load when deflated, are quite large and are lubricated, so that slipping between the tread and the base portions can take place without wearing them or without straining the sides of the tire casing. Some recent patents to Duryea show such a construction, although not yet on the market.

Other Less Practical Forms

Other still less practical forms of tires aimed to avoid punctures were brought out in 1892. A Chicago man advanced an idea, since frequently proposed, of inclosing the air tube inside the steel rim and providing a tire of solid rubber between the edges of the rim resting on the air tube, which rubber could yield and compress the air tube but would be so thick as to be unpuncturable. The little matter of friction, which would quickly ruin the solid rubber, was overlooked.

The Tire-Filling Business

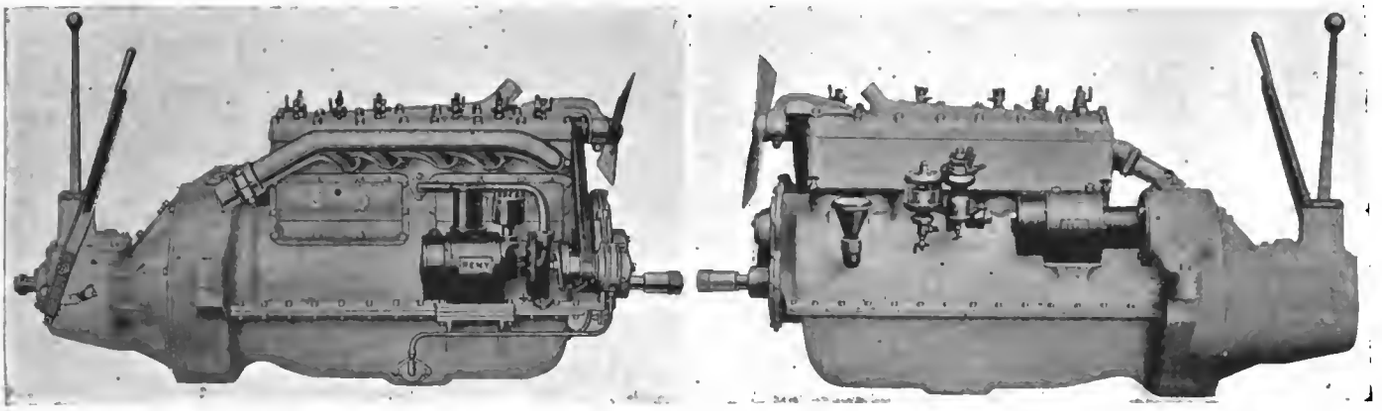
Another idea which has frequently come up since was patented by Sweeting in 1892, who proposed to fill the tire with water or with sponge afterwards soaked with water and thereby considerably expanded. It is a fact that a liquid will not flow through a puncture which permits air to escape readily and the thicker the liquid the larger this puncture may be, and yet the tire remain usable. This idea finally grew into a considerable business, the tires being filled with a sort of rubber imitation made under various formulas; some of these used the glue and molasses or glue and glycerine combinations of the printer's rollers while others used rubber compounds. In all cases, they were heavier and less resilient and therefore less valuable than the air tire and so have not found great favor. The water tire particularly failed because of its considerable weight and because it rendered the bicycle slow. Owen, some years later, suggested air chambers inside the rim which would serve as cushions and thus give a sort of elasticity to the incompressible water and perhaps overcome some of its disadvantages, but this device was never marketed.

Spring Tires in 1892

The spring tire again occurs in 1892, being shown by Whiting on a bicycle with two rims, one inside the other, and connected by radial, helical springs. The outer rim carried a solid rubber tire. Any arrangement of this kind requires that the bottom springs be strong enough to carry the whole load, and since the wheel turns, the total weight and strength of springs required is all out of proportion to the results. In spite of this, however, many attempts were made to develop a practical construction of this sort.

Palmer's Self-Healing Tire

Beginning about 1891, John F. Palmer began a development which grew into considerable importance in the next few years, although in a widely different line from that in which it began. As first shown, he had a valveless, pneumatic tire which could be inflated by inserting a hollow needle anywhere in the tread portion and which would seal the puncture just as the lump of unvulcanized gum inside the toy ball serves as a valve. Palmer's self-healing tire was more widely accepted than any of the other forms except the healing liquid and was made by vulcanizing a tube of fabric and rubber with the rubber on the outside followed by turning it inside out and splicing the ends. This put the rubber under a considerable compression and a puncture would be closed by the natural action of the rubber. Further, rubber looses its elasticity to a considerable extent if permanently held and so this original tendency to close an opening gradually disappeared and the tube ceased to be self-healing. Palmer's activities went into the thread tire, which was found to be considerably faster than the more common canvas ones and from which the modern cord tire has been developed.



Both sides of the unit power plant used in the 1917 Madison cars. The engine has a bore of 3⅛ and a stroke of 5 in. The cylinder head is detachable and the valves are inclosed and have easily removable brackets

Two Madison Chassis—Two Body Models

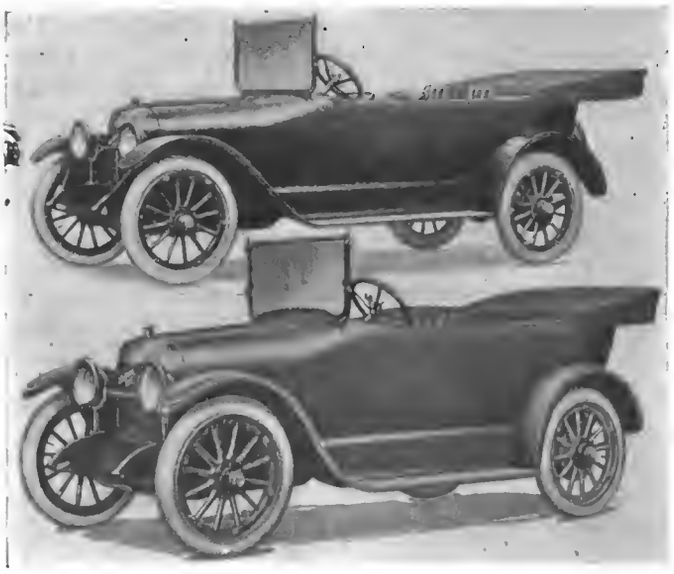
3 1-8 by 5-In. Unit Power Plant Used for Both Five and Seven-Passenger Cars—Refinements and Better Body Lines Are Only Changes for 1917—Valves Accessible

FOR 1917, Madison cars will be constructed upon the 6-40 chassis model and will be made in two body forms for five and seven passengers. Alterations in the body lines form the principal changes and these have been made to correspond to the flat cowl line which is in vogue this season. The prices for the five- and seven-passenger cars are $1,050 and $1,150 respectively.

Models Mechanically Similar

Rutenber engines are used in the Madison cars and the power plant for both the five- and seven-passenger model is identical. In fact the two cars are similar throughout except for a difference in wheelbase necessary to take care of the variation in body dimensions. The five-passenger car has a wheelbase of 115 in., while the seven-passenger has 124 in. A two-passenger roadster can also be secured if desired.

A unit power plant is used, the engine being direct-connected to a Muncie Gear Works gearset and clutch. Naturally in using the Rutenber power plant the improvements made in this during the past year have been incorporated in the Madison engines. The bore is 3⅛ in. and the stroke 5 in., and the six L-head cylinders are cast in a single block integral with the upper half of the crankcase. The valves are inclosed and the cylinder head is detachable.



The two 1917 Madison models, the seven-passenger being illustrated above and the five-passenger below. Note the new body lines with flat cowl effect

Three-Point Suspension

Three-point suspension is used and the rear support is secured by two legs on the rear of the crankcase casting. The third support is at the forward end of the engine and this is flexible, allowing the engine parts to be independent of any weaving of the frame. The pistons are cast iron and are fitted with three rings, two of which are close to the top and the third located just beneath the wristpin boss. The connecting-rods are of I-beam section, being drop-forged. The crankshafts are from 0.40 carbon steel and are balanced on the Norton machine before assembly.

Drop-forged camshafts, are used, the carbon content in this case being 0.20 and the diameter 1⅛ in. The cams are integral with the shaft and are hardened and ground, being carried in plain bearings at the center and front and at the rear in a double row S. K. F. self-aligning ball bearing. The valves are actuated by mushroom type flat followers which are offset 1/16 in. to distribute wear.

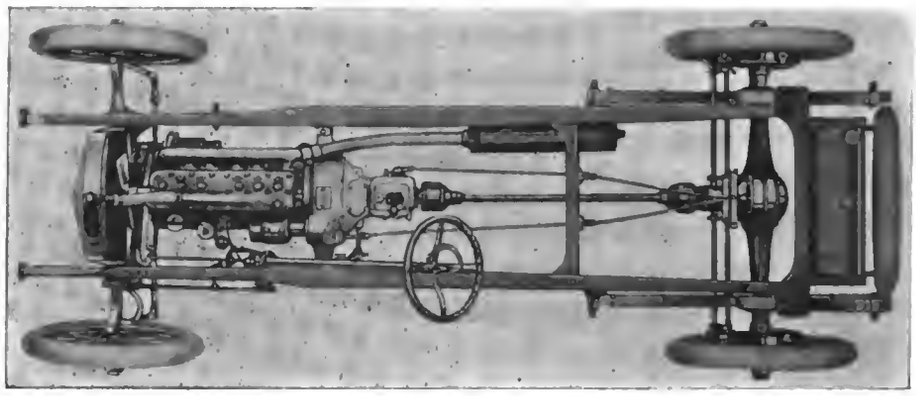
Valve Brackets Easily Removable

Two steels are used in the manufacture of the valves, carbon steel being employed for the heads while alloy steel is used for the stems. The diameter of the valve is 1 5/16 in. in the clear with a 5/16 in. width. A feature of the valve construction is that the entire valve bracket together with the lifting mechanism can be removed from the engine without disturbing the camshaft. This is done by removing the cover plate and stud nuts and then turning the crankshaft by means of the starting crank until the valves are at their lowest level. In arranging the valve timing the intake opens at 15 deg. after top center and closes 50 deg. after bottom center. The exhaust valve opens at 45 deg. before bottom center and closes 10 deg. after top center. Compression is 75 lb. absolute.

Power is transmitted by means of the Muncie Gear Works

dry-plate multiple-disk clutch, which is fitted with alternate disks of asbestos and saw steel. Annular bearings are used in the clutch release and these are lubricated by oil which is allowed to enter from the crankcase since the clutch housing is in direct communication with this part of the motor. The gearbox is a conventional three-speed unit of the selective type.

Two universals are used in the drive, the power being taken through the propeller shaft to a floating rear axle fitted with a pressed steel housing and Brown-Lipe nickel steel spirally cut gears. The axle shafts are supported on large annular bearings of heavy duty design and alloy steels are used throughout in the parts carrying the driving and torsion stresses. Hotchkiss drive is used, both torque and propulsion being taken through the rear springs.



Chassis of the 1917 Madison, showing three-point suspension of the unit power plant. Hotchkiss drive is used. The only material difference in the two chassis is in the dimensions affected by the difference in wheelbase

Remy Electric System

Electrically the Madison cars are Remy throughout. Starting is by an independent series-wound Remy motor used in connection with the Bendix drive for meshing the starting pinion with the flywheel ring gear. For lighting and current supply there is a Remy generator mounted on the right side of the engine and driven directly off the priming set. This generator unit also carries the Remy ignition distributer which is driven through a worm gear from the generator shaft. The generator also carries the regulator and automatic cut-out operating in connection with the Willard storage battery.

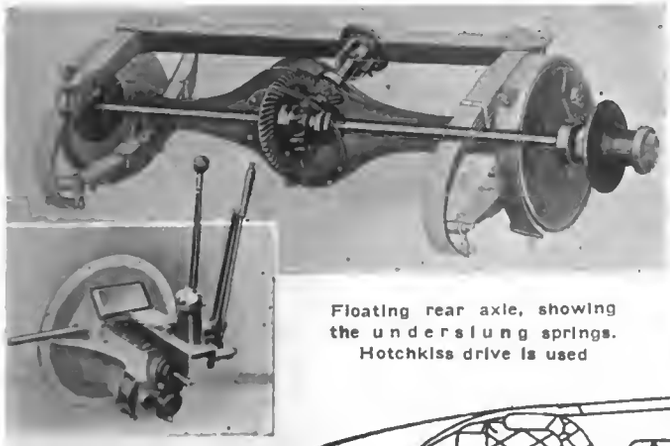
The gasoline system is composed of a 16-gal. tank supplied with a gage mounted on the rear of the chassis, a Stewart-Warner vacuum system, and a model M Rayfield carbureter provided with automatic air intake and climatic dash adjustment. Steering is by the T. W. Warner irreversible worm and full gear used with a steering wheel having an 18-in. corrugated rim. The wheels are artillery type 34 by 4 in. provided with demountable rims and an extra rim is located on the rear for carrying a spare tire. The tire equipment is Goodyear 34 by 4 in. all around, with the All-weather non-skid tread on the rear. Three-quarter elliptic underslung rear springs are used and the front are semi-elliptic. The steel used in the manufacture of these springs is English manganese with a double heat treatment.

Upholstery is in long grain black enamel leather with deep Turkish type cushions. On the five-passenger body a single front seat and rear seat are used, while on the seven-passenger the boat-shaped design is carried out with divided front seats and auxiliary seats which fold against the backs of the front seats entirely out of the way when not in use. The Madison standard body color is Richelieu blue.

Both bodies will be seen to follow the lines that are customary for the 1917 season, particularly as regards the flat section at the point of juncture between bonnet and cowl. The body curve sweeps back into the rear of the tonneau without a break and on the whole the design is one of smooth continuity. Particular attention is also being paid to seating arrangement and comfort this season, the camber of the seats and the curve of the seat backs being carefully worked out to fit the average passenger.

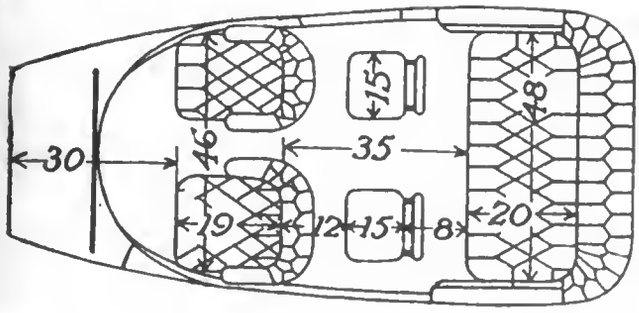
Equipment Is Complete

Full equipment is provided and included at the list price. Among the accessories provided with the car are a one-man top made of Neverleak, electric horn, Stewart-Warner speedometer, ventilating and rain-vision windshield, tire carrier, foot and robe rails, trouble lamp and a full tool outfit.

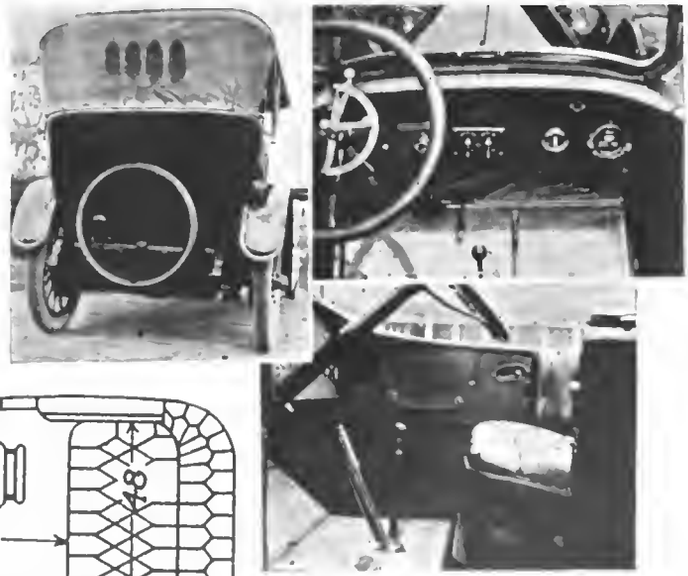


Floating rear axle, showing the underslung springs. Hotchkiss drive is used

Above—Details of mounting of gear-shift control levers on 1917 Madison



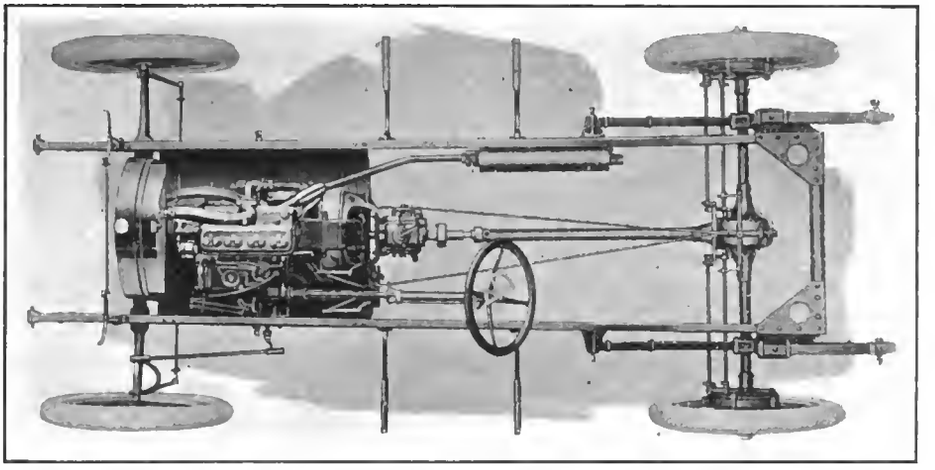
Right—Madison body layout, showing dimensions



Above—Tire carrier, instrument board and a view of the driver's compartment in the 1917 Madison

New Engine in Monroe Roadster

3 by 4 1-4 Block Power Plant of Brush Design with Overhead Valves—Disk Clutch Replaces Cone—Added Equipment —Price Higher



Chassis of the Monroe roadster for 1917, showing layout of the new power plant. This has overhead valves with outside adjustments. Note driveshaft torque tube

THE Monroe Motor Co., formerly located at Flint, Mich., but now at Pontiac, Mich., is now ready with its 1917 four-cylinder roadster, the only type of machine which it is making at present. Looking somewhat the same as the previous model, the new car, which is designated as model M-3, has a number of improvements over the model it replaces, all of which tend to make it a much better car. The price has been raised from $495 to $565, partly due to the added cost of materials, and partly to the added equipment and improvements in design and construction.

Chief among the changes over the preceding Monroe is the adoption of an entirely new engine to replace the 3⅛ by 3¾ in. type used last year. The new power plant is designed by the Brush Engineering Assn., Detroit, and has the same overhead-valve construction with outside adjustments that characterizes most of the engines Brush now lays out. This new block engine has a bore of 3 in. by a stroke of 4¼ in. and has the gearset in unit.

Along with the engine change, a multiple-disk clutch takes the place of the cone previously used and in the chassis there are several other modifications. The frame has been lengthened 3 in. at the rear to accommodate the longer rear deck now fitted, and the ratchet foot pedal that controlled the emergency brake heretofore has given way to the standard method of emergency control by a hand lever. In front of the radiator a sheet metal piece has been fitted between the frame rails. This helps to send the air to the radiator, and also acts as a mudguard for the radiator.

Crowned fenders have replaced the flat variety of last year, and they do much to enhance the outward appearance. This, together with the lengthening of the body back of the seat, suggests a larger vehicle, even though the wheelbase remains unchanged at 96 in.

Several additions have been made to the equipment. Demountable rims have replaced the clincher type, and in the rear the tires are non-skid treads instead of smooth. A muffler cut-out has been put on; a sight oil-feed has been put on the dash; a lock switch for protection against theft of the car has been added, and there is also a Stewart-Warner speedometer, no speed-indicating instrument being furnished as standard equipment previously.

Looking more closely at the details of the engine the cylinders and upper half of the crankcase are cast in one piece, a construction very often employed where the cylinder-head is removable, as in this case. The rocker arms and valves are carried in the head unit, being inclosed within a single cover plate that bolts to the top of the cylinder head. Protruding through the top of this cover plate are the adjusting nuts which, after the lock nut has been loosened, can be turned by hand until the proper clearance between the end of the valve stem and the rocker is obtained. The valve push rods run up to the rockers on the left side of the engine and the spark plugs enter the cylinders between the two rods of each cylinder as necessitated by the overhead valve construction.

Giving an idea of the 1917 Monroe roadster both coming and going. The splash guard shown in the front view helps direct air through the radiator

Units Compactly Mounted

Manifolds are on the right side, the intake having but a single connection to the carbureter pipe at the center of the head casting. Hung from a bracket, attached to the right rear side of the upper crankcase, is the Auto-

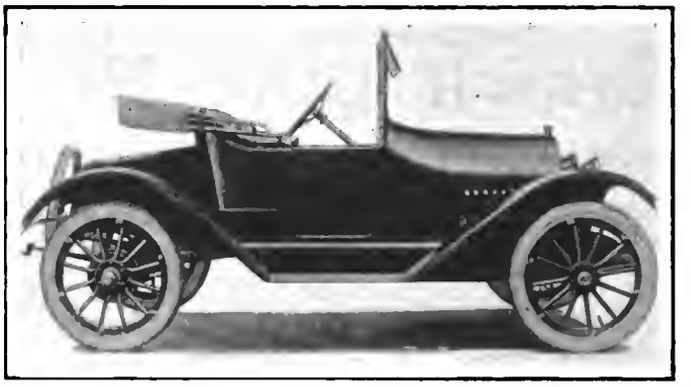
Lite starting motor, which is geared to the flywheel by means of the Bendix automatic starter drive. On the left and driven through gear connection with the camshaft is the generator, also an Auto-Lite unit. This generator has mounted on its top the ignition coil, and its rear end carries the vertical Connecticut ignition distributer which connects to the armature of the generator by helical gears. The flywheel is only semi-inclosed, due to the use of a form of bell housing which extends back from the crankcase and integral with it, until it meets the forward extension at the gearbox. Thus the lower half of the flywheel is exposed, as well as a portion of the upper part where the crankcase extension is cut out to reduce the weight without affecting the strength.

Peculiar to the Brush type of overhead valve engine, the rocker arms which transmit the upward motion of the push rods into a downward motion on the valves are not carried on rocker shafts as is usually the case. Instead, the rockers, which are steel pressings, have formed at their centers a socket which rests on a pivot and allows the same rocker motion that would be possible if the conventional form of shaft were used. The pivot is simply a threaded pin which seats in the body of the head, and its end protrudes through the top of the cover plate as already mentioned. Thus, adjustment of the rocker is obtained by screwing this pivot in or backing it out as the case may require. The valves are quite large for an engine of this size, having a diameter of 1¼ in., and being operated by a two-bearing crankshaft of generous proportions, the bearings of which measure ⅞ in. in diameter, by 2 7/16 in. long. It is driven from the crankshaft by helical timing gears inclosed in a compact manner.

As a great deal of the smooth running of any engine depends upon the sturdiness of the crankshaft and its support, the main shaft is of good size, having two main bearings, the front measuring 1 9/16 by 2 15/16 in. diameter and length respectively, and the rear of the same diameter, but 3 3/32 in. long. Although a moderately high-speed engine, it is fitted with a comparatively heavy flywheel of 12 in. diameter.

Splash Oiling—Thermo-Syphon Cooling

Lubrication of the motor is by splash, with the trough supplied by a plunger pump drawing its oil from the reservoir in the engine base. Each rod end dips into its trough and splashes the oil on to the several bearing surfaces in the customary manner. Simplicity is also obtained by the use of thermo-syphon cooling. The head casting carries the water outlet to the honeycomb radiator, and water enters the cylinder blocks at the center of the right side. A fan driven by belt from a pulley on the crankshaft is used, this having provision for adjustment of the belt tension by means of an arm attached to the forward end of the cylinder head.



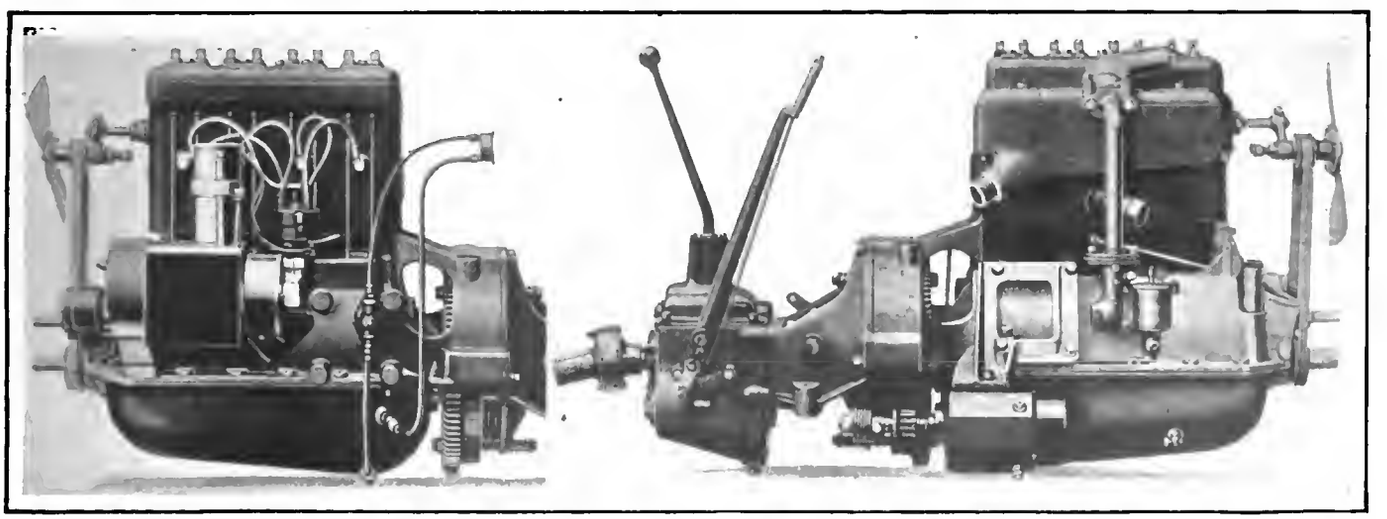
Monroe 1917 roadster which sells for $565. It has a four-cylinder 3 by 4¼-in. block engine and uses 30 by 3-in. tires

From the engine, the power passes through a simple dry-plate clutch having six disks alternately Raybestos and steel. Three selective speeds are afforded by the compactly-designed gearbox, which is mounted in unit with the motor, in the manner already described. The gears are of double heat-treated nickel steel, with stubby teeth to resist driving strains and sudden shocks. The gearshafts are carried on ball bearings. A ball and socket control lever is positioned on top of the gearbox proper, and the emergency brake lever attaches to the right side so as to play over a ratchet sector, also carried on this side.

Back of the gearbox there is a well-inclosed universal joint after which the driveshaft enters a torsion tube which incloses it to the rear axle. Drive is taken through the rear springs, while the torque is provided for by the propeller shaft housing. The three-quarter-floating rear axle affords a ratio of 4¼ to 1. Axles and pinion shafts are mounted on Hyatt roller bearings in conjunction with ball thrust bearings that take care of any end thrust. The axle tubes, which carry the car weight, are riveted into the two halves of the differential housing, and as a strengthening factor a truss rod passes below the housing between the brake drums.

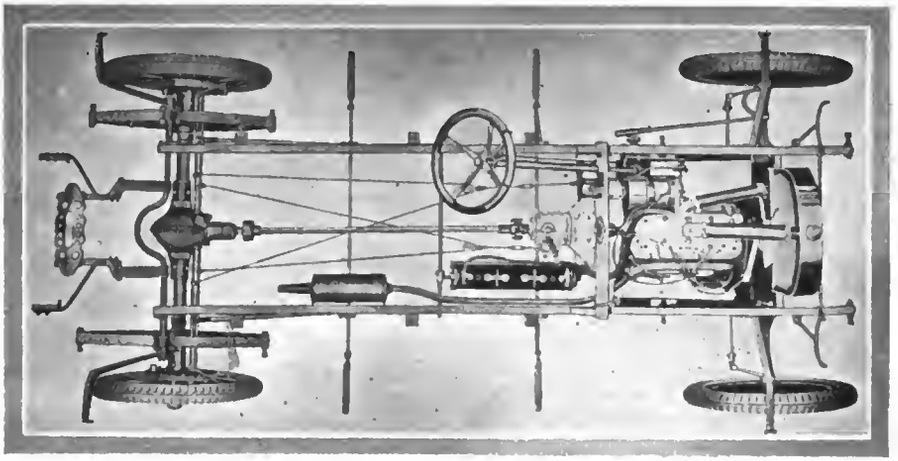
Rear springs, 46 in. long and of three-quarter elliptic form, are fitted at the rear, mounted outside the frame.

The new Monroe is painted a royal blue as a standard color and is said to be capable of speeds ranging from 3 to 50 m.p.h. on high gear. Tires are 30 by 3 in.



Both sides of the Monroe power plant, showing the arrangement of the manifolds, mounting of the electric units and the compact three-speed gearbox. Thermo-syphon cooling is used. Note the connection of the starting motor to the flywheel through the Bendix gear automatic starter drive

Brown Line Built on One Chassis



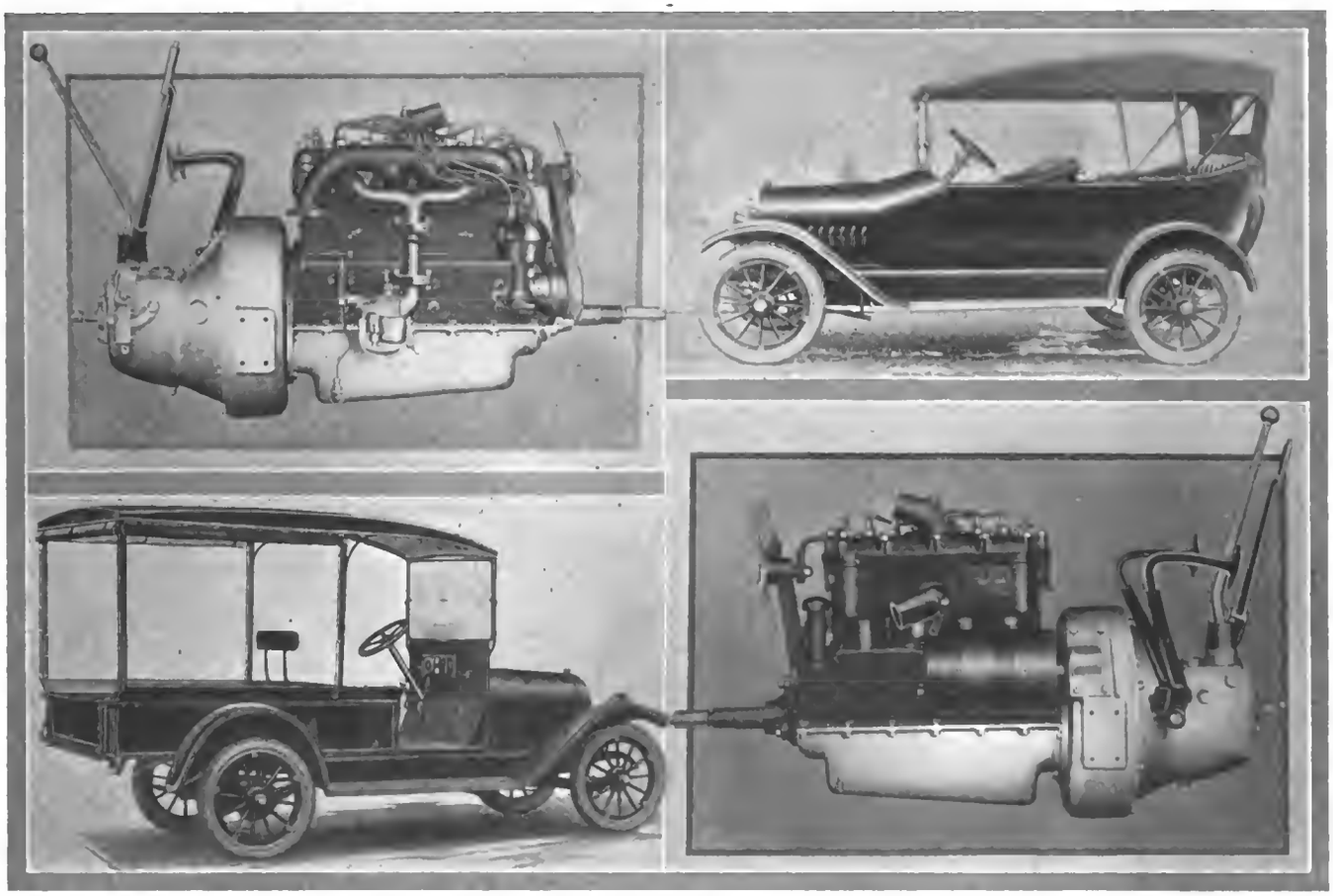
Chassis used for the Brown line of five-passenger touring car and delivery vehicles

A LINE of passenger and business cars has been put on the market by the Brown Carriage Co., Cincinnati, Ohio. This is an assembled product incorporating parts made by specialists among which may be mentioned the LeRoi engine, Walker-Weiss axles, Allis-Chalmers starting and lighting, Atwater Kent ignition, Kingston carbureter, U. S. L. storage battery, etc.

The LeRoi power plant is a unit construction incorporating motor, gearbox and clutch in a single housing. All four cylinders are cast in a single block and are of L-head shape with a bore and stroke of 3⅛ by 4½ in. The valves are on the right side and are completely inclosed. The upper half of the crankcase and the cylinders are in a single casting, while the lower half of the crankcase and the flywheel housing are in one piece and made from cast aluminum. The casting work is considerably simplified by the fact that the entire top of the cylinder is separate, being held in place by fourteen studs to the top of the cylinder with the joint sealed by an asbestos-copper gasket which prevents any leakage or loss of compression.

Large diameter valves are used but the lift is moderate, giving a quiet-running action; the valves are actuated by mushroom type push-rods which have an easy action on the cams. The bearings sizes are ample and the main bearings are all of die cast white bearing metal. The dimensions of the main bearings are 1¾ in. diameter by 2¾ in. length. The connecting-rod bearings are 1¾ by 2 and the camshaft bearings which are three in number are 1⅜ by 2 9/16, 1⅜ by 1⅝ and 1 3/16 by 1 11/16 in.

In order to preserve perfect alignment the flywheel contains a ball bearing which supports the front end of the gearset main shaft. Another point at which the bearings are carefully laid out is at the fan which also operates on



Brown touring car selling at $735 and delivery vehicle at $670 with LeRoi unit power plant used in both

ball bearings and which is adjustable by means of an eccentric insofar as tightening the fan belt is concerned. In the cooling layout the water inlets are large and are ample to take a 2-in. hose. The water is circulated by the thermo-syphon system.

Lubrication is by combined pressure and splash system with the oil delivered at either end of the engine by means of the oil pump and with the bearing taken care of by splash. Ignition is by the Atwater Kent system with automatic spark advance and in connection with the U. S. L. storage battery.

The balance of the electrical system is made up of the Allis-Chalmers motor-generator. With this system the instrument becomes a generator when the motor is running at speeds sufficient to charge the battery and becomes a starting motor when the gasoline engine is stopped and the starting switch closed. The characteristics of the engine are such that under ordinary conditions, the motor is cranked at more than 130 r.p.m. The storage battery floats on the line so that the lighting current is drawn directly from the battery.

A Kingston float feed carbureter is employed. This is a single adjustment type in which the only regulation is that of the needle valve governing the gasoline flow. The gasoline is fed to the carbureter by gravity flow and, as will be noted from the side view of the engine, the carbureter is placed low enough to insure a steady flow even on a steep grade. The carbureter is mounted on the right side of the engine together with both inlet and exhaust manifold and the ignition distributer drive, leaving the left side free except for the motor-generator, which is placed at the rear.

A multiple disk clutch is used lined with Raybestos. It is provided with six coil springs which insure perfect contact. The selective type gearbox is provided with three speeds and transmits the drive to a three-quarter floating Walker-Weiss rear axle. This is geared 4.25 to 1 on direct and the gears are of nickel steel with chrome nickel drive shafts carried on Hyatt high-duty roller bearings. The springs are of chrome steel with full elliptic rears. The front springs are conventional semi-elliptic. The wheelbase is 105 in. and the tire size is 30 by 3½ with non-skids front and rear. Demountable rims are used and one extra is provided on the touring car. Both Batavia and U. S. tires are used.

Full equipment is provided with the car, the top being a one-man mohair. The fenders are crowned and the running boards are covered with linoleum bound with aluminum.

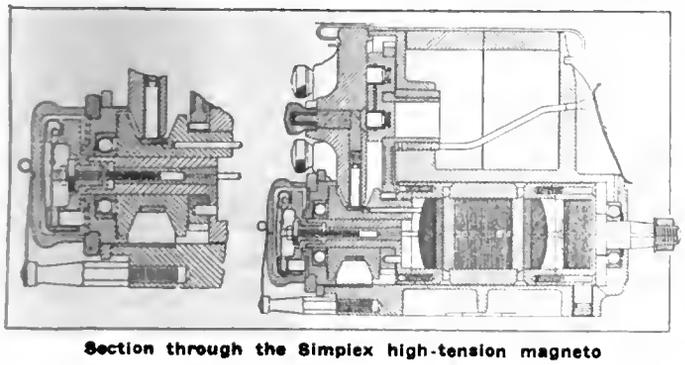
On this same chassis there is a five-passenger touring car at $735, a delivery car with 1000 lb. capacity at $675, a rear-door delivery at the same price and a general delivery open body at $670 including canopy.

Simplex a High-Tension Magneto

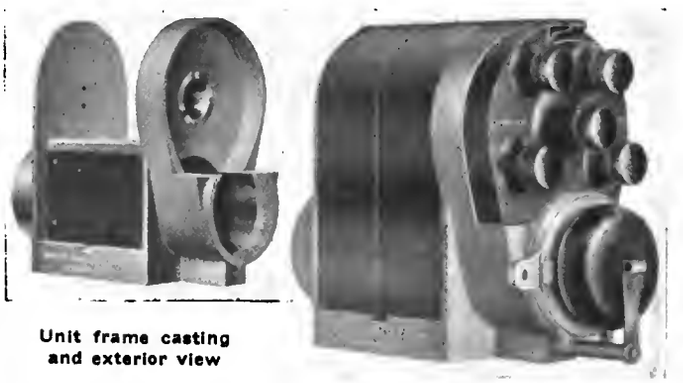
A NEW high-tension magneto has been put out by the Simplex Magneto Co., Inc., New York City. The men making up this organization have been connected with the manufacture of parts for European and American magnetos and have now organized to produce a complete instrument.

One of the features of the magneto, which is a high-tension type, and which in general is designed along conventional lines, is the simple interrupter which is so constructed that the centrifugal force of its moving parts is absorbed, thus maintaining an equality of pressure between the contact points and giving the same working conditions at high or low speeds. Another feature of the instrument is the ready accessibility of its vital parts, and the ease of disassembling to make minor repairs. An additional point of originality is the cast-in pole piece which is a laminated structure but so arranged that it does not have to be pierced by pins or bolts which would tend to increase the magnetic reluctance. The pole pieces and housing being integral, the air gap between the armature and field poles is very small. This tends to increase the intensity of the spark at low speeds, and, furthermore, since the poles and housing are integral they can be bored together to insure their alignment, and also renders the construction inherently waterproof.

As an example of accessibility, in removing the armature it is only necessary to turn a check nut and unscrew the armature ball-bearing cage. This allows the armature to be taken out of the frame without removing any of the parts.



Section through the Simplex high-tension magneto



Unit frame casting and exterior view

In connection with the armature an interesting feature is the construction of the condenser which is arranged with specially prepared insulating sheets between the individual foil laminations. This permits of a large number of sheets of useful foil, as the insulating sheets are very thin, giving an efficient indenture which tends to prolong the life of the points.

In general the Simplex magneto is a high-tension type carrying both the low tension and high-tension winding upon the single armature. The core is of laminated iron and on each side of this is a pole piece of the same quality of iron as is used in the armature. Holding this whole construction together are two bars which are firmly riveted into the pole pieces.

The details of wiring, etc., do not differ greatly from standard practice in high-tension magnetos. The low-tension winding has one terminal grounded and the remaining terminal is connected to an insulating plug allowing the path of the circuit to pass through the interrupter contact. The cam plate allows the spark advance to travel through an arc of 30 deg. and the interrupter mechanism is spring actuated giving a quick and snappy break of the primary circuit. The high-tension wire is attached to the distributer ring on one terminal and on the other to the ground by means of the common ground brush. The distributer mechanism is arranged for either four or six contact pieces, depending on the number of cylinders.

The Rostrum

Why Races Run Counter-Clockwise

EDITOR THE AUTOMOBILE:—Will you kindly advise the reason why practically all racing of every description is run in a direction from left to right, facing the track from the grandstand? It appears just as feasible for the entrants to face in the opposite direction, as racing cars, for instance, have the driver on either right or left side of the car which makes it apparent that racing in either direction should be practicable.

New York City. S. L. H.

—At the time the decision was made regarding the running of the races on the Indianapolis motor speedway anticlockwise it was for the reason that practically all the racing cars driven at that time had the steering column on the left-hand side of the machine and the driver's weight being on the left-hand side of the car naturally made the center of gravity and weight center a factor. Aside from this, it is natural to drive turns to the left with the right hand on the pulling side of the steering gear. If you are right-handed you will notice that it is always easier to control your car on the left-hand curve rather than a right-hand.

Conditions Due to Low-Test Gasoline

Editor THE AUTOMOBILE:—Is it not a fact that the low test gasoline of to-day causes the carbureter float to ride higher and consequently the level to maintain itself lower than with the gasoline of a few years ago?

2—In adjusting carbureter for this low test gasoline, in addition to changing level, is it advisable to use a slightly smaller jet?

3—Does not the action of atomization of gasoline in the carbureter cause the intake manifold to be cool, and is it not true that the richer the mixture, the cooler the manifold will keep? I have never seen an engine overheat due to a heavy mixture, but always with a lean one. Anyone can satisfy himself of this fact who has a Boyce Moto-Meter on the radiator.

4—Will not a manifold keep cooler with low test gasoline than with one of higher test and will not that coolness of manifold aggravate the difficulty of the carbureter to properly break up the fuel, unless heat is supplied in greater volume than formerly?

5—What is meant by low and high test? Is it density or specific gravity and what is the ratio between the two?

6—Is it true that if the slightest bit of acid used in refining oil should remain when graphite preparations of any sort are used mixed in the oil it will cause a stoppage in piping of oiling system?

7—Is it true that low test gasoline has more heat units and that a car will run farther on a given quantity than on the same quantity of high test gasoline?

Islip, N. Y. W. L. B.

—Yes, to an extremely small extent.

2—A smaller jet can be used sometimes but the difference must be very slight.

3—Yes, heat is required to vaporize the gasoline, and this is obstructed to some extent from the intake manifold. Obviously, the greater the amount of gasoline evaporated the greater the cooling effect on the manifold. Your experience regarding the effect of a heavy mixture on engine temperature is not normal.

4—A manifold will not keep so cool with low test gasoline, though it is also true that some heat is required.

5—Low and high test refers to the density. There is no ratio between the two, the words being used in a very loose way.

6—Yes.

7—The heavier oil contains more heat units per pound, but it is harder to make a good gas from it, wherefore it is usually impossible to obtain a greater mileage per gallon.

Oiling System of 1911 Pope-Hartford

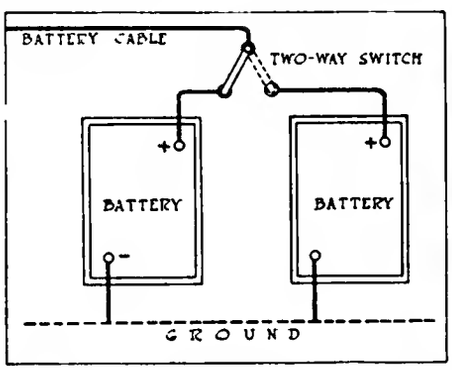
Editor THE AUTOMOBILE:—How does the oiling system on a 1911 Pope-Hartford work and how is same adjusted?

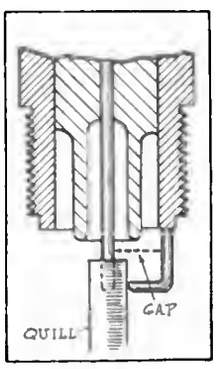
2—What is the correct timing of a 1914 four-cylinder National?

Providence, R. I. R. P.

—A mechanical oiler is located on the crankcase fitted with pumps, and an overflow standpipe. The bottom half of the crankcase is constructed with the oil reservoir beneath and cast integrally with it. In supplying the lubricating system with oil the mechanical oiler is first filled. The surplus oil runs into the crankcase, leaving the proper amount of oil in the oiler. The crankcase is also filled up to a level cock and holds about 3 gal. of oil. The pumps in the mechanical oiler force the lubricant to the cylinder and in addition a large suction pump sucks oil from the reservoir in the crankcase into the mechanical oiler, maintaining the proper level in this device.

Oil should be added through the filling tube every day or as often as necessary to bring the level high enough so that oil will run from the upper petcock which acts as a level gage. It is important that the oiler be adjusted so that one drop only at a time will show in the sight feeds to each cylinder. The leads are regulated by micrometer adjustment. The pipes run to the four cylinders and one adjustment takes care of the No. 4 cylinder and the sight feed on the dash. Individual sight feeds are fitted.





Left—Fig. 1—Connections for a two-battery ignition circuit, showing the use of two-way switch
Right—Fig. 2—Method of testing spark plugs by the use of a quill toothpick. By insulating the points the spark is made to jump a much larger distance than when in ordinary operation

The main crankshaft bearings are lubricated by splash, suitable pockets being cast on the inside of both ends and center of the crankcase for this purpose. The camshaft has four bearings all inclosed within the crankcase which are lubricated entirely by splash, suitable oil pockets, holes and grooves being provided for the purpose.

2—You do not mention the model to which you refer, but it is presumed that the information you desire is on the four-cylinder design. A timing diagram of this is given in Fig. 3.

Mistimed Spark Causes Power Loss

Editor THE AUTOMOBILE:—I have a C-36 Buick which does not have the ginger it used to have. In making hills on which it used to gain it now loses.

An expert on Buicks has ground the valve and cage seats, scraped the carbon out, seen that the cages were in right by taking the manifolds off, cleaned and adjusted the carbureter and adjusted the pushrods. Compression is good. Still there is no more snap to it. It also knocks when speeding up from 10 m.p.h. with spark well retarded. The bearings are all right.

Would burning out the cylinders and slowing down the timer stop the knock in picking up speed?

Lowville, N. Y. C. A. R.

—A possible explanation of your trouble is that the timer cam on the distributor shaft has slipped so that the spark is out of time. This a Buick service station will check up for you very quickly, if there is one near you.

You say the carbon has been scraped out, but if the cylinders were not removed to do this there will be a great deal left in which case burning out would be the cure.

Yet a third possibility is that the carbureter adjustment is incorrect.

A Method of Testing Spark Plugs

Editor THE AUTOMOBILE:—Referring to inquiry of E. E. F., Olmstead, N. D., in THE AUTOMOBILE for June 1, it may help him to know if his spark plugs are all right if he forces the spark to jump a decent gap. Naturally he cannot separate the points, but he can often introduce a quill or similar insulation between the points and make the spark jump a much larger distance. In most plugs it is possible to get a gap of ¼ to 5/16 in. or even more and this length of jump is pretty good evidence that the plug insulation will stand the voltage necessary to make the spark jump the point gap when under working conditions. Quills can be found at every poultry yard if in the country and quill toothpicks at many hotels. A piece of mica or celluloid can be used but not so handily on many forms of plugs.

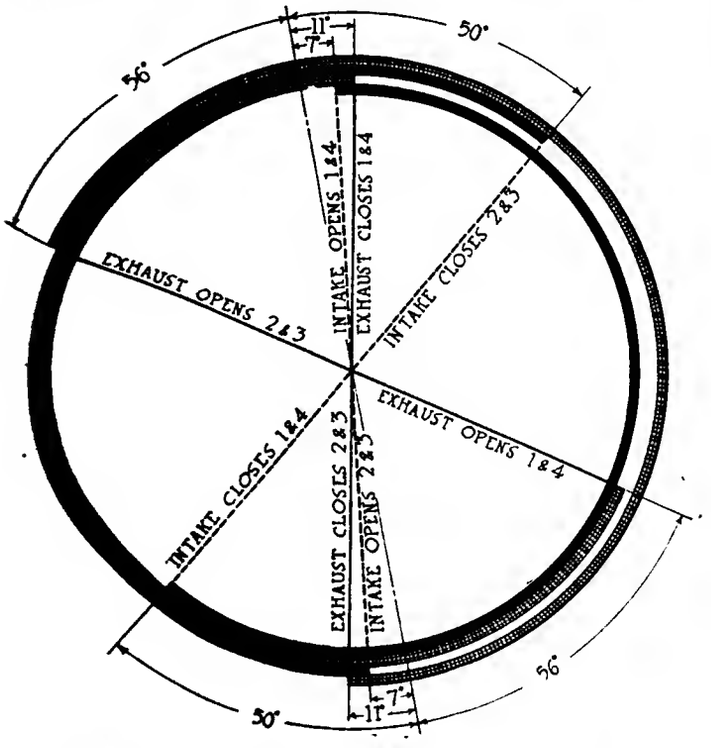


Fig. 3—Timing diagram of 1914 four-cylinder National

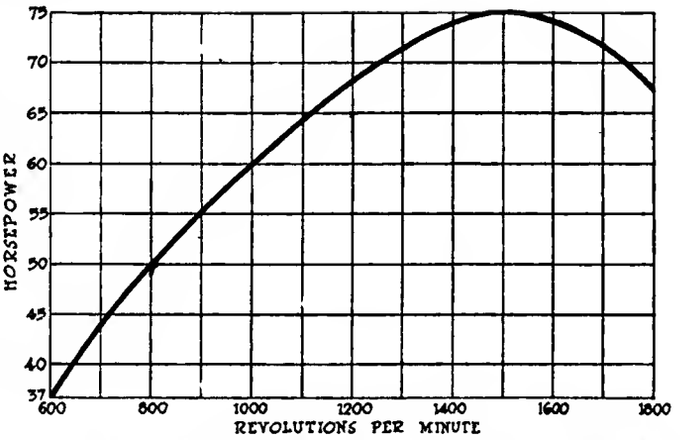


Fig. 4—Power curve of the 1910-1911 type 16 Lozier of 45 hp.

Crank and Eccentric Differential

It may interest your readers to know that the crank and eccentric differential described by Mr. Ormsby in his comprehensive article on differentials was invented by Edwin J. Gould, formerly of Colorado, but more recently of San Diego, Cal. Mr. Gould has spent much thought on the gearless differential problem and has recently made improvements to overcome some defects found in the original form.

Philadelphia, Pa. CHAS. E. DURYEA.

Wiring for Two-Battery Circuit

Editor THE AUTOMOBILE:—I have a car equipped with a double ignition system and am using one storage battery for starting on battery, electric horn, rear lamp, two dash lamps and one lamp inside of the car. As I have another battery, will you kindly publish a sketch showing how I can wire up these two batteries so that when one runs down I can switch on the other without taking one out or changing over any wires.

2—Kindly publish power curve of 1910 45-hp. Lozier.

3—Where can parts be bought for a 1905 Rochet-Schneider?

New York City. A. W. B.

—Presumably one terminal of your battery is grounded by a wire connecting it to the frame. In fitting the second battery it will be necessary to see that the corresponding terminal is grounded, that is to say, if you ground the negative terminal on the first battery it must be the negative terminal on the second battery that is also grounded. You can then readily use one battery or another by shifting over the wire attached to the positive terminal. To introduce a switch take the present battery wired to the middle point of a two-way switch and bring two wires from the two batteries attaching them to the other two contacts of the switch. Then by throwing the switch either one way or the other you can use either battery. The connections are precisely the same as those employed for an ignition switch which gives you either battery or magneto, as illustrated in Fig. 1.

2—Power curve of 1910 Lozier appears in Fig. 4.

3—THE AUTOMOBILE has had several requests for this information but has been unable to trace any stock of parts in America. It would probably be cheaper to have the parts made specially here than to get them from France.

The FORVM

LEAK-PROOF IS THE McQUAY-NORRIS PATENT TRADE NAME—ALL-YEAR CAR AND HUNDRED POINT SIX ARE KISSEL TRADE NAMES

Leak-Proof Is McQuay-Norris Patented Name

By L. A. Safford

Second Vice-President, McQuay-Norris Mfg. Co.

THE manufacturer of a nationally known and standardized trade-mark must of necessity jealously protect it. Our trade name, Leak-Proof, has been nationally standardized through extensive advertising and the phrase Leak-Proof is our own registered trade-mark.

Like many pioneers in a new field, this company has suffered through misuse of our trade-marked name, Leak-Proof, which applies specifically and only to the piston ring manufactured by this company. It is not a descriptive phrase pertaining to a type of ring, yet some automobile and engine builders who are departing from the conventional type of one-piece ring have described their ring equipment as being leak-proof or of a leak-proof type. The injustice of this is manifest.

Therefore, we will appreciate your giving publicity in the columns of THE AUTOMOBILE to this letter and the fact that there is no Leak-Proof piston ring except our patented, trade-marked product, which is not used by any automobile or automobile motor builder as universal equipment. Leak-Proof piston rings are sold only through jobbers and dealers for replacement purposes.

All-Year Car and Hundred Point Six Kissel Names

By H. F. Daniels

Kissel Motor Car Co.

ALL-YEAR car and Hundred Point Six are Kissel trade names. The first identifies the detachable top idea originated by Kissel. The second identifies a new and highly successful Kissel model recently introduced.

May we ask your co-operation against any who attempt to trade upon the reputation of our product by using either of these phrases?

We cheerfully acknowledge that it is largely due to the vigilance and sense of fairness of the press that All-Year car has not appeared extensively in connection with other cars.

We hope for this same vigilance and sense of fairness from you in regard to the Hundred Point Six.

Advantages of Metal Mesh-Type Running Boards

By M. K. Woodford

IN recent years most of the cars seem to be equipped with running boards of wood covered with linoleum or some similar substance, and after a comparatively short terminal service their appearance is usually far from a credit to the owner or manufacturer. Of course, some fastidious owners or operators of cars manage at the price of eternal vigilance to keep their running boards in good condition, but this is the exception rather than the rule.

Back in 1909 and even as far back as 1907, I remember a type of running board being in use which seems to me a much more serviceable and satisfactory construction than those employed at the present time. The boards to which I refer were made of strips of metal in zigzag fashion so that when the strips were placed side by side with their plane surfaces vertical they formed a sort of mesh. Two heavier metal strips formed the edges of the board and ⅛-in. bolts passing transversely through these and the intermediate strips secured them in place. Running boards built in this fashion were durable and of excellent appearance, having no linoleum covering to become streaked and spotted with oil or to stretch and bulge so that holes eventually appear.

The metal running board does away with the necessity for a scraper to remove mud from the shoes when entering the car and in case of the running board striking some object the metal strips are readily bent back into shape, thus saving the expense of the repair work necessary with the wooden boards when damaged. I would like to draw the attention of our car manufacturers to this minor but interesting feature of construction.

Car Needs Hand Brake in Alps

By M. Quesney

IN reading THE AUTOMOBILE for May 18, I find in the paragraphs on Current Topics an extraordinary Forum paragraph on the uselessness of the hand brake. Well, has the writer ever motored in mountains? If not, let him come in the Alps and try a dozen or more Alpine passes over 6000 ft. The glacier road, for instance, which goes to 8600 ft. or so, the last 4 miles 15 per cent grade with a round dozen of hairpin corners. The only sound and agreeable way I have found to coast down these roads is to engage second gear, switch off the magneto, shut off the gas and push the hand brake, more or less, so that you never come to more than 20 m.p.h. in the straight bits, then slow down at the corners with the foot brake, which is on the transmission and not on the back wheels. Of course, the average speed is very low, some 14 to 15 m.p.h., but you go there for scenery and not for mileage. Incidentally, my car is a small 7 hp., 56 by 120 mm. DeDion-Bouton, with a single seat and having a very short wheelbase, which is by far the best thing I have found for those roads.

Farm Motor Machines at British Show

Exhibition Curtailed by War Restrictions But Registers Growing Demand for Gas-Tractors and Plows

AT the 77th annual show of the Royal Agricultural Society at Manchester, England, the number of visitors rose to 149,000, as compared with 104,000 at the show of last year, at Nottingham, which was the first during the war. Previously the record attendance was 217,000 in 1897.

Though the number of exhibitors was larger than ever at the show as a whole, and especially in the live-stock department, the exhibition was not fully representative of the development in farm motor machinery, partly because manufacturers were busy with war work and partly by reason of restrictions ordered by the Minister of Munitions, excluding tractors applicable to other purposes as well as to agriculture. The resulting fragmentary character of the show is reflected in the reports of it, as contained in *Commercial Motor*, *Engineering* and *The Engineer*, from which the features and illustrations presented in the following are selected. In a general way it is notable that steam tractors no longer predominate absolutely over tractors or self-contained motor plows powered from internal-combustion engines.

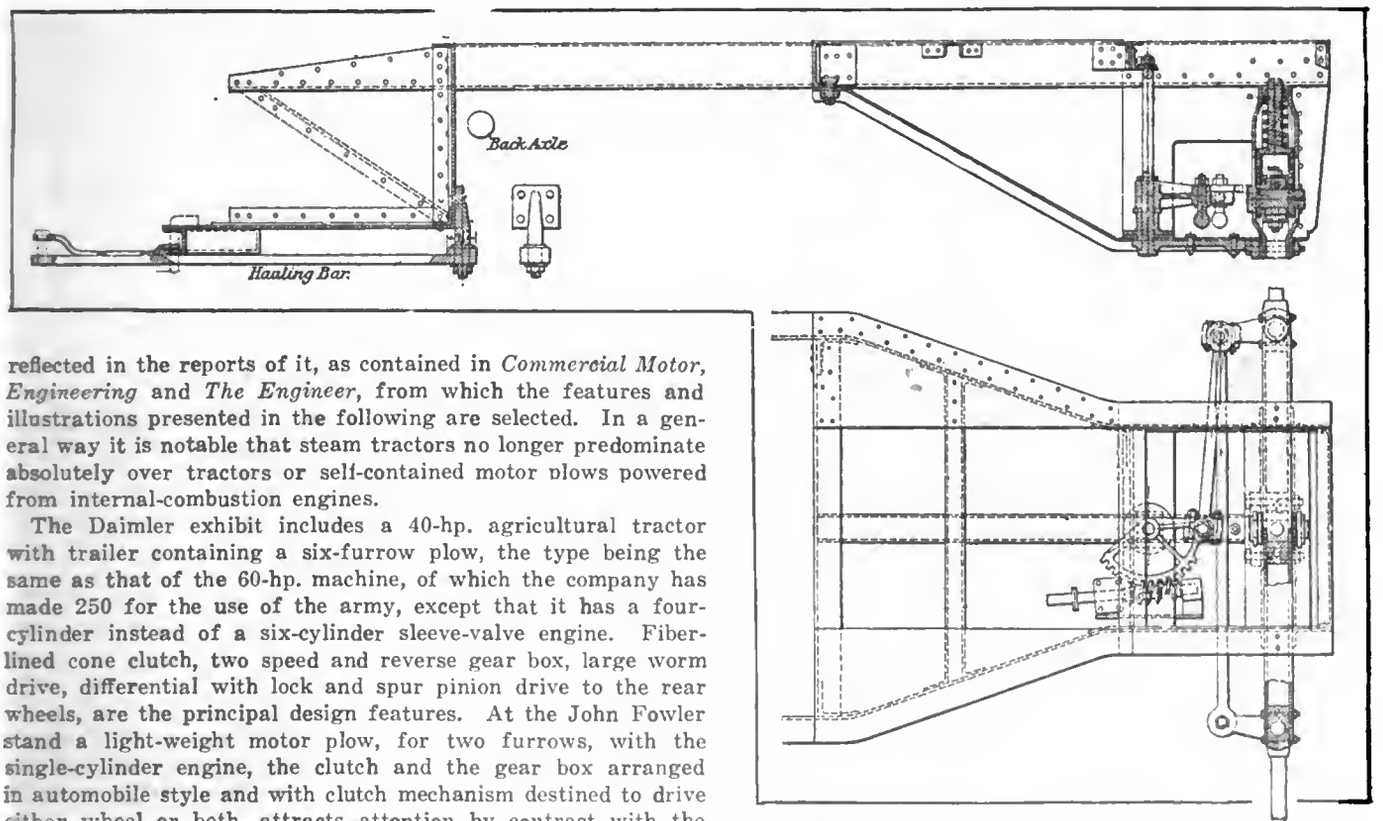
Fig. 1—The Omnitractor, a recent development in general-purpose tractors for use on farms

The Daimler exhibit includes a 40-hp. agricultural tractor with trailer containing a six-furrow plow, the type being the same as that of the 60-hp. machine, of which the company has made 250 for the use of the army, except that it has a four-cylinder instead of a six-cylinder sleeve-valve engine. Fiber-lined cone clutch, two speed and reverse gear box, large worm drive, differential with lock and spur pinion drive to the rear wheels, are the principal design features. At the John Fowler stand a light-weight motor plow, for two furrows, with the single-cylinder engine, the clutch and the gear box arranged in automobile style and with clutch mechanism destined to drive either wheel or both, attracts attention by contrast with the better known large Fowler units. Either wheel can be raised to ride on top of the land with the other in the furrow. The control is from the rear where a seat for the driver is accommodated on a castor wheel. A belt pulley is mounted on the engine shaft in front of the radiator.

The 24-hp., three-wheeled Ivel tractor is shown with a device for heating the fuel by the exhaust gas, so that kerosene may be used after starting with gasoline. The engine is a two-cylinder, horizontal-opposed located amidships on the off side and drives by silent chain to a countershaft and thence by roller chain to the differential on the rear axle.

The Martin Cultivator Company's two-furrow plow is the lightest machine with caterpillar traction belts. Either of these can be elevated.

The Omnitractor is a newcomer with many novel construction details, some of which are shown in the accompanying



Figs. 2 and 3—Showing built-up frame used for Omnitractors, supported upon front axle by helical spring, axle pivoted in its vertical plane, wheels steered on automobile plan

illustrations, Figs. 1 to 9 (from *Engineering* of June 30, where a full set may be found). A peculiarity is the extensive use of standard merchant bar steel and sections in popular sizes, the object being mainly to facilitate repairs, it is said. This four-wheel tractor weighs 3¼ tons and can apply a tractive effort of 2000 lb. at the wheel rims. The main features are as follows:

Engine, two cylinders, 6 in. bore, 9 in. stroke, giving 30 hp. at normal speed of 750 r.p.m. Starts on gasoline but can run on kerosene with water injection. Mounted over rear axle, transversely. Chassis entirely of merchant sections (Figs. 2 and 3). Three-point suspension of the frame, the front part being supported on a helical spring at middle of front axle and the axle pivoted. Ackerman steering by worm and sector, as shown.

Driving wheels, 5 ft. dia., 16 in. wide, all built up from sections without use of special forgings (see Figs. 4, 5 and 6). Front wheels, 3 ft. 6 in. dia., 8 in. wide. The drive by large cast steel spurgear wheel supported from wheel rim by four brackets.

Transmission entirely by spur gearing, bevels being avoided to escape necessity of maintaining accurate alignments. Transverse mounting of engine serves this plan. Moving part of clutch is mounted on sleeve which runs loose on engine shaft and at outer end carries belt pulley for driving farm machinery. To drive tractor itself a sliding pinion on this clutch sleeve can be thrown into engagement with gearwheel on differential. The engine speed is governed.

Gearbox gives 2¼ and 4½ m.p.h. forward and one reverse, operated by independent but interlocking levers, the locking device preventing improper operation. Emergency brakes are applied direct to drivers and will hold tractor on any hill.

Cooling system includes centrifugal pump drawing from bottom of fan-cooled radiator into which water flows from cylindrical tank on front end of frame containing large number of 2-in. tubes serving as flues for a draft induced by discharging engine exhaust through a series of jets below a chimney fitted above the top tubeplate of the tank. Loss of water said not to exceed 1 gal. per working day.

Fuel; provision made for heating the air on its way to the engine in order to run on kerosene, with by-pass and valves for switching from and to gasoline.

Differential (Figs. 7, 8 and 9); as stated before, bevels are avoided, and construction is therefore by spur pinions as shown. Locking by dog clutch shown to the right in Fig. 7, operated by lever provided on the foot-plate.

Starting gear on clutch sleeve is of safety type, causing release in case of backfiring.

The Overtime farm tractor weighs a little over 2 tons and has a two-cylinder horizontal engine, with bore and stroke 6 and 7 in., developing 24 hp. at 750 r.p.m. Many of this model, which is of American type and origin, were shown. An American-made tractor shown this year for the first time at the Royal Show was the Bull. The Wyles two-furrow motor plow was shown with no other material changes since last year than an enlargement of the cooling system and a provision for controlling engine speed by correcting the strength of the governor spring. The steam equipments exhibited differed little from those previously known.

Opinions on Different Traction Systems for Farm Work

APPARENTLY realizing that rapid progress in applying motor power to agricultural work depends on clearing up all doubts as to what system of machinery will give best results for a given set of working conditions, *Commercial Motor* presents interviews, one of which represents a decided preference for the cable system, another a conditional preference for the general-purpose tractor and a third perfect satisfaction with results so far accomplished with one of these. It is noted that the cable system advocate, Mr. John Allen, is governing director of the Oxford Steam Plough Company and has been identified with cable-ploughing for 40 years, meaning the system by which the plough is hauled to and fro by attachment to a cable passing around drums of powerful engines, one at each side of the field to be worked.

Condensed statements from each of these interviews are given herewith.

John Allen, advocate of the mechanical drum-and-cable system, says:

Plowing can be done more rapidly by cable than by any other method, so as to utilize favorable weather fully.

For cultivating, dragging and harrowing, traction by cable is acknowledged to be superior, because moving of the motive power over the already plowed land is avoided.

Traction plows are unable to compete with cable plows in quality and quantity of the work on hilly, heavy or clay land and on ridge-and-furrow land.

The field for the tractor-plow lies in work of a supplementary character to that done by cable. It is useful in the rush periods and for owners willing to limit their use to supplementary plowing, breaking up clover stubble and for power purposes, such as threshing.

The "farmer's small plowing set" was formerly much talked about, but now different types of engines are made for different jobs, in response to the demand.

Tractors will never be suitable for cultivating and subsequent operations.

American and Canadian conditions do not apply where it is important to get the largest yield per acre.

American and Canadian tractors are not built to stand up on hard roads and will not endure road-haulage in European countries where roads are hard.

A steam-plowing set (with cable) costs approximately $15,000. *A contractor can make profits with them because he can find work from mid-March to mid-November.*

Skilled labor, used to working with agricultural tractors, will not turn to ordinary farm work, and here lies a source of trouble.

Hereafter, if farm work cannot be done by mechanical means, it cannot be done at all.

Tractors, if light enough, should become useful for reaping and binding, as well as for plowing and stationary work. But the tendency is to make tractors heavier to secure increased output and robustness.

Mr. R. G. Patterson, prominent agriculturist and landowner not yet using motor power in the fields, says:

Mechanical means for cultivation are necessary, but I am not at all sure that a suitable and reliable machine is yet available.

I do not feel specially called upon to do pioneer work for the makers of agricultural machines.

A tractor for the average farmer should not weigh more than two tons, to avoid packing the land as it traverses it, and the price should be less than $1,250.

Engineers must decide how heavy the tractor must be to draw three or four plows or a large cultivator.

With a tractor the farmer can go on with his work when the weather is fit, and does not have to wait for a cable-plow contractor to get through with other work first.

Tractors must be light so as to be usable under the least favorable conditions of soil and weather without harming the surface. But nothing must be sacrificed to obtain lightness.

Mr. J. W. Bradford, who for 2 months has used 2-ton Overtime tractor on 480-acre farm recently taken over in bad condition from neglect, says:

Two shillings an acre covers operating cost, not figuring wages of two men, one on tractor and one on plow.

With a four-furrow plow operated from tractor's seat and arranged to lift each plow as it reaches the end of the furrow, the work can be done by a man and a boy.

I have made a hobby of plowing two or three acres after tea with the aid of my little girl only.

With a tractor you can wait till the good weather comes and then rush the work, while with horses you would fall behind on that plan.

The Portent of Electric Farm Machines

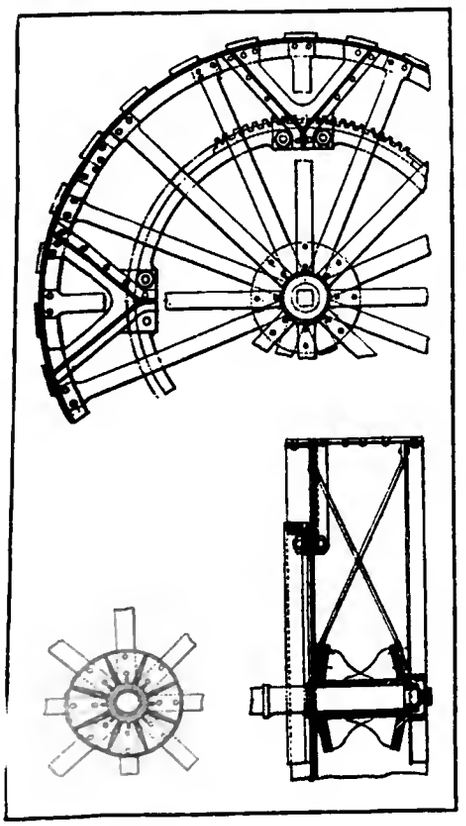
To Protect Sales of Cars and Trucks the Automobile Industry May Be Obliged to Lead Development of Agricultural Motor Machinery and Prepare to Manufacture a Type Adaptable to All Conditions

By Marius C. Krarup

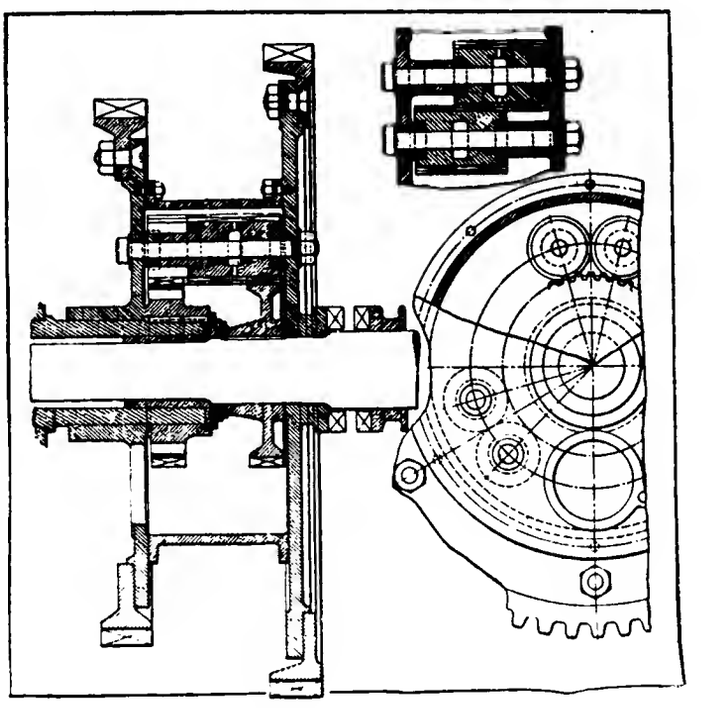
FOR several years descriptions and illustrations of mechanical design and detail in agricultural self-propelled machines have from time to time been urged upon the attention of automobile manufacturers, with a hazy idea that the collaboration of the automobile industry might result in benefits for all concerned. But it has generally been supposed that the decision as to what should be the type of the agricultural machine lay with the farmer and with the implement makers who have been in close touch with the wants of farmers for many years. It has come to be almost accepted that there must be many types of machines, differing radically in the means employed for replacing animal power and locomotion—apart from the necessary differences dictated by the many variations in the nature of the work for the sake of which the power and the locomotion are required. At the same time opinions are varying more and more as to what type of motor machine is most suitable for the average farmer, and on the basis of which the largest and most profitable, useful and interesting business can be created.

If it can be shown that the type which will win out is liable to throw the manufacture of cars and motor trucks for farmers into the hands of those who make farm machines of this type, the choice and development of this type suddenly becomes a matter of vital importance to the automobile industry, which does not wish to lose its rural trade and, on the other hand, will hail with satisfaction any development that promises to expand it. If a study of the present situation in the design and manufacture of farm machines supports the idea that the eventually prevailing type among these machines will be one—or only may be one—which will take its power from the farmer's automobile or from the motor trucks on the farm, provided the automobile and the motor truck can be and are made suitable for supplying it, no great foresight or imagination is required for discovering that the automobile industry will stand to lose or to gain greatly according to what action its members take at the present time in sizing up the situation.

In the account on the preceding pages of the Royal Agricultural Show at Manchester the emphasis is still on the



Figs. 4, 5 and 6—Construction details of driving wheels for Omnitractor. Hub a steel casting. All the rest built up from merchant sections



Figs. 7, 8 and 9—Spur pinion differential in Omnitractor; less sensitive to misalignment than the bevel pinion type

mechanical details of the "agrimotors" actually exhibited, but from the accompanying extracts of interviews one gets a rather vivid impression to the effect that the waiting and hesitating world is most deeply interested in the choice of the type and consents to examine the mechanical details, ingenious as they may be, mainly because they are helpfully suggestive in the effort for reaching larger and more important conclusions or, at best, because the practical situation is so urgent that an immediate choice must be made in order to get needed work done somehow.

An automobile manufacturer, whether he contemplates to manufacture farm machines, or merely to protect his automobile business, is called upon to go more energetically into the question of type than the prospective user of agricultural machines, to whom any machine may be better than none. Some ideas come up in connection with this subject which may serve to show how relatively unimportant are all matters of mechanical detail in tractors or motor ploughs so long as it is doubtful if a suitable basis for developments has been discovered.

Need of a Basis

Real automobile manufacture began only when Levassor had devised a design having the peculiar property that improvements could be added piecemeal without ripping the previous construction to bits. It was perfectible.

In comparison with automobiles the new field, whose magnitude and promise everybody now sees, presents the enormous difficulty, for the start, that the output must at once be clearly superior in operating economy to the system of farm work so far employed—including investment charges—but also the important easement that machines can be marketed if they only fulfill this first condition for one of the many greatly varying sets of circumstances and classes of work for which agricultural machines are wanted. The easiest requirements, however—those relating to large estates with level or gently undulating land almost free from stones—are precisely those which have been met by the steam plough and farm tractor industry as it exists to-day, and which no other concern in this line can figure on without also figuring on the sharpest possible competition backed by valuable experience. In this section of the market a new concern must at once be able to offer efficiency and economy markedly better than obtained from the machines now sold. If it cannot do that—and this in itself would mean a new type—it has practically only the difficult end of the market to depend upon, for which nobody so far has been able to devise machines that are or can be accepted as final in type or detail.

It is therefore with regard to machines for difficult mechanical or economical conditions that every prospective newcomer must view the subject so sharply in order to make sure that the type he selects to manufacture has the principle of growth in it and is not one which will be scrapped the moment a more generally adaptable type makes its appearance. And, if he does not contemplate to enter upon new manufacture, it is also from this section that the type may arise which may interfere with the business of selling cars and trucks to farmers. Evidently the coming of such a type should be recognized as long in advance as possible. When industrial activities begin to cluster around it, the opportunities for embracing it get scarce. And it is of course more profitable to embrace than to fight it.

The British Show gives but few clues that can be helpful in looking out for what there may be in store of this nature. Steam tractors, gas tractors, cable system, self-contained motor ploughs in different sizes and recourse to the caterpillar traction system—these make the list of expedients mentioned as actual.

The highly desirable adaptability of every machine unit to MANY agricultural conditions is not strongly represented in any of these types. But the eventual type must have that, since not only are there many kinds of farms but each farm as a rule has many different conditions to meet; on upland, low land, rough land, heavy soil, light soil, level land, hillside, and in the varieties of crops which are cultivated.

Designer's Guide Book Wanted

Probably not one-tenth of the things to be considered in a farm machine equipment has ever been brought home to the machine designer in such form that he can keep his mind on them all at the same time and can allot to each of them its proportionate value in the general scheme. And probably one of the most fundamentally useful things that could be done at present would be to arrange a competition for the production of a slender volume—say a book of 200 octavo pages—setting forth in the most orderly and convincing fashion the agricultural requirements to which farm machines should conform; and setting forth also, partly for the information of farmers, an analysis of those mechanical methods for working the soil which differ from customary plowing, harrowing, dragging, weeding, etc., etc. These may be better adapted for operations by machinery than the old methods, which are so clearly an outgrowth of the use of animals and cheap human labor and should not be accepted as a necessary or permanent handicap for machine design, though of course they should not be discarded lightly or prematurely, as so many people know how to work with them and are disinclined to abandon them.

The adaptability of a type would clearly be greatly enhanced if it included that either old or new soil-working tools and methods could be used with it without radical transformation of the basic equipment. The hoe has always produced better crops than the plough, and the motor hoe is in the ascendancy in France, Bavaria and Austria.

An Adaptable Type

With experiments in mind which have been made in this country, and also in Germany in connection with an illumination scheme for night work in the field, it seems possible to sketch a type which gives more promise for the large majority of farmers, big or small, than any of the types exhibited at the Royal Show, and which, in addition, bids fair to interest automobile manufacturers greatly, for better or worse. This type means an equipment depending for power on the internal-combustion motor and on electric transmission for reaching the machines in the field.

The power unit may be the motor truck of general utility on the farm or an automobile otherwise used for personal transportation. This power unit itself would have electric drive. The generator would have connections not only to the electric vehicle motors but also to insulated feed wires wound upon one or two dismountable reels and terminating in properly safeguarded attachment plugs. The field units would be (1) a light four-wheeled carrier with swiveled front axle, two front driving wheels (with expansible rims and projecting tines, the tines being normally kept shorter in proportion as wheels were expanded to larger diameter, making higher gear, but susceptible of independent adjustment to allow one wheel to be made larger than the other, a differential gear compensating them, and completely retracted within wheel for road travel) and one or two electric motors to drive the tined wheels and also a main shaft arranged to be connected, when required, at different gear ratios to different tools; and (2) the agricultural tool of whatever kind, highly specialized for its work, to be attached as a plough or dropped into the carrier unit and connected—rigidly or flexibly, as the case might demand—to the main shaft just referred to at the gear ratio suitable for its work.

With the power unit remaining stationary, the feed wire or wires would be paid out from the reel or reels as the work-

ing units advanced over the soil and, having suitably swiveled attachments, would be rewound as the working units returned, the reels being of the largest practicable diameter to minimize wear of the wire insulation. A lasting and yet not bulky or heavy insulation would here be one of the few things yet to be devised.

Equipments somewhat of this nature—excepting little but the division of the field machine into a general electric tractor unit and the interchangeable mechanical soil or harvest tool—have been found suitable in their general features for agriculture as well as for lumbering in this country and in Canada, but have received little public mention. But the rapid growth in the demand for farm machines, as well as the prominence accorded to other types, now seems to call for all the mental energy that can be brought to bear to decide the question whether this type of equipment is not more adaptable to all kinds of soil and surface and to all kinds of work than any other, and especially than either the mechanical cable traction system or the universal tractor system. As it can be worked with a movable trolley wire, charged from the power unit (thereby avoiding the question of special insulating material), just as well as with a trailing feed wire, it is not limited to fields of small dimensions.

Perhaps it may prove a matter of the greatest importance in the choice of the type which shall predominate, that the millions of soldiers who will return to farms after the end of the European war will all be familiar with the erection of electric wire posts and with the careful handling of heavily charged wires.

The Urgency

The special interest of the electric equipment to the automobile industry, over and above any attaching to any other type that has been proposed, seems to be beyond doubt, since its general acceptance would involve the manufacture of farm automobiles and farm trucks on a plan suitable for making the power of such vehicles useful all the year round and almost all the time, thereby adding to their value and the universal demand for them. For the farmer it should be a valuable though subordinate advantage and convenience to be able to hang up an electric motor to drive a shaft at any place on his farm where power may be temporarily wanted, as for churning, milking, baling, conveying, pumping, etc., and to arrange readily for electric lighting in house, barn or field.

The North Adjustable Cantilever Spring

Editor THE AUTOMOBILE:—Perhaps you will allow me, as the inventor of the Adjustable Cantilever Spring described in your issue of June 1, to reply to your Reviewer's criticisms of the mathematical treatment of the design.

Mr. Krarup appears to object to my considering the spring as two separate portions. I would point out to him that though the fulcrum may be moved during the process of adjustment from the position above *B* toward *D* the clip remains attached to the *same* point on the spring. The only source of error in the assumption that I have made lies in the fact that it is impossible to estimate accurately the exact effect on the portion of the leaves embraced by the clip, of the pressure of the gripping wedges or set screws.

I remember seeing a fairly elaborate discussion of the effect of buckles or clips on the theoretical deflection of the spring, in the American automobile press some time ago. In my experience, the effect of such a clip as shown is to make the spring about 2 per cent stiffer than it would be if the clip were replaced by a single bearing point. This was specifically mentioned in the article, and it is only in this respect that the mathematical treatment given is based on approximation. As a matter of fact, every spring that has been made with my adjustment has given deflections which agree with the calculated deflections within 5 per cent, for all positions of the adjustment, and considering that this variation includes that caused by inaccuracy of the thickness of the leaves I consider that result proves in a practical way that my mathematical reasoning is correct. If your Reviewer will bear in mind the point mentioned at the commencement of my letter, viz: that the clip is always attached to the same portion of the spring, he will see that my mathematical reasoning does not involve any unfounded assumptions, and is quite logical.

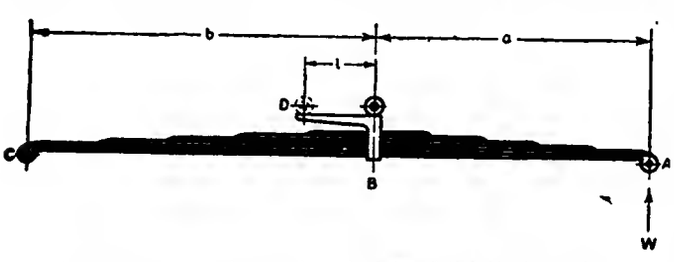


Diagram illustrating main principle of the North spring

The method of calculation of the deflection at the point *A* from the deflection at the point *C* is absolutely correct, as it is simply a question of taking the moments about the point *D* to obtain the displacement at *A* which a given deflection at *C* would cause. In this part of the calculation, it is merely a question of leverage and of relative movement. The fact that point *C* is anchored instead of being free to deflect makes not the slightest difference to the stresses and deflections of the spring itself, and I think that if Mr. Krarup takes the opportunity of looking further into my mathematics he will find that his criticism of my reasoning is unjust and unfounded. If he can show me a simpler way of calculating these springs, I shall be only too pleased to learn from him, but I confidently assert that he cannot show me a more accurate method.

London, June 28, 1916. O. D. NORTH.

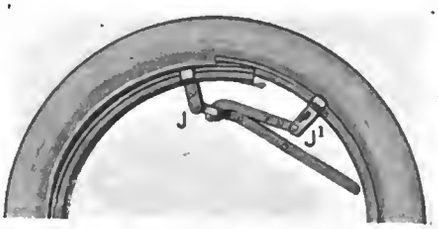
Mr. M. C. Krarup is agreed with Mr. North that the tests of his spring may testify to or toward the correctness of the mathematical demonstration. His objection was to accepting the mathematics in advance as in themselves convincing. In fact, he offered reasoning to the effect that the mathematics were superfluous for proving that the stresses arising in the spring must be acceptable, leaving in contest only the claim to accurate correspondence between the premises accepted for the mathematics and the physical realities of the spring. He cannot agree that it is self-evident that a stress transmitted from the free end to the anchored end, and there resulting in a certain flexure must cause an additional deflection of the free end in exact proportion to the leverages involved. He would expect the real deflections to fall somewhat short of those calculated in this manner. But he would accept tests showing that only 5 per cent of flexibility is lost. He would ask if such tests show the discrepancy not exceeding 5 per cent, mentioned by Mr. North, coming always on the side of reduced flexibility and whether the length of the front-end shackle influences the result. Such test results could then be incorporated in all cantilever spring mathematics, it seems.

With regard to other points the reader is referred to THE AUTOMOBILE of June 1. All points specially mentioned in Mr. North's letter were understood then as now. Mr. K., however, wants to add his sincere thanks to Mr. North for his very interesting treatment of an opportune subject, and does not think that a little difference of opinion *as to when the mathematics of the case begin to become convincing* involves any injustice to Mr. North.

ACCESSORIES

K. P. Universal Rim Tool

DESIGNED for use on rims of the transversely split type, such as the Baker, Stanweld, Kelsey, Detroit, etc., this tool makes their operation both quick and easy. It locks the rim in a collapsed position while the tire is being removed or replaced, pulling the joint on the Baker type down and sideways to clear the valve stem and opening the joint on rims which, like the Kelsey, use an interlock. The manufacturers state that it does not slip, spring the rim out of shape or throw all the strain on one point of the rim, but gradually pulls it all the way around. Tube-pinching is impossible, as the tire slides easily over the rim without the use of forcing tools. In removing a flat tire from the rim jaw J is clamped 4 or 5 in. from the split end of the rim that is to be pulled under. Jaw J1 is then clamped as far from J as the handle of the tool will permit before striking the rim. With rims of the Stanweld type the joint is broken with the screwdriver and the handle pulled over to the position shown in the illustration, which locks the tool, freeing the tire. With the Baker type the handle is pulled sideways until the rim clears the valve stem and lugs. In replacing the tire and locking the rim the tool is capable of forcing the joint together, as is sometimes necessary when the bead of the tire is undersize. The tool is practically unbreakable, being made of cold-rolled steel, and weighs only 3 lb. It sells for $2.—K. P. Mfg. Co., 250 West Fifty-fourth Street, New York City.



K. P. Universal rim tool

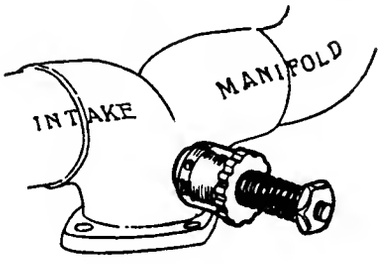
Cantilever Shock Absorbers

The Forgesteel cantilever shock absorber for Fords consists of a lever which takes the place of the spring shackle, to the end of which a long coil spring running to the frame is attached. A single lever set costs $8 and double lever, $10.—Home Light Co., 3353 Milwaukee Avenue, Chicago, Ill.

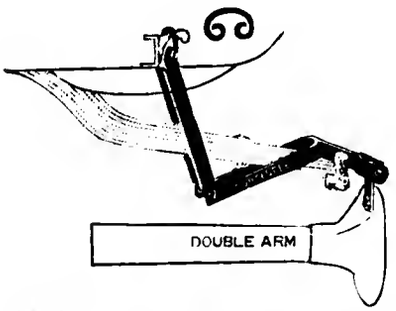
Right Gasoline Saver

The Right gasoline saver is in principle an automatic relief valve that attaches to the manifold and admits additional air to the cylinders in greater or less amount, according to the speed and load of the engine. The air intake is controlled automatically and admits additional air to the cylinders only when the engine is not pulling hard—that is, when the car has attained the desired speed. The valve remains closed while the engine is accelerating, so that it does not decrease the power of the motor when increasing the speed or in going up hill. When properly adjusted it does not interfere with the idling of the engine, while also it will fit any manifold. The manufacturer guarantees a saving in fuel of 30 per cent, and says that in tests the device has shown a saving of more than 60 per cent. It can be installed in 30 min. It lists at $5.—Right Motor Specialties Co., Chicago, Ill.


Legalite headlight lens



Right gasoline saver



Cantilever shock absorbers for Fords


Post type Evenlite

Legalite Headlight Lens

The main principle of construction in the Legalite, which is a multiple-prism lens, is that the lens consists of several types of prisms. Because of this the light is not diffused, while no glare is possible, the beams being sent downward and ahead, shining across the entire width of the road. It has been shown by tests that the Legalite device throws a driving light from 250 to 500 ft. ahead, and yet the light is at no point more than 4½ ft. off the ground. It is stated that the lens, which replaces the ordinary headlight lens, gives 25 per cent more light than the latter. Up to 8½ in. diameter the Legalite sells for $2.50; 8½ to 10½ in., $3; 10½ to 11⅛ in., $4.—Legalite Corp., 117 Boylston Street, Boston, Mass.

Post Type Evenlite

This device is designed to give headlights of constant brilliancy on Ford cars regardless of speed. It is stated at 7 m.p.h. it gives five times the standard Ford light, at 10 miles, 3 times the standard, at 15 m.p.h., twice the standard and at 20 miles and over, it is constant regardless of engine speed. The post type requires less than 30 min. to install and is supplied with two lamps, clamps and screws as well as with necessary wiring. The hood type sells for $4 and the post type for $6.—St. Louis Electrical Works, St. Louis, Mo.

Schultze Tire Tool

This split rim tool can be adjusted to fit any rim, straight side or clincher, from 30 by 3½ to 36 by 4½ by altering the position of the thumbscrew in the adjusting holes in the cross member, which is in two parts. The expanding mechanism is a simple toggle joint which operates to open or close according to the lever motion. Price $2.50.—Schultze Machine Shop, Chenoa, Ill.

Repair Gears and Parts

Repair gears as well as various other parts such as driving shafts, differential cases, bearings, etc., for more than 100 makes of cars, are furnished by the Auto Gear & Parts Co. These parts are kept constantly in stock for immediate shipment.—Auto Gear & Parts Co., 1777 Broadway, New York City, 1461 South Michigan Avenue, Chicago, 275 Marietta Street, Atlanta, Ga.

The Automobile

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The South American Trade

IN the last 10 months South America has given our makers a taste of the possible ability of Argentina and parts of Brazil and other countries to purchase low-priced U. S. A. cars for farm use, a field hitherto very little exploited in these countries. The market is to-day a really appetizing one, but the question is, will it remain such after the termination of the war, when the time arrives that European countries can step back into the harness and pick up the reins of South American business that laid down on Aug. 1, 2 years ago.

Selling to the farmer in Argentina is in reality a new business, as the European car that dominated the South American field for nearly 20 years was largely sold in the cities. Europe has been watching with naturally covetous eyes the rapidly increasing sales of our cars in the country and reports from different countries suggest that after the war Europe may be much better fitted to compete with our low-priced cars than she was before the war. France is reported to be forming a $50,000,000 company to build low-priced machines on a great production scale. Some months ago reports leaked through from Germany that a similar project was under way there, and with the progress shown by England in various lines it would not be surprising if she, too, were engaged in like plans.

It seems certain that competition after the war will be keener than ever before and if the U. S. A. prices can continue to be much lower than European prices as in the past then there can be no doubt that our cheap cars will dominate the South American field as they are dominating other fields. But if Europe really meets us in price then we will be face to face with death-dealing competition because with our lack of U. S. A. ships and our poor exporting ability Europe can handle freight rates to suit its convenience and what advantages we gain by cheaper methods of manufacture, etc., will be offset on the freight question. There is at present sufficient difference in freight between Europe and South America as compared with U. S. A. and South America to indicate that with the war over, there would be a still greater difference. The U. S. A. ability to dominate the automobile market in South America will be very largely dependent on shipping rates. That is the only factor beyond the direct control of the automobile maker, and one that he must watch.

Farm Tractor Opportunity

THAT the sale of the modern type of small farm tractor is going to rest more or less with the automobile dealer has been indicated by the strong movement in their direction shown at the first tractor demonstration in Texas. Already many tractor makers have signed with large automobile distributors for large territories and more announcements of similar deals are being made every day. The tractor maker has been studying the dealer question carefully since last January, in fact before. At that time the tractor show in Kansas City was held the same week as the automobile show for the ostensible purpose of getting as many automobile dealers as possible to visit the tractor show. The object was partly accomplished, in fact, many automobile dealers signed for tractor territories at that time. Since then a vigorous campaign has been carried on and tractor makers have been keen students of the possibilities of the automobile dealer becoming the tractor dealer.

In our large agricultural areas the automobile dealer has for several seasons reported that he has been selling 75 to 95 per cent of his automobiles to the farmer. The automobile has been an unexpected asset to the farmer. He has been tied closer to the automobile dealer by the transaction and there is no more logical person to handle the tractor in our agricultural states than the up-to-date dealer.

Not all automobile dealers will be tractor dealers. Some are not qualified for the work. Some handle cars that do not suit the agricultural trade. Others are not adapted to handle the farm business. There will be many good implement dealers who will take their place in the tractor dealer field. The ultimate dealer of tractors is bound to be a compromise. But to-day the automobile dealer who has not looked into the tractor field for territory is overlooking a good opportunity. It is a certain business. The question for him to settle is, "Am I capable of handling the business?"

100,000 at Tractor Demonstrations

Oklahoma and Texas Farmers Crowd Into Dallas—Automobile Dealers Interested

By S. P. McMinn
Staff Correspondent

DALLAS, TEX., July 22—Demonstrating since Tuesday to interested crowds totalling over 100,000 and marked by many sales and even more agencies established, the first national tractor demonstration, participated in by nearly 100 machines representing some thirty manufacturers, came to a close here last night.

The farmers of Texas have flocked to the demonstration in numbers that have truly astounded those who expected a big attendance.

Car Dealers in Evidence

It is a significant fact that dealers and garagemen are taking such great interest in the demonstration. While manufacturers of tractors are plainly uneasy in their minds as to who ultimately will handle the tractor—automobile dealer or implement man—there seems no doubt but that the tractor maker will have to look to the garagemen for his service.

The demonstrations this year are being run in an entirely different manner from those of years gone by. The competitive spirit is entirely lacking and instead the whole affair is a demonstration in the purest sense of the word.

As an exhibition it is not unlike a great automobile show except that in every instance all the tractors are operating on gasoline and kerosene. Each exhibitor has a big tent; few of them have provided sawdust, and in each tent there is from one tractor to half a dozen.

Each day the machines are started running about 8 o'clock in the morning and few of them are stopped, except occasionally to replenish fuel, until 6 at night. Even during the plowing demonstrations the exhibition machines are permitted to run, often without attendance of any kind.

In this respect it is a tribute to their designers, that, in spite of the terrific heat, which during the first part of the week was as high as 103 deg., none of the machines evidenced any inclination to steam.

The public demonstration is started each day promptly at 1 p. m. At 12.15 all of the tractors leave their respective tents, and, towing the implements that will be demonstrated, make a great, noisy procession to the demonstration field, which is perhaps half a mile from the tents.

The demonstration is being held on what is known as the Caruth farm, a great tract of land giving about 1200 to 1500 acres on which to manipulate the tractors. Each tractor manufacturer has allotted to him each day a strip of land, the size of the strip being proportioned to the size of the tractor to be demonstrated and the number of plow bottoms it will pull.

Every tractor operator must start his machine at a given signal and continue to plow until all his land has been finished. This, of course, promotes some friendly rivalry between the various companies, but this is the only spirit of competition there is.

No restriction is placed on the kind of fuel employed. A maker may use either gasoline, kerosene or distillate, though up to to-day only one maker has been doing any plowing with the latter. But each maker must procure his fuel from a designated source, so that there may be no doubt of its gravity.

Most of the machines in use have been burning kerosene. On the first day, when there were some forty-four machines on the field at the same time, twenty-seven of them were operating on kerosene as against seventeen operating on gasoline.

The fuel problem does not appear to worry the farmer greatly in Texas. Gasoline is at present selling for 19 cents per gallon, but he can get kerosene from 7 to 10 cents. All manufacturers are taking kerosene into consideration.

During the week a large number of contracts have been signed and though few manufacturers care to make public the names of new dealers and distributers they have no hesitancy in saying that wherever it is possible they invariably prefer to do business with the automobile dealer or the garageman.

The accessory exhibit is one of the most interesting tents on the grounds. That there is a market and a big one for accessories there can be no doubt, for from the engine back to the transmission gear there is not a great deal of difference between the tractor and the automobile. Exhibitors:

TRACTOR EXHIBITORS

Waterloo Gasoline Engine Co., Waterloo, Iowa.—24 hp. kerosene; drawing one 10-ft., 10-disk harrow with one 10-ft. grain drill.

Standard-Detroit Tractor Co., Detroit—10-20 hp., gasoline, drawing one 4-gang Sanders disk plow.

Simplex Tractor Co., Minneapolis—10-20, gasoline, drawing one 4-gang La Crosse plow.

Rock Island Plow Co., Rock Island—10-20, gasoline, drawing one 4-gang Sanders disk plow.

Peoria Tractor Co., Peoria—8-20, kerosene, drawing one 4-gang Sanders disk plow.

Parrett Tractor Co., Chicago—12-25, gasoline, drawing one 4-gang Sanders disk plow.

Nilson Farm Machinery Co., Minneapolis—24-35, gasoline, drawing one 4-gang La Crosse plow.

Moline Plow Co., Moline—6-12, gasoline, drawing two 14-in. moldboard and two disk plows.

Twin City Tractor Co., Dallas—15-30, kerosene, drawing 6-gang Sanders disk, 40-60, kerosene, drawing 18-gang Sanders disk; 15-30, sub-soiler, drawing 32 12-in. spades and 3-gang Sanders disk plow.

Bates Tractor Co., Lansing—13-30, kerosene, drawing 4-gang Sanders disk plow.

International Harvester Co., Chicago—15-30, Titan kerosene, drawing 6-gang Sanders disk; 12-25, Mogul, kerosene, drawing 5-gang Sanders disk plow; 10-20, Titan, kerosene, drawing 4-gang Sanders disk plow; 8-15, Mogul, kerosene, drawing 3-gang Sanders disk plow; 8-16, Mogul, kerosene, drawing an Osborne disk harrow with tandem attachment; 10-20, Titan, kerosene, drawing two Kentucky 10 x 7 grain drills; 12-25, Mogul, kerosene, drawing 3 Webber wagons.

Holt Mfg. Co., Peoria, Ill.—25-45, gasoline, drawing 12-gang Sanders disk plow.

Happy Farmer Co., Minneapolis—8-16, gasoline, drawing 3-gang Sanders disk plow.

Hart-Parr Co., Charles City, Iowa—15-30, kerosene, drawing 3-gang La Crosse disk plow; 18-35, kerosene, drawing 8-gang La Crosse disk plow; 30-60, kerosene, drawing 10-gang La Crosse disk plow.

Emerson-Brantingham Co., Rockford, Ill.—12-20, Model L, kerosene, drawing 4-gang disk plow; 12-20, Model Q, drawing 4-gang disk plow; Big Four, 20, distillate, drawing 7-gang disk plow.

Denning Tractor Co., Cedar Rapids, Iowa—10-18, kerosene, drawing 3-gang Sanders disk plow; 10-18, kerosene, drawing John Deere pulverizer and harrow.

Sandusky Tractor Co., Dallas—15-35, kerosene, drawing 6-gang La Crosse disk plow.

J. I. Case T. M. Co., Racine—9-18, gasoline, drawing 3-gang Grand Detour disk plow; 10-20, kerosene, drawing 4-gang disk plow; 12-25, kerosene, drawing 6-gang disk plow; 20-40, kerosene, drawing 10-gang disk plow.

Wallis Tractor Co., Racine—26-44, gasoline, drawing 8-gang Case disk plow.

Bull Tractor Co., Minneapolis—7-20, gasoline, drawing 3-gang Sanders disk plow.

Avery Co., Peoria—5-10, kerosene, drawing 2-gang Grand Detour disk plow; 8-15, kerosene, drawing 4-gang John Deere disk plow; 12-25, kerosene, drawing 6-gang Rock Island plow; 18-35, kerosene, drawing 8-gang Rock Island disk plow; 25-50, kerosene, drawing 12-gang Rock Island plow.

Avery & Sons, B. F., Louisville—10-20, gasoline, drawing 2-gang Avery disk plow.

Allis-Chalmers Mfg. Co., Milwaukee—10-18, gasoline, drawing 3-gang John Deere plow.

Advance Rumely Thresher Co., La Porte—30-660, kerosene, drawing 14-gang Sanders disk plow; 15-30, kerosene, drawing 8-gang Sanders disk plow; 12-24, gasoline, drawing 3-gang moldboard plow.

Ford Tractor Sales Co., Minneapolis—8-16, gasoline, drawing 3-gang Sanders disk plow.

Standard Tractor Co.—22-24, gasoline, drawing 6-gang P. & O. disk plow.

Western Tractor Co., Dallas—8-15, gasoline, drawing 3-gang P. & O. disk plow.

ACCESSORY EXHIBITORS

Avisco Oil Co., L. Sonneborne & Sons, McQuay-Norris Mfg. Co., Pyrene Mfg. Co. of Texas, Gulf Refining Co, Eisemann Magneto Co., Hyatt Roller Bearing Co., Domestic Engineering Co., Sumter Electric Co., Kingston Electric Co., Byrne-Kingston Co.

Tractor Ratings Committee Appointed

WICHITA, KAN., July 23—The National Gas Engine Assn. has appointed a tractor ratings committee which will seek to standardize methods of rating farm tractors, both as to drawbar pull and belt horsepower. The drawbar rating favored is in pounds pull with the time element incorporated. The belt power will be in terms of horsepower. The committee will endeavor to evolve a method which will be satisfactory to all manufacturers.

Chairman of the committee is Raymond Olney, editor, *Gas Power*. Other members are: Fred Glover, vice-president, Emerson-Brantingham Implement Co.; C. M. Eason, Hyatt Roller Bearing Co.; G. T. Strite, president, Strite Tractor Co., and H. C. Buffington, chief engineer, Minneapolis Steel & Machinery Co.

Oakland Plans Big Expansion

New Buildings To Be Completed and Machinery Installed Oct. 1

PONTIAC, MICH., July 20—Announcement is made by the Oakland Motor Co., this city, that its plans for greatly expanding its plant have been officially approved by President W. C. Durant of the General Motors Co., and building operations will begin as soon as the buildings on the old Studebaker site have been removed.

In addition to the 4-acre site, formerly a part of the old Studebaker works, negotiations have just been completed for the annexation of the solid block extending from Oakland Avenue to Howard Street, fronting on Baldwin. The new buildings will be occupied by a machine shop and additional assembly departments.

Immediate expansion of the plant was imperative in order to bring the output up to a point which will meet the demand for Oakland cars.

Until the architects have completed detailed plans, it is impossible to accurately estimate the increase in floor-space the expansion gives, but it is said that the output will be materially increased and that it will ultimately employ double the present force of workmen. Work on the new buildings will be pushed to the limit, the contracts for the work calling for completion by Oct. 1, ready for the installation of machinery already purchased and en route.

At the close of business July 1, the Oakland company was several thousand cars ahead of the last fiscal year.

Detroiter Adds $1,098 Roadster

DETROIT, MICH., July 25—The Detroiter Motor Car Co., Detroit, which heretofore has manufactured a touring car only, now has added a roadster body to fit the same six-cylinder chassis, and priced at $1,098. The new roadster body adheres to strictly modern lines, with sloping hood and cowl, slanting windshield, and sloping rear deck. There is room for three passengers in the wide seat, and at the rear there is a large waterproof compartment for luggage or other articles. The new roadster is sold with option of colors, and is upholstered in leather to match.

Many Changes in New York Overland Organization

NEW YORK CITY, July 25—The Willys-Overland Co. as a result of taking over its own branch in this city and surrounding territory, has made many changes in its local organization.

E. M. Lied, formerly zone manager in this territory, has been appointed assistant manager of the local branch in the Circle Building, on Broadway and Fifty-ninth Street. H. F. Harris, formerly assistant manager of the L. Michael Co., Chicago, Ill., becomes comptroller.

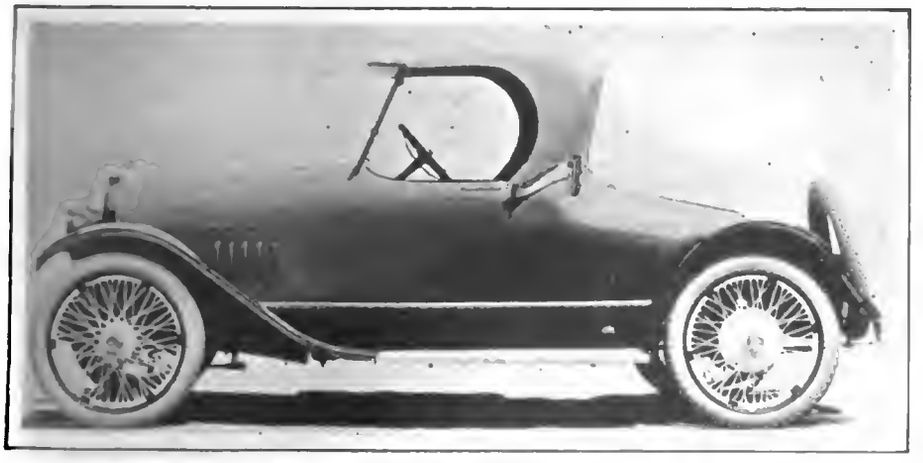
R. D. Willard, formerly manager of the Carl H. Page Co.'s branch in Philadelphia, has been appointed sales manager. S. D. Miller, also a member of the Carl H. Page Co., having managed the Brooklyn branch, joins the Overland forces as manager of the Newark, N. J. branch.

L. F. Seeback, formerly manager of the Brooklyn branch of the C. T. Silver Co., remains in that city as manager of the new Willys-Overland branch.

The Brooklyn branch is temporarily located at 338 Flatbush Avenue while the Newark branch is at 35-37 Halsey Street. The company expects to enlarge its territory by establishing branches in Yonkers and other nearby cities.

Fisher Body to Expand

DETROIT, MICH., July 22—To care for further expansion, the Fisher Body Co., body manufacturer, is preparing to float an issue of $5,000,000 of preferred stock through Hallgarten & Co., New York bankers.



New Detroiter 6-45 roadster which sells for $1,098, with complete equipment

Ford Co. Adds 34 Branches

New Quarters Planned in 28 Cities—Factory Closed for Inventory

DETROIT, MICH., July 20—The Ford Motor Co. marks an expansion of its branch sales and service organizations by the addition of thirty-four new branches, effective Aug. 1.

The cities selected for the Ford establishments are: Akron, Ohio; Albany, N. Y.; Troy, N. Y.; Baltimore, Md.; Birmingham, Ala.; Des Moines, Iowa; Duluth, Minn.; Fresno, Cal.; Grand Rapids, Mich.; Havana, Cuba; New Orleans, La.; Oakland, Cal.; Peoria, Ill.; Richmond, Va.; Rochester, N. Y.; Sacramento, Cal.; St. Joseph, Mo.; Salt Lake City, Utah; San Antonio, Tex.; Scranton, Pa.; Sioux City, Iowa; Spokane, Wash.; Springfield, Mass.; Tacoma, Wash.; Toledo, Ohio; Trenton, N. J.; Worcester, Mass., and Youngstown, Ohio.

With the establishment of these new branches the total number reaches eighty-five, besides the twenty-eight branch factories.

DETROIT, MICH., July 20—Notices are being given out to the workmen of the Ford Motor Co. whereby most of the 30,000 employed in the Detroit factories will not be required to be at work from July 25 to Aug. 7, during which period a complete inventory of property valued at approximately $100,000,000 will be taken. Ford's fiscal year ends July 31.

Two New Buildings for Monroe Body—Capital Increased

PONTIAC, MICH., July 20—Work is about to begin on two new buildings for the Monroe Body Co., an office building and a pressed steel plant. The office building is to be located on the west side of Osmun Street, and will be a brick structure 28 by 56 ft., and one story high. The new factory building will be located in the rear of the office building, fronting on the Michigan Air Line tracks a distance of 156 ft. The greatest depth will be 82 ft.

The capital stock of the Monroe company has been increased to $150,000.

Golde Top to Enlarge

NEW YORK CITY, July 25—The Golde Patent Mfg. Co., this city, will rent additional factory space in order to double its manufacturing facilities during the coming year. Besides the premises which it now occupies at 509-515 West Fifty-sixth Street, it has rented about 10,000 sq. ft. in an adjoining building 512-515 West Fifty-seventh Street. During the last 18 months this company has turned out over 89,000 one-man tops.

Comparative Statement of Packard Motor Car Co. Covering the Period from 1909 to 1917

	Capital Stock Issued						
	Common	Preferred	Total	Net Assets	Earnings		
Sept. 1, 1909	$5,000,000	$5,000,000	$10,000,000	$10,766,847.65	.....		
Year 1909-1910	5,000,000	5,000,000	10,000,000	12,819,799.23	$2,612,774.08		
" 1910-1911	5,000,000	5,000,000	10,000,000	14,079,741.98	1,609,942.75		
" 1911-1912	5,000,000	5,000,000	10,000,000	12,523,432.84	2,068,648.75 (2)		
" 1912-1913	5,000,000	5,000,000	10,000,000	14,538,000.86	2,364,568.02		
" 1913-1914	7,065,300	5,000,000	12,065,300	15,414,355.02	1,161,054.16		
" 1914-1915	7,065,300	5,000,000	12,065,300	17,833,873.87	2,769,518.85		
" 1915-1916 (1)	11,656,930	8,000,000	19,656,930	26,003,274.12	6,050,000.00		
Totals	.....	.....	.....	.....	$18,636,506.61 (3)		

	Common Dividends		Common Dividends		Preferred Dividends		
	Rate Paid	In Stock	Annual Rate	In Cash	Annual Rate	In Cash	Surplus Balance
Sept. 1, 1909	....	.....	...	.....	...	.....	$766,847.65
Year 1909-1910	....	.....	8%	$298,572.00	7%	$261,250.50	2,819,799.23
" 1910-1911	....	.....	...	.....	7%	350,000.00	4,079,741.98
" 1911-1912	....	.....	...	.....	7%	350,000.00	2,523,432.84 (2)
" 1912-1913	....	.....	...	.....	7%	350,000.00	4,538,000.86
" 1913-1914	40%	$2,000,000.00	...	.....	7%	350,000.00	3,349,055.02
" 1914-1915	....	.....	...	.....	7%	350,000.00	5,768,573.87
" 1915-1916 (1)	60%	4,591,630.00	7%	395,599.75	7%	455,000.00	6,376,344.12 (3)
Totals		$6,591,630.00		$694,171.75		$2,466,250.50	.....

(1) 9 months actual; 3 months estimated. (2) After writing down rights, privileges, etc., from $3,274,958.89 to $1; (3) After deducting depreciation for these 7 years of over $9,000,000.

Packard in 7 Years Earns $18,636,506

Over $9,000,000 Charged Off for Depreciation—$6,050,000 Expected During Fiscal Year.

DETROIT, MICH., July 23—In a comparative statement of its capitalization, net worth, dividends and surplus for the 7 years beginning Sept. 1, 1909 and ending at the close of the current fiscal year on Aug. 31, 1916, the Packard Motor Car Co. shows aggregate earnings of $18,636,506 after deducting more than $9,000,000 for depreciation during this 7-year period. The earnings for the present fiscal year, 9 months of which are based on actual figures and the last 3 months estimated, amount to $6,050,000 as compared with $2,769,518 for the year 1914 to 1915, which was the best previous earnings for the company. In offering this statement, F. R. Robinson, comptroller of the company, points out that the figures for the fiscal year—1915 to 1916—contain a conservative estimate covering the last quarter of the year and after paying regular preferred and common cash dividend and deducting the 10 per cent common stock dividend declared Feb. 1, 1916, and the 50 per cent common stock dividend to be distributed Aug. 1, the balance in the surplus account the end of the year will undoubtedly exceed $6,376,344. In the 7 years the capital stock of the company has been increased from $5,000,000 common and $5,000,000 preferred to $11,656,930, common stock and $8,000,000 preferred. In the same period the net assets have increased from $10,766,847 to $26,003,274.

The comparative statement by fiscal years appears herewith:

Crude Oil Prices Drop

NEW YORK CITY, July 26—The most important event in last week's market report was the drop of 10 cents a barrel of Kansas crude petroleum. Announcement was made yesterday by the Prairie Oil and Gas Co., Tulsa, Okla., that it had reduced the price to $1.45 a barrel.

Supplementing the drop in crude petroleum comes the announcement of a reduction in price of linseed and lard oils. The former product is selling now at 69 cents a gallon, and the latter at $1.05.

Rubber prices were unsteady at the closing on Saturday. Prices on fine up-river Para, however, managed to remain unchanged at 66 cents a pound. Ceylon, first latex grade, suffered a drop of 2 cents a pound, the quoting yesterday being 56 cents.

Metal prices remained constant and strong with a heavy demand.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb	.58	.58	.58	.58	.58	.58	...
Antimony, lb	.14½	.14½	.14½	.14½	.14½	.13	— .01½
Beams and Channels, 100 lb	2.67	2.67	2.67	2.67	2.67	2.67	...
Bessemer Steel, ton	40.00	40.00	40.00	40.00	40.00	40.00	...
Copper, Elec., lb	.26½	.26¼	.26½	.26½	.26½	.26½	...
Copper, Lake, lb	.26½	.26¼	.26½	.26½	.26½	.26½	...
Cottonseed Oil, bbl	9.95	9.65	9.65	9.60	9.52	9.45	— .50
Fish Oil, Menhaden, Brown, gal	.55	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime, gal	1.10	1.10	1.10	1.10	1.10	1.05	— .05
Lead, 100 lb	6.30	6.30	6.30	6.35	6.35	6.35	+ .05
Linseed Oil, gal	.70	.70	.70	.70	.70	.69	— .01
Open-Hearth Steel, ton	42.00	42.00	42.00	42.00	42.00	42.00	...
Petroleum, bbl., Kans., crude	1.55	1.55	1.55	1.55	1.55	1.45	— .10
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal	.92	.92	.92	.92	.92	.92	...
Rubber, Fine Up-River Para, lb	.66	.66	.66	.66	.66	.66	...
Rubber, Ceylon, First Latex, lb	.58	.58	.58	.57	.57	.56	— .02
Sulphuric Acid, 60 Baume, gal	3.00	3.00	3.00	3.00	3.00	3.00	...
Tin, 100 lb	37.50	37.13	37.50	37.70	38.00	38.25	+ .75
Tire Scrap, lb	.053¼	.053¼	.053¼	.053¼	.053¼	.051½	— .001½

$1,275,000 Profit for Stewart-Warner

Earnings Based on 6 Months' Operations — Declares Quarterly Dividend of 1½ Per Cent.

CHICAGO, ILL., July 20—The Stewart-Warner Speedometer Co. has declared the regular quarterly dividend of 1½ per cent on the common stock, payable Aug. 1 to stock of record July 22.

The corporation reports for the 6 months ending June 30 last net profits of $1,275,000, a new high record. The net profits in the last quarter totaled $703,254, against $571,873 in the first quarter of the calendar year.

The balance sheet shows assets as follows: Real estate, buildings, machinery, etc., less depreciation, $1,720,774; patents, trade marks, and good will, $9,096,967; inventories and receivables, $3,454,008; deferred charges $154,158; total assets, $14,425,908.

Liabilities: Preferred stock $724,400; common stock $10,000,000; current liabilities $420,317; surplus $3,281,191. Surplus includes $307,463 set aside to retire the preferred stock.

Sewell Cushion Increases 300 Per Cent

DETROIT, MICH., July 20—The Sewell Cushion Wheel Co., this city, shows an increase in business for the first quarter of its fiscal year of 300 per cent over the same period last year.

Plans are now being formulated for establishing service stations, in connection with the branches in Buffalo, Boston, New York City, Philadelphia, Baltimore, Minneapolis, Rochester, Cleveland, St. Louis, Pittsburgh, Los Angeles, Seattle, and Chicago. A service station is maintained at the factory for the benefit of Detroit users.

Murray Parts Increases Capital

DETROIT, MICH., July 25—The J. W. Murray Mfg. Co., this city, maker of au-

tomobile parts, has increased its capital from $200,000 to $500,000. $250,000 of this amount is subscribed, the greater portion of which will be paid in by the declaration of a 100 per cent stock dividend, the balance being taken by the directors.

To take care of its increased business, the company has also recently invested in 3½ acres of additional property and a factory, at an outlay of $175,000. This will serve to double its capacity, as all the original plants will still continue to be operated, and will afford in all over 150,000 sq. ft. of floorspace.

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Burdick and Hagerman Now Control Central Wheel

STURGIS, MICH., July 20—A deal was consummated to-day whereby F. L. Burdick and Roy H. Hagerman have purchased the controlling interest in the Central Wheel & Mfg. Co. The purchase was made from Mrs. Emma Westendorf, formerly vice-president. The company was organized in 1909, and its products include wheels of all sorts.

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Wichita Falls Plans to Expand

WICHITA FALLS, TEX., July 24—The Wichita Falls Motor Co. has increased its capital stock from $100,000 to $400,000. It has met with much success in manufacturing motor trucks at its plant here and it is stated that it plans to greatly enlarge the industry.

Securities in Demand

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Chevrolet and Maxwell Feature Rise in Prices—Stocks Are Strong

NEW YORK CITY, July 26—Automobile securities showed pronounced strength last week and picked up somewhat in prices. Rumors of further mergers and dividend action had their potent effect on the market in general and prices rose as a result of the demand in those stocks so affected. The market as a whole was steadier than last week and stocks were in demand.

Chevrolet and Maxwell featured the market with rises of 22 points and 7⅜ points, respectively. Dame Rumor has it that Chevrolet common is due for a large dividend and as a result it is expected that the stock will reach a new high mark before the next month is over. Maxwell rose as a result of the belief that the directors of that company will place the common stock on a dividend basis at their meeting on Aug. 8. This stock was one of the most active of the motor stocks, the turnover on Saturday being 5400 shares. It is expected that if the common stock dividend is declared that the second preferred will come in for an initial dividend.

The new Stromberg and Kelsey Wheel stock was introduced on the Curb last week. The former sold at $42, $42.25 and $42.50, the sales amounting to 1800 shares. Kelsey Wheel common advanced from 60 to 63 after its introduction. Stewart-Warner Speedometer common, it is stated, will be listed on the New York and Chicago stock exchanges.

Stutz stock was one of the strongest issues on the curb Saturday due to rumors of a merger of that company with Stromberg. Both of these companies are now under control of Allan A. Ryan & Co., this city.

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Wayne Oil Increases Capital $200,000

FORT WAYNE, IND., July 25—The Wayne Oil Tank & Pump Co., this city, has increased its capital from $500,000 to $700,000. The object of the increase is to provide for big additions to the plant to take care of the concern's rapidly expanding business. Among the improvements will be the construction of a factory building nearly 400 ft. long.

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Reports $13,000 in Krit Assets

DETROIT, MICH., July 22—Final reports in the case of the Krit Motor Sales Co., the bankrupt selling organization for Krit cars, were filed in the United States district court here this week, and show approximately $13,000 of the company's assets remaining on hand. The total receipts for the sale of the property were $81,126 and the total disbursements $67,883, of the latter $65,047 representing dividends to creditors amounting to 37½ per cent. Indications are that another dividend of about 4 per cent will be declared.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co. (new)	..	..	64	65	+ ½
J. I. Case pfd	70	79	83½	89	+1½
Chalmers Motor Co. com	89	92	175	180	+10
Chalmers Motor Co. pfd	95	98	98	103	..
*Chandler Motor Car Co	..	..	107½	108	+4
Chevrolet Motor Co	..	..	216	218	+22
Fisk Rubber Co. com	..	..	..	160	..
Fisk Rubber Co. 1st pfd	..	..	114	120	+2
Fisk Rubber Co. 2d pfd	..	..	120	..	+8
Firestone Tire & Rubber Co. com	506	512	915	930	..
Firestone Tire & Rubber Co. pfd	109	111	111	115	+1½
*General Motors Co. com	179½	181	480	530	—5
*General Motors Co. pfd	105	107	110⅛	114⅞	+ ⅝
*B. F. Goodrich com	50	51	73⅛	73½	+ ½
*B. F. Goodrich pfd	104½	106	113	115	— ½
Goodyear Tire & Rubber com	269	272	225	228	+2
Goodyear Tire & Rubber pfd	105	106½	106	106¼	..
Grant Motor Car Co	..	..	9	11	..
Hupp Motor com	..	..	6½	7	— ½
Hupp Motor pfd	..	..	80	100	..
International Motor Co. com	17	19	5	10	—2
International Motor Co. pfd	40	44	17	25	—1
*Kelly-Springfield Tire & Rub. com	165	168	70¼	71	+1¼
*Kelly-Springfield Tire & Rub. 1st pfd	86	87	96	97½	+1
Kelsey Wheel com	..	..	60	63½	..
Kelsey Wheel pfd	..	..	100¼	101	..
*Lee Rubber & Tire Corp	..	..	45	45½	+2½
*Maxwell Motor Co. com	35½	37	81⅛	81½	+7¾
*Maxwell Motor Co. 1st pfd	84	86¼	87½	87¾	+3¼
*Maxwell Motor Co. 2d pfd	31	33	57¾	58⅛	+3¼
Miller Rubber Co. com	196	199	200	215	..
Miller Rubber Co. pfd	94	96	104	106	..
Packard Motor Car Co. com	110	115	168	173	..
Packard Motor Car Co. pfd	97	..	100	105	..
Paige-Detroit Motor Car	..	..	45	50	..
Peerless Truck & Motor Corp	..	..	23	25	+1
Perlman Rim Corp	..	..	..	..	..
Portage Rubber Co. com	36	38½	113	115½	..
Portage Rubber Co. pfd	92	95	115	117	..
Regal Motor Co. pfd	..	..	17	20	..
Reo Motor Truck Co	15½	..	37¼	37¾	+1
Reo Motor Car Co	30	31	43½	44	+1
Saxon Motor Car Co	..	..	75	78	+2
Springfield Body	..	..	77	78	..
Standard Motor Co	..	..	5	6	..
Stewart-Warner Speed. com	65½	66½	103	105	+5
Stewart-Warner Speed. pfd	105	107	..	..	..
Stromberg Motor	..	..	42	42¼	..
*Studebaker Corp. com	81½	83	126½	126¾	+1⅞
*Studebaker Corp. pfd	99	101	109	111	..
Stutz Motor	..	..	62¾	63	+2¾
Swinehart Tire & Rubber Co	77	78	85	87	..
United Motor Corp	..	..	69	69¼	+3⅝
*U. S. Rubber Co. com	43½	45	53⅝	53⅞	+1⅞
*U. S. Rubber Co. pfd	102	104	108	109	+ ¼
White Motor Co (new)	99	103	54	54¼	+1½
*Willys-Overland Co. com	132	133½	60½	60⅝	—3¼
*Willys-Overland Co. pfd	102	103¾	105⅝	106	+ ⅝

*At close July 24, 1916. Listed New York Stock Exchange
Quotations furnished by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co	..	..	..	..	..
Chalmers Motor Co. com	..	91	172	..	..
Chalmers Motor Co. pfd	94½	97	..	103	..
Continental Motor Co. com	205	..	35¼	36½	..
Continental Motor Co. pfd	82	86	9½	10½	..
Ford Motor Co. of Canada	1475	..	337½	352	..
General Motors Co. com	178	183	470	510	—10
General Motors Co. pfd	105½	107½	..	111½	..
Maxwell Motor Co. com	35½	37½	75½	78½	+2
Maxwell Motor Co. 1st pfd	82½	84½	84	87	+1
Maxwell Motor Co. 2d pfd	31½	34	55	59	+2
Packard Motor Car Co. com	110	115	..	176	..
Packard Motor Car Co. pfd	98	100¼	..	104	..
Paige-Detroit Motor Car Co	..	..	44	50	..
W. K. Prudden Co	19½	21	44	46	..
Reo Motor Car Co	30¼	31½	43¼	44¼	+ ⅝
Reo Motor Truck Co	17	..	37	38	..
Studebaker Corp. com	81½	83½	126	129	+1
Studebaker Corp. pfd	99	101	105	..	..
C. M. Hall Lamp Co	..	..	..	32	..

INACTIVE STOCKS

Atlas Drop Forge Co	..	26	..	40	..
Kelsey Wheel Co	205	..	450	..	..
Regal Motor Car Co. pfd	15	25	17	..	..

Left—Doane truck crossing frail bridge with 12,000-lb. load in Panama-California Exposition Commercial Vehicle run, Los Angeles to San Diego, July 14 and 15. Right—Trucks checking in at San Juan Capistrano, the first day noon control

Plan Another Desert Race

Course from Los Angeles to Salt Lake Over Arrowhead Trail

SAN BERNARDINO, CAL., July 19—There is to be a desert road race staged in the Southwest this fall which will not be a revival of the Phoenix road race. There is to be a race from Los Angeles to Salt Lake over the Arrowhead Trail, a road that cuts in on the National Old Trails route between this city and Needles.

Charles Biglow, field secretary of the Arrowhead Trail Assn., which is promoting the event, was in Los Angeles yesterday for a conference with Al. G. Waddell, representative of the contest board of the A. A. A. and a car is going out to pathfind the route within the next few days. The dates asked for by the Arrowhead Trail Assn. are Oct. 8, 9 and 10. The race is to finish at Salt Lake at at noon of the third day, Oct. 10, which is the opening day of the Mormon Conference. One night control is to be at Ely, Nev., and the second is to be at St. George, Utah.

From St. George into Salt Lake, the cars are to be limited to a safe pace on account of the great number of children in the country through which the Utah State highway passes.

It is planned to have a large enough purse to offer $5,000 first money. The Salt Lake Railroad is to run the "Howdy Special," which was always a feature of the Phoenix races.

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Eleven Perfect Scores in Truck Reliability Run

EXPOSITION GROUNDS, SAN DIEGO, CAL., July 20—Eleven out of fourteen trucks entered in the commercial vehicle reliability run of 150 miles from San Diego to Los Angeles on July 15, finished with perfect scores. The run was over the worst highways of southern California.

The trucks ranged from 1000 to 12,000 lb. capacity. Those that were penalized had minor troubles.

The following list gives the truck, the name of the driver and the load carried:

Truck and Driver.	Load Carried
Vim, Krapp	1,100
Vim, Kirkpatrick	1,100
Vim, Lloyd	1,200
Downe, Miller	12,000
Stewart, Fouch	1,030
Studebaker, Futley	1,090
Studebaker, Fortine	2,121
Smith Form A Truck, Meisel	2,090
G. M. C., Hurd	7,400
Denby, H. G. Pendell	3,010
Little Giant, Darin	1,590
Little Giant, Johnson	3,130
Autocar, Heffner	3,150
G. M. C., Burris	1,670

Another truck reliability tour is planned. The Motor Truck Dealers' Assn. of Los Angeles has made application to the Contest Board of the A. A. A. for a sanction for a run Oct. 22 and 23. This run would be approximately 400 miles and the course would include every road condition.

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Accidents Mar Tacoma Races

TACOMA, WASH., July 23—*Special Telegram*—Ulysses Aubrey, driving a Tacoma special and his mechanician, Frank Lake, were instantly killed in the Australian pursuit race on the Rose City Speedway to-day. A series of accidents marred a good race program with record attendance. F. M. Penticost, driving the Schnieder Special, went through the fence but was unhurt. M. J. Moosie of Los Angeles, in the Gandy special, plunged 300 yd. and his car jumped 22 ft. in the air with a broken steering knuckle. The 50-mile race was won by Omar Toft of Los Angeles, time 49 min. 27 2/5 sec. The 20-mile race also was won by Toft in 20 min., 29 1/5 sec.

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Sealand Resigns from Winton

DETROIT, MICH., July 21—F. A. Sealand, manager of the Detroit branch of the Winton Motor Car Co. for the last 4½ years, has resigned to become general manager for T. H. Towle, proprietor of the Cleveland-Cadillac Co., the Columbus-Cadillac Co., and the Toledo-Cadillac Co.

De Palma Wins at Kansas City

Takes 100-Mile Race at 58.48 M. P. H.—O'Donnell Injured in 25-Mile

Winners of 100-Mile Race

Car	Driver	Time	M.P.H.	Prize
Mercedes	DePalma.	1:42:54	58.4	$2,500
Duesenberg	O'Donnell.	1:45:6	57.02	1,000
Duesenberg.	Buzane...	1:49:42	54.6	600
Kleinart....	Klein ...	1:54:56	53.1	400

KANSAS CITY, MO., July 22—Marred by only one accident, an injury to Eddie O'Donnell, the daring Duesenberg driver, Kansas City has at last held a successful speedway meet. O'Donnell will be out of the hospital in 2 weeks.

Ten thousand enthusiastic Kansas Cityans this afternoon saw Ralph de Palma in his cream-colored Mercedes win the 100-mile grind after a thrilling contest with O'Donnell. The Italian's time was 1:42:54, or an average of 58.48 m.p.h.

After cheering O'Donnell to the echo for his game fight against the veteran De Palma, the crowd saw the clever little driver hurtle through the fence on the first turn of the track in a 25-mile event which followed the first race. He was badly hurt but his mechanician was unhurt. A broken steering knuckle caused the accident.

Before the 100-mile race had been half finished the 1⅛-mile dirt speedway became so full of ruts and wallows that it became necessary to shut off the power entirely at some places. The strain on the cars was so terrific that only five out of twelve starters finished, although there were six money prizes. The terrible condition of the course had something to do with the fact that less than half the starters finished the first race. De Palma, after winning the first event, refused to enter the second, which had been originally scheduled to go 50 miles but was cut down to 25.

De Palma drove his usual steady pace, stopping only twice at the pits, once to replace broken goggles and the second time to change a tire.

Eddie Rickenbacher's Maxwell led the field until the thirty-second lap, setting a hot pace. Up to the time he was forced to quit because of a broken water connection he had averaged 66.77 m.p.h. When Rickenbacher relinquished the lead to O'Donnell, the Duesenberg driver maintained first place until the sixty-sixth lap, when De Palma took it from him in a sharp brush in front of the grandstand.

Second Race Unfinished

A bad accident was narrowly averted because Burt stopped his Ogren car at the pit just before his rear axle, which had been cracked, became dangerous. He was third in the race at this time.

The second race never was finished, the only two contestants being left on the course after O'Donnell's accident being flagged down at the end of the fourteenth lap. W. W. Brown, driving a DeChesneau, who was leading at that time probably will be given first money, however, $600. Art Johnson who was also on the course in a Crawford probably will be awarded second prize, $400.

The speedway association plans strengthening the track and holding a meet Oct. 7, the last day of the American Royal Live Stock Show.

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King and Winterson Join Chalmers

DETROIT, MICH., July 24—C. H. King and J. P. Winterson have been added to the sales staff of the Chalmers Motor Co. Mr. King has been connected with the automobile field since 1905, having been with such companies as the Motor Car Sales Co., New York City and the H. L. Keats Auto Co., agent for the Chalmers in 1907 at Portland, Ore. Mr. Winterson was connected several years ago as a member of the Lozier staff in New York City. Later he joined the Chandler organization.

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Backus Ford's Baltimore Mgr.

BALTIMORE, MD., July 20—E. T. Backus has been appointed manager of the branch of the Ford Motor Co. in Baltimore, Md., which will be opened Aug. 1.

Start of the 100-mile race on the Kansas City speedway. This event was won by De Palma in his Mercedes with O'Donnell's Duesenberg second

Saxon Relay Breaks Record

43 Sixes Relay from New York to Frisco in 6 Days, 18 Hr. and 10 Min.

DETROIT, MICH., July 22—Forty-three Saxon six automobiles, racing in relays, established a new transcontinental record when the last car reached San Francisco precisely at 4.40 Saturday morning, 6 days, 18 hr. and 10 min. after leaving New York City.

This record from coast to coast was made carrying a message from Mayor Mitchel, of New York to Mayor Rolf of San Francisco, over the proposed Lincoln Highway route.

An official observer started with the first Saxon car at 10.26 a. m. Saturday, July 15, and went the entire distance by changing from car to car as the relay progressed. The cars were driven by regular Saxon dealers and while the official mileage of the Lincoln Highway is 3,331 miles, it is stated that the total distance traversed was considerably more than this, due to detours, etc. The Saxons averaged about 25 m.p.h. for the entire distance. Forty-two changes from car to car were made.

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Rubber Interests on Outing

BOSTON, MASS., July 20—The 17th annual outing of the Rubber Club of America was held on July 17 and 18, taking in places and events of interest in both Boston and Lowell.

A large delegation of western men, headed by H. S. Firestone, president of the club, P. W. Litchfield of the Goodyear company, C. B. Raymond, secretary of the Goodrich company, and W. O. Rutherford of the Goodrich company, as chairman of the western delegation arrived here to-day.

The last day was devoted to match plays at golf, tennis, baseball, etc.

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Minneapolis Speedway Suspended

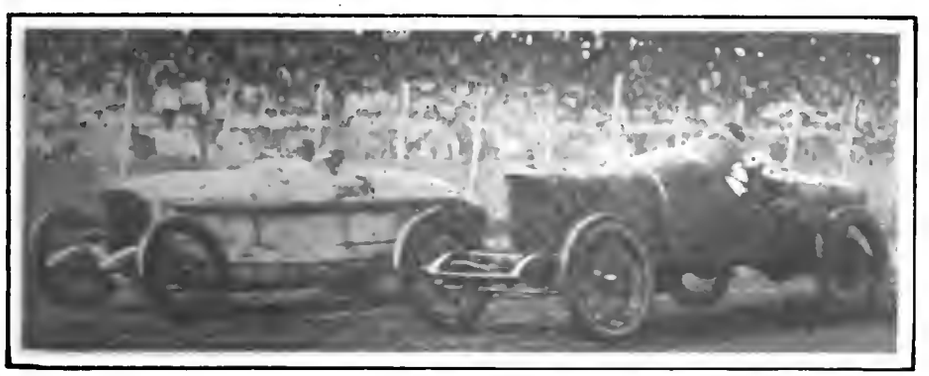
NEW YORK, July 25—The track license of the Minneapolis speedway which was opened scarcely a year ago was withdrawn by the Contest Board of the A. A. A. to-day, due to certain difficulties that arose in connection with the meet there on July 4, when the prize money was not posted and when the drivers had to take $6,800 instead of $20,000 as advertised in the entry blanks. J. F. Sperry, manager of the track has been suspended for 2 years for difficulties in connection with the meet, which was a fiasco.

Because of the small attendance at the Sioux City races on July 4, when the drivers' prizes were 50 per cent of the gate receipts and when the drivers were not adequately reimbursed for their expenses, the board voted not to grant any future sanctions where cash prizes are a percentage of gate receipts. In such cases the drivers have little chance of perhaps even paying expenses.

Indianapolis speedway has applied for a sanction on Sept. 9 for a championship 100-mile event, the prize being $900. Shorter events may also be listed.

Two competition records were allowed, both to Dario Resta in the Chicago race of June 18. The 50-mile mark allowed is 31:57 2/5 as compared with the old mark of 33:55.42. The other mark was at 10 miles, the time being 5:51 1/5, as compared with the old mark of 6:35.52.

For not advertising one of its speedway performances in accordance with A. A. A. rules the Hudson Motor Car Co., Detroit, was fined $1,000 with the option of disqualification until Jan. 1, 1917. This was in connection with races on the Chicago speedway, June 17.



De Palma taking the lead away from O'Donnell in the 100-mile race on the Kansas City speedway. The brush occurred on the grandstand stretch

Factory Miscellany

To Make Parts—The L. O. Gordon Mfg. Co., Muskegon, Mich., has been formed by a syndicate of Cleveland and Muskegon capitalists to manufacture automobile parts. The erection of a plant to cost $100,000 will begin at once.

National Rubber Buys Land—The National Rubber Co., Pottstown, Pa., has purchased additional land on which it will erect a large factory.

Allen to Add—The Allen Motor Co., Bucyrus, Ohio, has broken ground for the erection of a large addition to its motor and transmission plant.

Clyde Truck Breaks Ground—The Clyde Motor Truck Co. has secured a tract of 40 acres at Farmingdale, L. I., and plans are now about complete for the breaking of ground for the erection of its factory buildings there.

New Tire Plant for Cuyahoga Falls—A new tire plant will shortly be opened in Cuyahoga Falls, Ohio, in the old factory building recently vacated by the Falls Rubber Co., and purchased by the new company. The new concern is backed by Akron capitalists and is incorporated at $25,000 and will be known as the Supreme Rubber Co. Daniel Zeistof of that city, formerly connected with the Marathon Rubber Co., will be general manager. The building will be ready for work in about three weeks.

Firestone Factory Picnic July 29—The Firestone Tire & Rubber Co., Akron, Ohio, will hold its annual picnic on July 29 at Silver Lake Park, near Akron. It is expected that during the course of the day and evening at least 25,000 people will be in attendance.

Maxim Silencer Uses Tent—The Maxim Silencer Co., Hartford, Conn., pending the completion of a new addition to the factory is making use of a tent for the welding department. The general offices have been removed from the factory to an adjacent dwelling, which is connected with the factory by a runway. Still another addition is being considered by the company.

New Departure Adds—An addition is to be made to the factory of the New Departure Co., Bristol, Conn., 300 ft. long and U-shaped. This will be known as the ball department when it is completed. The company has acquired considerable other ground for enlargement of the factory.

New Plant for Los Angeles—The latest manufacturing concern to enter the field in southern California is the Davis Manufacturing Co., which is located at 1238-44 South Flower Street, Los Angeles, Cal. The concern is manufacturing complete the Standard truck attachment and doing general machine work, making parts for any automobile or truck on the market.

Takes Over Top Co.—Continental Auto Top Mfg. Co., St. Louis, has taken over the plant and business of the Continental Auto Top Co. Arthur Leeser succeeds G. I. Juhlein as owner of the majority interest. The plant at 814-16-18 is being entirely overhauled. Automobile tops, jiffy curtains, seat coverings and commercial bodies are the output.

Miller Rubber Holds Outing—The thousands of employees of the Miller Rubber Co., Akron, Ohio, held their annual outing and picnic at Silver Lake, July 15. It was planned to hold the outing at Cedar Point, but inability of railroad companies to furnish equipment made it necessary to hold it nearer home. The day was spent in games and athletic events.

C. A. S. Products Busy—The new plant of the C. A. S. Products Co., Columbus, Ohio, recently formed with a capital of $100,000 to manufacture the Foster gear, an invention of a Columbus man, has booked orders to keep the plant to capacity until June, 1917. C. D. Cutting of Detroit is president and general manager, and A. W. Tyler is secretary and superintendent. The plant has 50,000 sq. ft. of floor space and already additions and extensions have been started. More than 150 men are on the pay rolls.

Leak-Proof Plant Expanded—The McQuay-Norris Mfg. Co., St. Louis, has just completed an addition to its factory which increases the plant by one-third and gives 100 ft. of frontage on Locust Street in the heart of the automobile district.

The Automobile Calendar

ASSOCIATIONS

Aug. 15—Metropolitan Section, S. A. E. Meeting at Automobile Club of America. Subject, "South America."
Aug. 28-Sept. 1—Milwaukee, Wis., Booster Tour of Milwaukee Automobile Dealers.
Sept.—Indianapolis. Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.
Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.
Dec. 2-9—Electricians' Country-wide Celebration.

CONTESTS

Aug. 5—Tacoma Speedway Race, Tacoma Speedway Association.
Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12—Portland, Ore., Track Race, Hiller-Riegel Co.
Aug. 18-19—Elgin Road Race. Chicago Auto Club.
Aug. 26—Kalamazoo, Mich., 100-Mile Track Race.
Sept. 1-2—New York, N. Y., Sheepshead Bay Speedway, 24-Hour Race, Trade Racing Assn.
Sept. 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.
Sept. 4—Cincinnati, Ohio, Speedway, Cincinnati Speedway Co.
Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.
Sept. 4—Indianapolis Speedway Race.
Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 16—Providence Speedway Race.
Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.
Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30 — New York City, Sheepshead Bay Speedway Race.
Oct. 7—Philadelphia Speedway Race.
Oct. 7—Omaha Speedway Race.
Oct. 14 — Chicago Speedway Race.
Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.
Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

SHOWS

Aug. 2-9—Hollywood and West End, N. J., Show, Atlantic Exhibition Co.
Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.
Sept. 4-11 — Indianapolis, Ind., Show, Indiana State Fair, Indianapolis Automobile Trade Assn.
Sept. 10-16 — Milwaukee, Wis., Show, Wisconsin State Fair, Machinery Bldg.
Oct. 14 - 31 — Dallas, Texas, Show, State Fair.
Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 13-20 — Montreal, Que., Show, Montreal Automobile Trade Assn.
Jan. 27-Feb. 3, 1917 — Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb.—St. Louis, Mo., Show, Auto Manufacturers and Dealers' Assn.

TRACTOR

July 24-28 — Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4—St. Louis, Mo., Tractor Demonstration.
Aug. 7-11—Fremont, Neb., Tractor Demonstration.
Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.
Aug. 21-25—Bloomington, Ill., Tractor Demonstration.
Aug. 28-Sept. 1—Indiana Tractor Demonstration.
Sept. 4-8—Madison, Wis., Tractor Demonstration.
Sept. 11-16 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Automobile

Vol. XXXV
No. 5

NEW YORK, AUGUST 3, 1916

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Three dollars a year

Stewart

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It's only a matter of time before all good cars will be.

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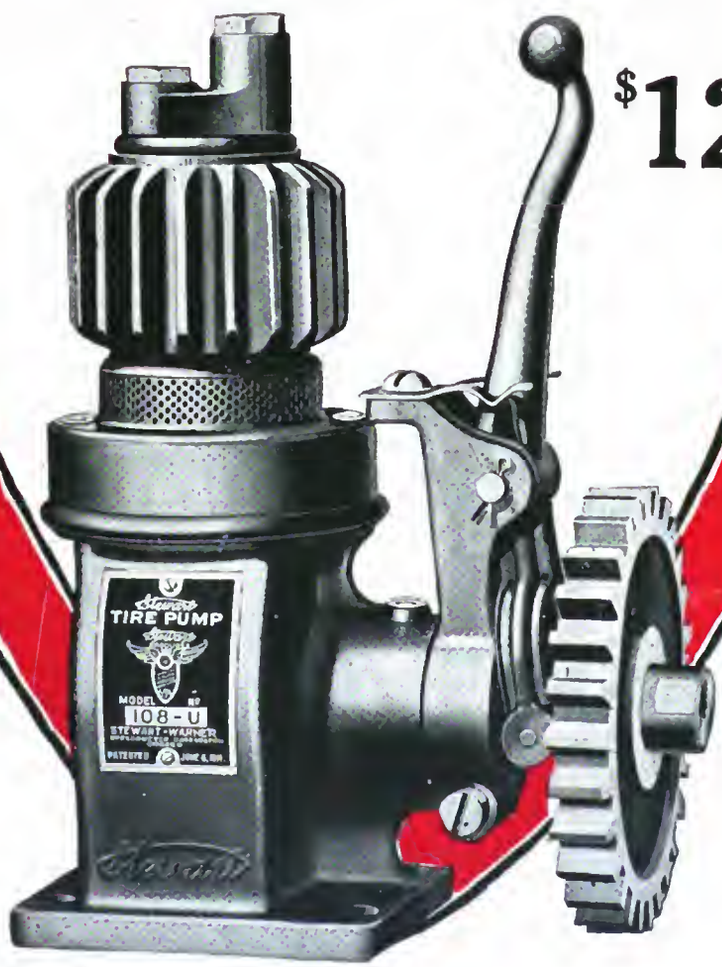
"No car is better than its accessories"

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.



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The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, AUGUST 3, 1916—CHICAGO No. 5

G. M. C.—121,113 Cars in 11 Months

Earns $144,000,000 or $50,000,000 More than in All 1915

	1916	1915
Earnings, 11 months	$144,000,000	$86,000,000
Automobiles, 11 mos.	121,113	68,604

DETROIT, MICH., Aug. 1—Gross sales of the General Motors Co. for the first 11 months of its fiscal year, or to June 30, were $144,000,000. This is over $58,000,000 more than the sales for the same 11 months of the 1915 fiscal year. This total of gross sales is nearly $50,000,000 more than the total sales for the entire fiscal year of 1915.

In the 11 months ending June 30 there were 121,113 automobiles produced by the organization as compared with 68,604 in the corresponding months of the previous year. In the first 11 months of this year the company has produced 43,045 cars more than in all of 1915.

President W. C. Durant states that the undivided profits applicable to common stock amounted to approximately $24,500,000 on June 30 this year instead of $11,686,280 for the similar period of 1915. On June 30 General Motors had approximately $25,700,000 in cash in banks and in sight drafts with documents attached. July is expected to show very satisfactory results, although in some of the plants of the company there might have been a slight decrease in production on account of inventories

(*Continued on page* 208)

—

Friend Is United Motors V.-P.

RACINE, WIS., Aug. 1—Otis C. Friend has resigned as sales manager of the Mitchell-Lewis Motor Co. to become vice-president and general manager of the United Motors Co. He commences his new duties in the New York City offices of the United Motors Co. the middle of August. Mr. Friend has been connected with the automobile industry for nearly a score of years, beginning with the Chicago sales of the Locomobile. He joined the sales force of the Chicago Mitchell agency in 1900, and later handled Mitchells as the firm of Brown & Friend in Milwaukee.

Mr. Friend then became purchasing agent of the Mitchell-Lewis factory here and was successively assistant to J. W. Bate and general superintendent of shops. Later he became assistant factory manager, assistant sales manager and advertising manager. His successor at the Mitchell factory has not yet been appointed.

—

Coffin Goes to Europe

NEW YORK CITY, Aug. 2—Howard E. Coffin, consulting engineer of the Hudson Motor Car Co., sails for Europe next week on the Philadelphia to spend a month in England and France investigating industrial and transportation conditions in these countries. Mr. Coffin is a member of the U. S. Naval Consulting Board and has taken a very active interest in motor transport as connected with the government during the present year.

—

Dort Raises Price to $695

FLINT, MICH., Aug. 2—The Dort Motor Car Co., this city, has raised the price of its touring car from $665 to $695, beginning Aug. 1.

—

Stewart Warner Buys V-Ray

CHICAGO, ILL., July 31—The Stewart-Warner Speedometer Corp. has purchased the V-Ray Spark Plug Co., of Marshalltown, Iowa, and will begin the manufacture of V-Ray plugs in the new addition to the Chicago plant of the Stewart company. Production will be increased to several thousand a day. V. S. Hanson, president of the V-Ray company, becomes manager of the spark plug department.

Ford Prices Cut 18 Per Cent

Touring Model Now Sells for $360—Roadster Reduced to $345

PRESENT AND FORMER PRICES OF FORD CARS

	Aug. 1 1916	Aug. 1 1915	Aug. 1 1914	Aug. 1 1913	Aug. 1 1912
Touring	$360	$440	$490	$550	$600
Roadster	345	390	440	500	525
Chassis	325	360	Not sold	Not sold	Not sold
Coupelet	505	590	750	....	....
Town Car	595	640	690	740	....
Sedan	640	740	975	....	....

DETROIT, MICH., July 31—Starting with Aug. 1 new prices on Ford cars will prevail. The reductions vary all the way from $35 on the chassis up to $95 on the sedan. The touring car has been reduced $80 from $440 to $360. The runabout is now $345 instead of $390. The chassis alone sells for $325, whereas it formerly sold for $360. The coupelet is $505 instead of $590, the town car $595 instead of $640 and the sedan $645, which is a $95 reduction from the former price of $740.

Improved Body Lines

Accompanying the change of price there will also be a change of appearance, as the new Ford cars will be fitted with sloping hoods and crowned fenders which will give a new outline. The radiator shape also will be remodeled to accord with the molded form that has now been adopted.

From time to time Ford prices have been reduced materially and it is outside rumor that the eventual aim is a $250 car with a production schedule of 1,000,000 cars per annum. Recent property acquisitions will more than double the available factory space, and since the schedule is now 500,000 cars a year, it does not seem impossible that the 1,000,000 mark will be reached. Ford reached a production of 1000 cars a day during

(*Continued on page* 208)

Studebaker Earns $6,028,329

Only $180,000 Profit from War Orders—Common on 10% Basis

SOUTH BEND, IND., Aug. 2—At the regular meeting of the directors of the Studebaker Corp. yesterday the regular quarterly dividends of 1¾ per cent on the preferred stock were declared and the common stock was put on a regular 10 per cent basis by the declaration of 2½ per cent quarterly dividends, which, like the preferred dividend, are payable Sept. 1. Heretofore the common has received quarterly dividends of 1½ per cent plus 1 per cent extra.

Net profits for the 6 months ending June 30, after deductions for appreciation and profit sharing, were $6,028,329.16, including $180,000 from war order profits. After deducting the 7 per cent dividends on the preferred stock, this figure is 18.8 on the common stock outstanding and is at the rate of 37.6 per cent for the year.

During the corresponding period of 1915 the corporation's net profit amounted to $5,774,074.87, which included nearly $3,000,000 of war order profits, while this year's profits include only $180,000 from war order profits. Thus the profit earned from regular business this year was $5,848,329.16, as compared with $2,774,074.87. The increase this year was thus 11 per cent. On June 30 the total surplus in reserves amounted to $16,664,160.69. Cash on hand exceeds $4,000,000 and the corporation is wholly free from indebtedness.

War order contracts are about completed and the corporation is not seeking new business of this character. The plants have been operated at full capacity on regular business for the past 12 months and are earning 80 per cent ahead of last year in the automobile division and 50 per cent in the horse-drawn vehicle division. The domestic business in a general way is 50 per cent greater than at any previous time of the corporation's history.

—

Ver Linden Is Oldsmobile Manager

LANSING, MICH., July 31—E. Ver Linden, factory manager and associate executive of the Olds Motor Works, this city, has been created general manager following the resignation last week of Jay Hall. Committee management at the works is now abolished in favor of one-man control. It is expected to increase the output next year to over 20,000 cars.

Before joining the Olds organization, Ver Linden was production expert for the Buick company, managing plant No. 1. Before that he was in business for himself, under the corporate title of the Michigan Auto Parts Co., which was bought out by the General Motors Co. in 1909. His early training in production methods was gained with the American Radiator Co.

—

Goodrich Profits for 6 Months $4,800,000

AKRON, OHIO, July 29—The books of the B. F. Goodrich Co., this city, were closed on July 1 for the purpose of determining the result of operations for the first 6 months of 1916. After making proper provision for maintenance charges, depreciation, doubtful accounts and all known outstanding current liabilities; the net profits for the period amounted to $4,800,000, an increase of 20 per cent from the same period a year ago, net then being $4,000,000. The increase alone is equal to the 6 months' dividend on the $27,000,000 preferred.

—

Nash Motors Co. Incorporated with $24,999,500 Capital

BALTIMORE, MD., July 29—The Nash Motors Co., which has been organized to take over the Thomas B. Jeffery Co., Kenosha, Wis., as reported in THE AUTOMOBILE for July 20, applied for incorporation before the state tax commissioner here this afternoon, with a capital stock of $24,999,500. R. F. Herrick, J. Wells Farley, Edward A. Taft and Phillips D. Ketchum, all of Boston, are named as incorporators.

—

Marmon Coast-to-Coast Record

S. B. Stevens Covers Distance in 5 Days, 18 Hr. and 30 Min.

SAN FRANCISCO, CAL., July 29—A Marmon car driven by S. B. Stevens, well known in motoring circles around New York, reached San Francisco to-day, having crossed the continent in the record time of 5 days, 18 hr. and 30 min. This is a gain of more than 41 hr. over the record established by the Cadillac eight last May.

The car left Columbus Circle, New York City, at 1.30 a. m. July 24, and on its trip covered a distance of 3476 miles at an average speed of 25.1 m.p.h. The record made by Baker in the Cadillac was established at an average of 18.8 m.p.h. The car traveled as far as Cheyenne at an average of better than 32 m.p.h., but owing to bad roads beyond that point its average was pulled down to nearly 25.

(*Continued on page* 206)

Maxwell to Pay 10% on Common

Committee Also Will Recommend Dividends on Preferred —Earnings Over $5,000,000

NEW YORK CITY, Aug. 2—The executive committee of the Maxwell Motors Co. has decided to recommend to the directors payment in full of the outstanding dividend warrants on the first preferred stock, payment of quarterly dividends on the second preferred at the rate of 6 per cent per year, beginning Oct. 2, and the inauguration of quarterly dividends on the common stock at the rate of 10 per cent per year, also beginning Oct. 2. More than 90 per cent of the first preferred dividend warrants have been converted into first preferred stock.

The earnings of the company for the fiscal year ending July 31 will be in excess of $5,000,000.

—

Signal-Commerce Merger Completed

DETROIT, MICH., Aug. 1—The merger of the Signal Motor Truck Co. and the Commerce Motor Car Co. to form the Signal-Commerce Motor Truck Co. has been completed. An issue of 450,000 shares of stock will include 250,000 shares to be offered to the public at $6 per share, the remainder of the stock going to the owners of the two companies. Thomas Neal, former president of the General Motors Co., is president of the new concern and Walter Parker is vice-president. Other officers will be announced later.

—

International Motor Plans Exchange

NEW YORK CITY, Aug. 2—It is understood that the International Motor Co.'s financial readjustment, which is being worked out in view of the approaching maturity of $2,800,000 of notes on Nov. 1, will propose an exchange of new first preferred stock with a bonus of 50 per cent in new common stock for the notes.

—

Adams Trucks No More

FINDLAY, OHIO, July 29—The Adams Truck, Foundry & Machine Co., of this city, which 2 years ago changed its name to the above from that of the Adams Bros. Co., has discontinued the manufacture of Adams commercial vehicles, to concentrate on foundry and machine shop work.

—

Prescott a Stutz Director

NEW YORK CITY, July 29—Sherburne Prescott has been elected a director of the Stutz Motor Corp., succeeding K. R. Howard.

Exports Total $97,464,381

Year Ended June 30 Shows Falling Off in Last Month Despite Huge Total

WASHINGTON, D. C., July 29—The exports of automobiles during the fiscal year ended June 30, 1916, reached a total of 77,496 machines, valued at $97,464,381, together with parts, not including engines and tires, to the value of $22,536,485, according to figures compiled by the Department of Commerce. During the fiscal year the exports were classified as follows: Commercial cars, 21,265, valued at $56,805,548; passenger cars, 56,231, valued at $40,658,833. During the fiscal year of 1915 there were 37,876 machines exported, the value being $60,254,635, the exports consisting of 13,996 commercial cars, valued at $39,140,682, and 23,880 passenger cars, valued at $21,113,953.

While the year's totals mounted high the figures show a decided falling off during June last as compared with the same month of last year. During June last 1416 commercial cars, valued at $3,551,148; and 4905 passenger cars, valued at $3,416,396 were shipped abroad, together with parts, not including engines and tires, to the value of $1,886,746. In June a year ago the exports consisted of 2990 commercial cars, valued at $8,578,802, and 4418 passenger cars, valued at $4,785,998.

Manufacturers interested in the export trade will find much to interest them in the accompanying table, which shows the number and value of vehicles, both commercial and passenger, shipped to various foreign countries during June last.

Canada was the largest customer for passenger cars, taking 1145, with British South Africa second with 553 and France third with 408. Among the South American countries, Argentina made the best showing, taking 369, while Venezuela bought ninety-one, Chile seventy and Brazil forty-seven.

Weatherproof Body Reorganized—Takes Over Wilson

DETROIT, MICH., July 31—The Detroit Weatherproof Body Co., which was organized during the latter part of 1915, has been reorganized, having taken over the business of the C. R. Wilson Body Co. The company's capital stock is now $750,000, instead of $10,000 when it was first incorporated. The concern manufactures the Detroit top, which is a detachable, convertible, all-year-around limousine top of medium price.

The Weatherproof company has secured factory space totaling about 50,000 sq. ft. at 1884 Mount Elliott Avenue and will employ several hundred men. A new factory will be erected some time during the latter part of the year. It is planned to make from 50,000 to 100,000 tops. The officers of the company are: S. P. Douglass, president; Lawrence Moore, vice-president and general manager; H. H. Sanger, treasurer, and H. B. Barbour, secretary.

Tractors Make Hit in Kansas

Demonstration Shows Ability of Machines to Plow in Sun-Baked Soil

By S. P. McMinn
Staff Correspondent.

HUTCHINSON, KAN., July 27—Kansas soil is proving a difficult test for the farm tractors that have been brought here for the second of the series of eight national tractor demonstrations started July 18 in Dallas, Tex. The Kansas demonstration was officially opened on Tuesday and from then until now the grounds have been thronged. The attendance is, perhaps, not quite as good as it was at Dallas because there is not as great a metropolitan area from which to draw and because railroad facilities are not as good. Still, the crowd is an excellent one and has been drawn from the farthermost corners of the State.

A fair number of bona fide sales already have been made, though few dealer and distributor contracts have been signed to date. Manufacturers are now signing prospects obtained at the Dallas demonstration, many of them having left men behind for the purpose, so it is likely much of the business here will be deferred until after the furore of the demonstration has subsided somewhat. In a measure this is an encour-

(*Continued on page* 207)
(*News continued on page* 202)

Exports of Automobiles, Trucks and Parts for June and 12 Previous Months

	June 1915 Number	June 1915 Value	June 1916 Number	June 1916 Value	12 Months Ending June 1915 Number	12 Months Ending June 1915 Value	12 Months Ending June 1916 Number	12 Months Ending June 1916 Value
Passenger Cars	4,418	$4,785,998	4,905	$3,416,396	23,880	$21,113,953	56,231	$40,658,833
Commercial Cars	2,990	8,579,802	1,416	3,551,148	13,996	39,140,682	21,265	56,805,548
Parts, not including engines and tires	.....	1,139,182	.....	1,886,746	.....	7,853,183	.....	22,536,485
	7,408	$14,503,982	6,321	$8,854,290	37,876	$68,107,818	77,496	$120,000,866

PASSENGER CARS

Country	1916 Number	1916 Value
Denmark	40	$28,939
France	408	239,861
Greece	12	15,408
Italy	80	39,788
Netherlands	71	67,701
Norway	134	105,560
Portugal	60	68,575
Spain	68	66,910
Sweden	79	72,104
United Kingdom	87	68,455
Bermuda	10	3,760
Canada	1145	833,551
Costa Rica	2	940
Honduras	2	1,215
Panama	21	14,514
Salvador	4	5,407
Mexico	34	21,863
Newfoundland	6	5,422
Barbados	5	2,652
Jamaica	21	14,919
Trinidad	31	16,727
Other British West Indies	10	4,042
Cuba	167	129,324
Danish West Indies	3	962
Dutch West Indies	3	1,768
French West Indies	6	5,012
Haiti	2	752
Dominican Republic	15	8,799
Argentina	369	187,123
Bolivia	3	3,763
Brazil	47	$35,412
Chile	70	49,486
Columbia	5	2,893
Ecuador	2	1,365
British Guiana	25	11,494
Dutch Guiana	4	1,758
Peru	1	1,221
Uruguay	39	22,717
Venezuela	91	48,890
Aden	3	1,686
China	72	45,236
British India	159	111,438
Straits Settlements	74	44,344
Dutch East Indies	154	109,436
Hongkong	3	3,600
Japan	16	12,185
Russia in Asia	3	1,870
Siam	6	4,499
Australia	333	238,542
New Zealand	222	162,865
Philippine Islands	31	23,190
British West Africa	13	10,680
British South Africa	553	389,900
British East Africa	51	29,618
Canary Islands	1	800
Madagascar	7	2,532
Morocco	11	4,810
Portuguese Africa	11	8,113
	4,905	$3,416,396

COMMERCIAL CARS

Country	1916 Number	1916 Value
France	280	$843,290
Netherlands	1	1,200
Norway	10	13,049
Portugal	81	328,582
Russia	44	157,900
Spain	7	10,302
Sweden	1	1,700
United Kingdom	646	1,374,410
Canada	46	77,772
Panama	3	7,618
Mexico	4	6,019
British West Indies	4	9,142
Cuba	22	33,123
French West Indies	1	2,310
Dominican Republic	1	354
Peru	4	4,221
Uruguay	1	2,351
Venezuela	1	1,800
Korea	1	988
British India	3	5,115
Straits Settlements	1	1,227
Dutch East Indies	14	21,799
Russia in Asia	201	598,284
Siam	3	2,913
Australia	2	3,920
New Zealand	4	4,361
Philippine Islands	27	28,753
British West Africa	1	4,397
British South Africa	1	1,445
Portuguese Africa	1	2,803
	1,416	$3,551,148

Left—There are 63 miles of this stone block road between Buenos Aires and La Plata. It is Argentine's finest road. Right—Touring road between Buenos Aires and La Plata, which is built in the middle of the dirt wagon road

South America—II

Argentine Growing Market for U.S.A. Cars—Needs Population—Rich But Backward in Development—Accommodations Excellent—Industries Progressing

Part II

By David Beecroft

LAST week was told the past and present of the automobile industry in the Argentine and how the lower-priced American cars started selling nearly 2 years ago in the agricultural sections and a year ago took a perceptible jump forward in volume of sales. This week we take a closer look at this country, having in mind its possible purchasing capacity for automobiles.

The Argentine republic, with its population of 8,000,000, must not be looked upon as a new country for its oldest cities were founded between 1515 and 1535 so that, measured in years, they are older than New York City. Argentina boasts of its national university at Cordoba, a night's ride by train west from Buenos Aires, because it is many years older than Harvard and perhaps the oldest university in the western world. To-day it has a very high standard and while not the largest institution of the kind is still a potent educational force. So through the country you find evidences of antiquity on every hand.

Population Too Small

Yet Argentina is an undeveloped land compared with the United States. She has great areas but not enough population. Population is her greatest need. Nature has been kind to her, but industrial progress has been kinder during the past century to North America than to South America. North America is a week from Europe and the old world but South America is 3 weeks off. This remoteness has had its influence.

But other differences have been at work. North America has grown up under the influence of Anglo-Saxons and Teutons, whereas South America, with the exception of Brazil and Guiana, was reared under the Spanish régime. South American republics threw off the Spanish yoke during the Napoleonic wars 100 years ago. In fact, it was just 100 years ago in July that Argentina finally got its constitution ratified. But the development of Argentina under its own government was slow and it was really not until 1852 when progress started and it is only in the last 35 years that rapid development has taken place. The great meat exporting industry is 35 years old and other industries have sprung up since that date.

To-day the country is making rapid progress, year by year old influences are being thrown aside and more modern measures adopted, but still you must not think of Argentina in

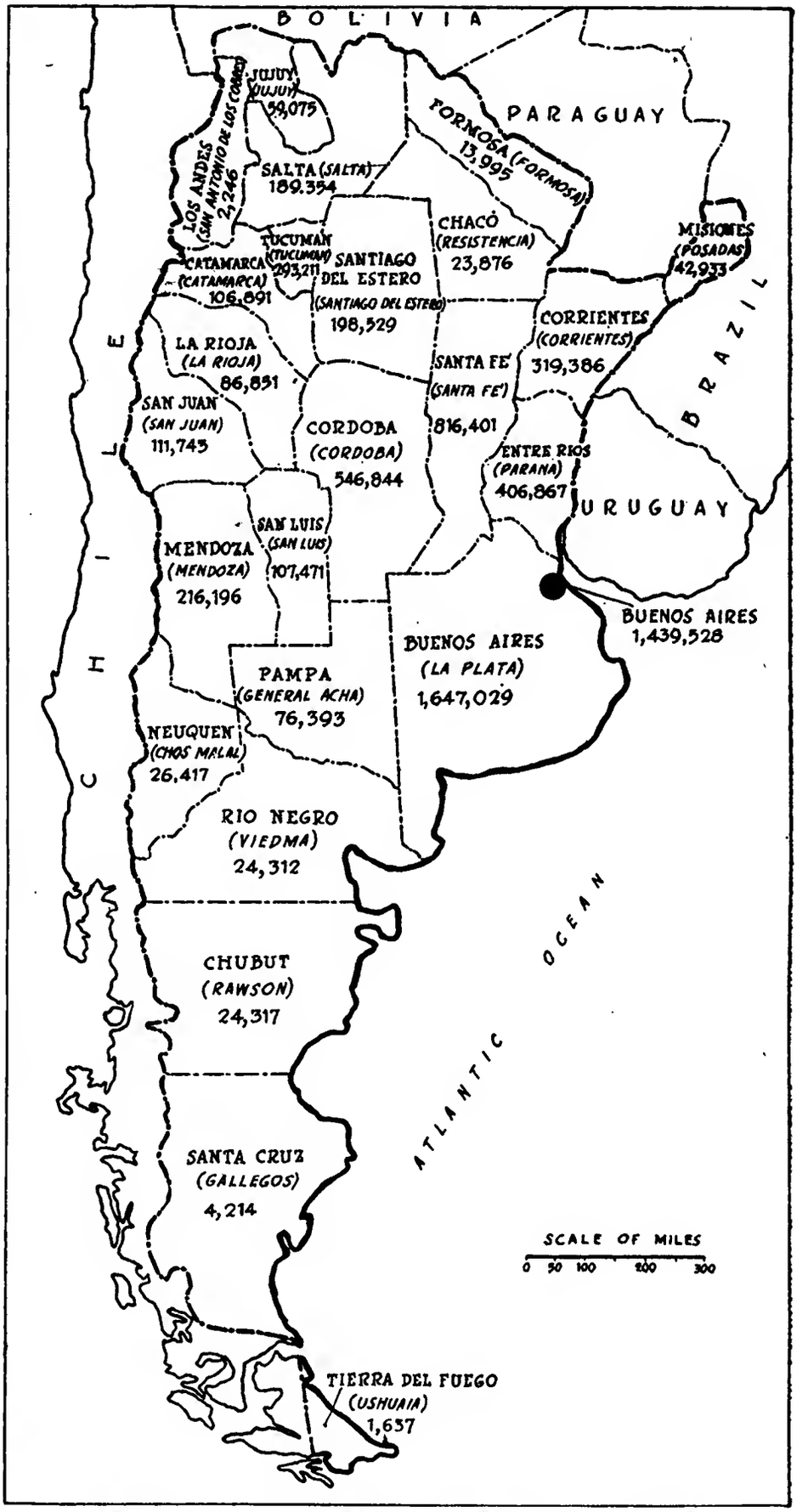
One street in Buenos Aires which is largely used for automobile salesrooms. The J. I. Case Co. occupies the corner

the same way you think of the United States. You must think of it as a land with 8,000,000 people, one-half of whom are Argentines and the other half foreigners. You must think of Argentina as a land very rich in Agricultural possibilities, but laboring under an agricultural system in which land is held in huge areas of 100,000 acres or more and where the small farmer as we know him does not exist. You must not think of it as a land like Iowa, dotted with comfortable small homes located on farms of 160 or 320 acres in extent, but rather as a land dotted with mud huts which our farmers would refuse to live in. Sparsely situated from 10 to 20 miles apart are the city-like homes of the large landowners. This system of farming gives a low percentage of potential buyers as compared with our system of small farms where the majority hold title to their property.

A Wide Expanse

Argentina is not generally settled throughout its length and width as is the United States. There is not enough population. Spread 8,000,000 over the United States east of the Mississippi and you will get some conception of how sparse the population really is. The north central part of the country from Buenos Aires west to the Andes and south for several hundred miles is the most thickly settled. The southern half of the country is very thinly populated, being used partly for sheep grazing and cattle, and there is not any agriculture. The northern section is largely timber lands. That part around the City of Buenos Aires and north is well watered, there being an ample rainfall, in fact too much at times. Going west toward the mountains the rainfall diminishes and irrigation is needed the same as in our western States. In the great grape growing area the rainfall is but 8 in. per year as compared with 37 in. along the river Plate, as the Rio de la Plata is called.

Perhaps the best conception of how Argentina is populated can be had from a brief glance at the divisions of the republic. Argentina is divided into twenty-five divisions, fourteen of them being called provinces and ten territories, the last one being the federal capital and corresponding to our District of Columbia. Buenos Aires is located in the federal capital area. The City of Buenos Aires has nearly 25 per cent of the entire population of the country. In four provinces are located 72 per cent of the total 8,000,000. Imagine 72 per cent of the population of the United States being grouped into New York, Connecticut,



ARGENTINE REPUBLIC, SHOWING DIVISION INTO PROVINCES

Tha Argentine Republic is divided into twenty-five political divisions, fourteen of which are provinces corresponding to different states in U. S. A. Ten ara territories which have not yet attained tha political statura of states, and one is a federal district in which the city of Buenos Aires is located, and corresponds to the District of Columbia in U. S. A.

Top—One of the largest automobile supply stores in Buenos Aires. This store carries a large supply of accessories as well as raw materials

Middle—Studebaker salesroom in city of Rosario, which is a six-hour railroad ride from Buenos Aires

Bottom—Overland salesroom in Rosario. This salesroom is typical of many seen in this city as well as in similar cities in the Argentine

New Jersey and Pennsylvania or similar small areas.

The four provinces that contain 72 per cent of the population are Buenos Aires, which contains the city; Santa Fe, Cordoba and Entre Rios, all bordering on the province of Buenos Aires on the west and north. The map shows these, as well as the population of all the others.

When you get outside of these four provinces you get into sparse population; for example Mendoza, the center of the grape industry, has only 277,000 population in the province. It lies on the west, close to the Andes and nearly opposite to Buenos Aires.

Good Selling Grounds

The Province of Tucuman in the northwest and where the sugar industry is centered has 322,000 population. San Luis province which is proving a good selling field for American cars has 116,000 population. Pampa Central, another section midway between Buenos Aires and the mountains with 101,000 population, is proving a good selling ground.

The entire country needs automobiles, it needs motor farm tractors and it needs many light-capacity trucks as well as many heavy-capacity vehicles. There are large possibilities of business at the present time and with normal development which should follow soon after the war closes, there should be much more rapid progress.

We cannot estimate the future buying capacity from the past because of abnormal conditions and also because it is only within the last year that our low-priced cars have taken hold. During the first 3 months of 1916 Argentina imported 1462 automobiles, which is nearly as many as in all 1915. The 1915 figures were 1838 cars imported. The 1462 cars imported this year were largely American machines, the only European country furnishing a few being Italy. If this rate of importation continues for the remaining three-quarters of the year the figures will approach 550 machines, being higher than 1911, the year before the crisis and when the importations from Europe reached their zenith.

The figures of 1462 for the first 3 months of this year do not give an adequate conception of the demand there for American cars, because many dealers were months behind in deliveries, due to lack of shipping facilities from New York. Some dealers did not receive a single car in January and February, 2 of the best selling months, and were receiving cars in June that should have been on their selling floors Dec. 15. If Argentina could have received in January, February and March all of the American cars it needed the figures would have been double 1462. One Buenos Aires dealer received nearly 400 cars in May and June that should have been in his hands in January. He will be compelled to hold them to the opening of the selling season in November.

18,162 Cars in Three Months

In the last 5 years and during the first 3 months of this year Argentina has purchased 18,162 cars. The majority of these are European cars which gradually rose in sales until 1911 and have gradually fallen since. The importations for the different years are:

Year	Cars	Year	Cars
1911	2461	1914	3004
1912	4281	1915	1838
1913	5115	1916 (3 mo.)	1462

When these importations are translated into car values in dollars the figures show a great falling off. The European cars represented expensive machines, generally with costly limousine bodies made by the finest body builders in Europe. Against this you must contrast the low-priced American machines of the last 2 years.

Too much attention must not be placed on these figures. They are accurate, but must be interpreted in the light of the great change that has taken place with regard to American cars. In reading over these figures you must recall that our cars have started selling on farms, where cars never sold before. You must remember that, while our cars have been selling, storerooms have remained filled with expensive European cars.

These figures are more eloquent than they appear. They

Left—Studebaker salesroom in Tucuman, the capital of the province of Tucuman, and the heart of the sugar district. Right—Ford agency in Tucuman, showing heavy shutters for doors and windows when store is closed

are rather suggestions of what the future has in store. You must rather be looking ahead when contemplating on them than looking back to the figures of previous years. You must interpret them in the light of prejudices against our cars that have been overcome. You must recollect that these sales have been made in spite of the lack of roads. They have been made in spite of deep founded prejudices against our cars in all of the cities. They have been made in spite of depression due to the war. They have been made in spite of gasoline selling as high as 70 cents a gallon. They have been made in spite of freight rates of $1 per cubic foot instead of 35 cents. They have been made in spite of car prices having been raised. In this light the figures are eloquent in the meaning they convey.

Business Methods Win

These increases in sales have largely been made by two or three concerns who have gone into the Argentine in a business way and with a determination to build up a business there. They have generally opened their own branches, and, in short, established their own selling policies throughout the country. They have stocked up with a big equipment of spare parts and have demonstrated to the Argentine that they mean business and are there to stay. This impresses the Argentine. He delights in seeing the United States citizen or the citizen from any other country coming into his land to live. The Argentine is just as proud of his land as we are of ours and every permanent business investment of this nature pleases him and builds up that spirit of confidence which is so essential to Latin-American business.

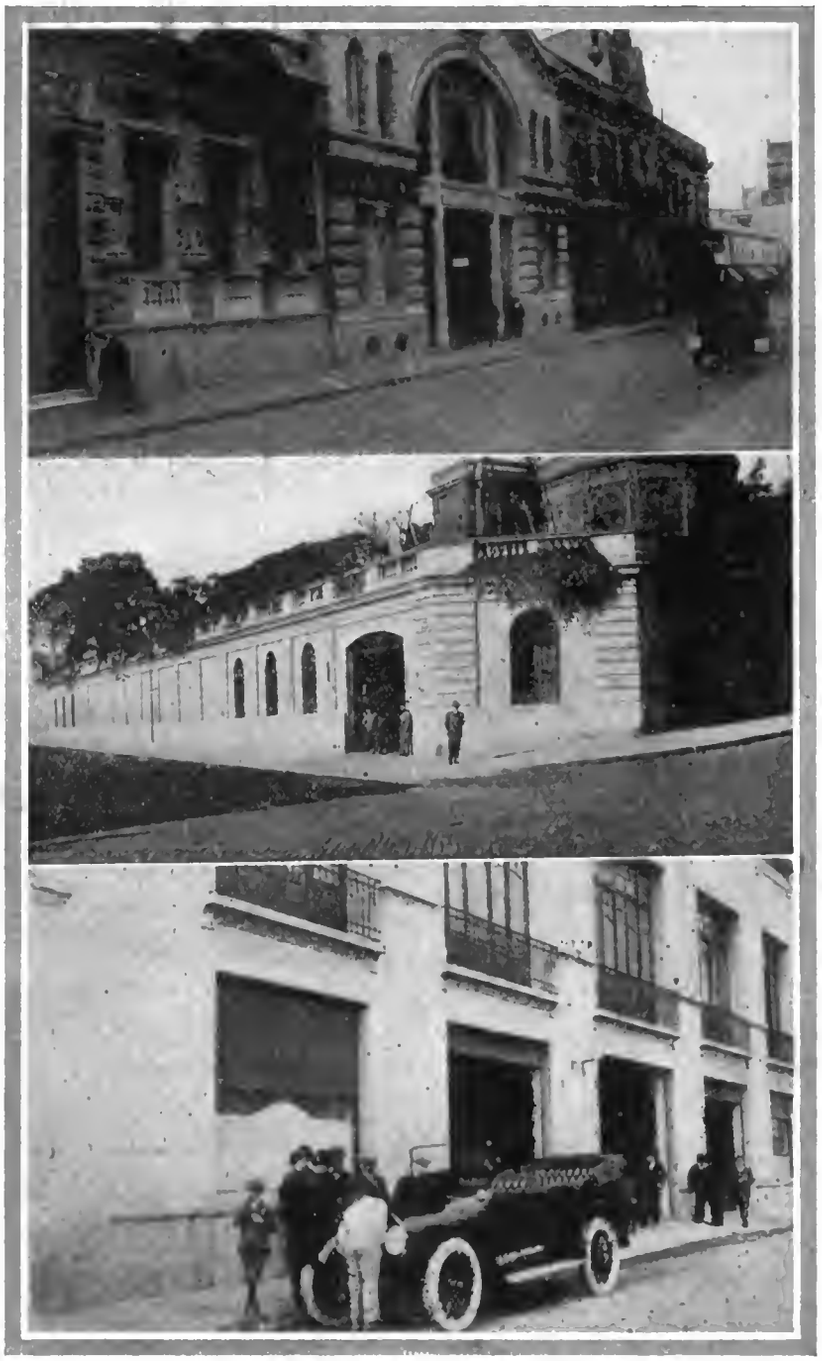
Basement of Ford Agency in Rosario, showing a small corner of spare-stock department. It is as orderly as in any U. S. A. branch

Spare Parts Essential

A good stock of spare parts is the biggest selling argument in Argentina for any American car. You realize the value of such when you think of 3 weeks to send a letter for a spare part on boat, 3 weeks more for it to return on boat, and then perhaps a week or so waiting for a boat. Add to this loss of time in customs and you are out of the use of your car for 2 months. In the United States with cheap telephone and telegraph arrangements your car would not be laid up for more than a day or so. It is no wonder then that any American automobile manufacturer contemplating going into the Argentine market must make up his mind to stock up with spare parts. If he does not he had better leave the market alone.

Further glimpses of the Argentine may not be amiss, for the sole purpose of this article is to give a clearer conception of the country so that its possibilities may be better understood.

Argentina is not a manufacturing country in that it has few minerals and little if any coal. Up to the war coal was all brought from England but since then the United States has been shipping all it can get ships for. The lack of coal will prove a serious handicap, but there are possibilities that electric power and petroleum may partly make up for this lack. There are great water powers well located and there are two different petroleum deposits, which, while they have not been well developed the feeling is that there is a good future for them. One is in the south at Rivadavia and the other in the north in Catamarca. The country to-day is a great cattle, sheep and horse country with much wheat, corn and other grains. It is a greater grain exporter than the United States. Unfortunately at present for Argentina Europe has been buying more grain from Canada and the United States, as the freights are shorter, and Argentina finds itself with much of the present stock stacked in sacks at the different railroad stations and much of it on the farms. There will be a very heavy grain loss, because the country is without a system of railroad grain elevators.



Top—The building with the arched entrance is an example of the newest style of Buenos Aires garage construction, with capacity for upward of 100 cars. Middle—Typical example of private garage, Buenos Aires. Bottom—Two-story Buenos Aires garage, with capacity for 100 cars. Electric elevators and all other modern conveniences are in use.

The country has many factories of varying kinds. There is a large boot and shoe industry; there are many flour mills; wood-working factories of different kinds are being built and a variety of others including dye factories, etc., are being established. Land heretofore has offered the greatest opportunities for wealth and it was but natural that little attention would be given to manufactories. With fuel shortage the handicap was greater. To this can be added sugar, wine, rice, hides, meat packing and other industries.

It is much easier to do business in Argentina to-day than it was a few years ago. Buenos Aires has a large branch of the National City Bank of New York. This bank, already in sixth position in a list of twenty, has a very elaborate credit department and has been pushing its commercial departments rapidly. The bank is prepared to give almost any information on credits and its establishment has greatly facilitated doing business with the United States. Through it any American maker can secure all necessary credit ratings. It used to be that before this only American bank was established money transactions had to go through London, Paris or Berlin. To-day it is as easy to do business from Buenos Aires to New York as to any of the European capitals. True, England, Germany, France, Italy, Belgium and other European lands have most of the banks well established and we have only one, but our start has been made and now the dollar is becoming known in Argentina as well as the pound sterling. The ice has been broken. The American maker has now adequate facilities at his disposal to do business.

Railroads and Hotels Good

American automobile makers will not have to confine their business in Argentina to Buenos Aires, but will find nearly a score of other cities in which agencies can be placed. There are already several agencies in such cities as Rosario, Cordoba, La Plata, Bahia Blanca, Tucuman, Mendoza, San Luis, etc. In the smaller places showrooms are not maintained, and often the car is sold by the firm handling National cash registers, Remington typewriters, or Singer sewing machines.

There are excellent railroad facilities to all of these cities; in fact, Argentina has good railroad systems and plenty of them. The sleeping cars and dining cars are as good as you get in Europe, being generally of English manufacture. You find satisfactory hotels nearly every place you go; in short, there are no serious obstacles to the general development of the business.

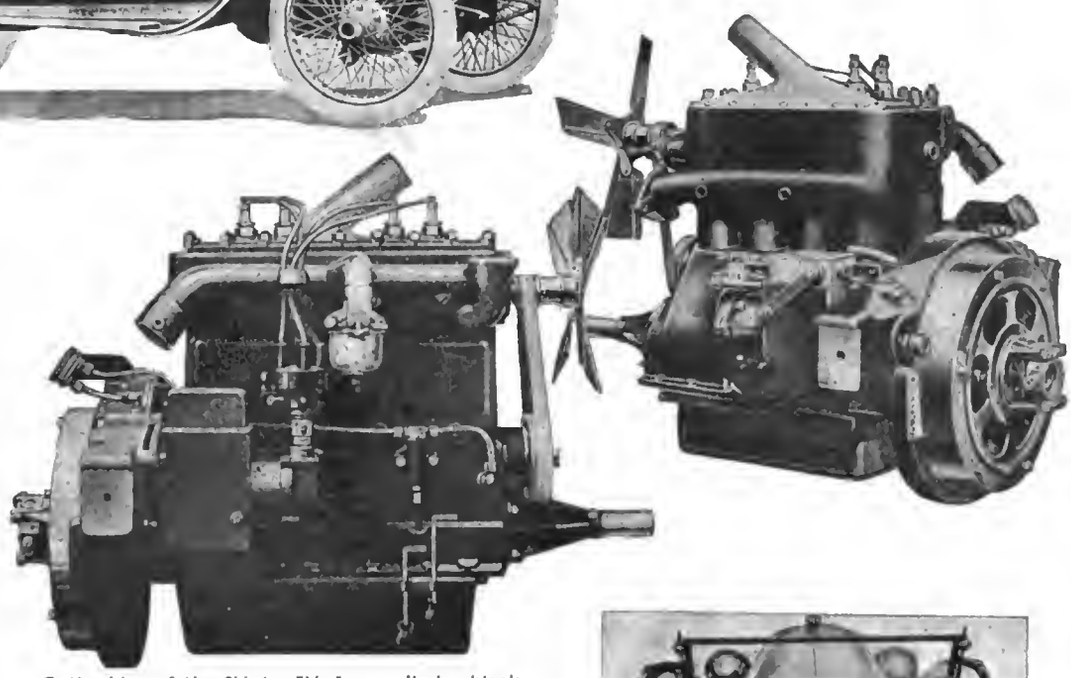
Perhaps roads, or the lack of them, is the heaviest handicap. They are utterly lacking in many places. The country has few real highways although there are some sections where road building is easy. Buenos Aires is located in a plain as level as Chicago. The soil is black loam and the rainfall fairly heavy. This is the richest section of the country and has the poorest roads. Three real efforts at road building have been made, but yet there is only one city you can tour to by motor car and that is La Plata, 65 miles, and the capital of the Province of Buenos Aires. There are two good roads there, roads as good as in the United States. One road is a new stone block one, not cobblestones, but a road as smooth as a brick pavement, which is just completed. It is ideal for motor truck traffic and equally good for passenger traffic. This road was built by a French engineering organization and resembles a railroad right-of-way. It is as straight as an arrow until lost in the horizon beyond. Mile after mile it stretches over the pampas in this straight course, and as level as a table all of the way. It is a beautifully built road with stone curbs on each side just like a city boulevard, and with excellent bridges every few miles in places. It is a monument to road building in South America.

There is another good dirt road built some years ago between Buenos Aires and La Plata which is a fine motor road, horses being barred from it. The wagon road was very wide, perhaps three times the width of an American road and the motorists got permission to build a motor road in the center of it. To-day the motor road is hard and dry, even after rains, whereas the wagon roads at the sides are literal quagmires after rains. The third road out of Buenos Aires leads to a great summer picnic ground.

Briscoe Brings Out New Four

3⅛ by 5⅛-In. Engine On 105-In. Chassis—Bailey Gearless Differential and Rear Axle Gearbox

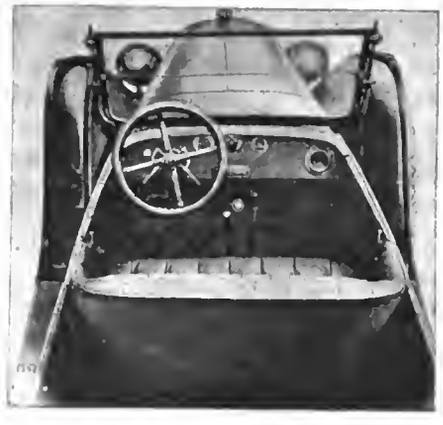
New Briscoe Twenty-four five-passenger touring car which sells for $625



Both sides of the 3⅛ by 5⅛ four-cylinder block engine used in the new Briscoe Twenty-four, showing mounting of accessories

BRISCOE has a brand new car fitted with a four-cylinder engine and priced at $625 with either a five-passenger touring or a four-passenger roadster type. It is a distinctive car in a number of respects, both in chassis design and body arrangements. The Briscoe Motor Corp.'s plan of quantity production is doubtless one factor which makes the price possible.

Following the latest body contour, the new Twenty-four, as it is called, has a rather high and narrow radiator, and a sloping hood and body. There is no transitory curve where hood joins body, and at the cowl, the body is rounded over in line with the present tendencies in body fashions. There is no doubt that body shaping has come to the point where speed is suggested in every curve, and it is to be hoped that the fashion will not change. The Briscoe designers have evidently caught the idea, for a distinct suggestion of speed and power is given by the lines of the new bodies. Then, a slanting windshield has been fitted, this alone being a sort of finishing touch to a very pleasing general body outline.



Illustrating the tapered stream lines of the new Briscoe touring car model

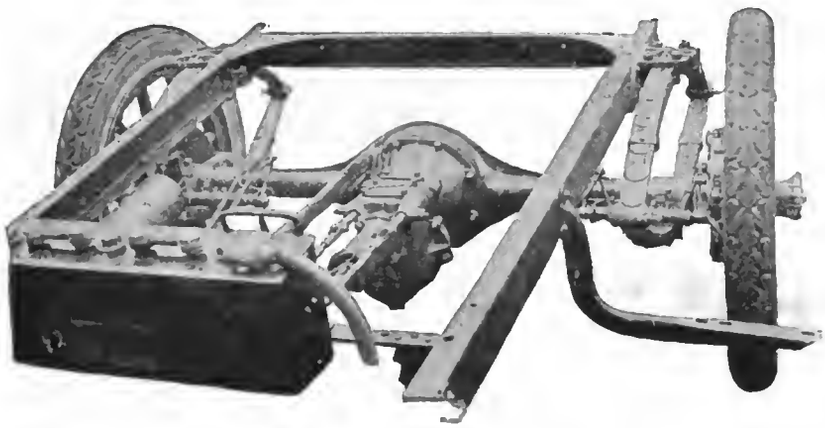
Ample Leg-Room

The new Briscoe is built on a wheelbase of 105 in., and the space has been commendably utilized to give a very roomy car. Like most other designers, the Briscoe sponsors have seen to it that the old criticism of not having sufficient legroom in the drive seat to give the driver comfort does not hit their new creation.

Looking at the mechanical specifications, we find a 3⅛ by 5⅛ four-cylinder block engine having a detachable cylinder head plate that gives access to the valves; an inverted type of cone clutch; three-speed gearset in unit with the rear axle; floating rear axle in which is incorporated the Bailey gearless differential; elliptic front and rear springs; tapered frame and 30 by 3½-in. tires all around.

From the above it will be evident that the engine has quite a long stroke as compared with the bore, the dimensions giving a stroke-bore ratio of 1.64 to 1, which is somewhat greater than the average. The formula accords the engine 15.64 hp., but it is capable of over 30 hp., due to the long stroke and general design. A better idea of this may be gained from the fact that while the bore is not large, the long stroke raises the piston displacement to 157.2 cu. in., which figure is a direct indication of the power.

Of the type in which the upper part of the crankcase, which carries the crankshaft and camshaft as well, is in unit with the cylinder block, the engine provides for quick valve accessibility by the use of a detachable plate that extends the length of the top of the casting over the eight valve chambers,



Rear of Briscoe Twenty-four chassis, showing rear axle gearbox, unusual spring mounting, etc.

this being on the right half of the top. The left part of the top is taken up by the large water outlet connection which works in conjunction with thermo-syphon cooling. The bottom of the engine is inclosed by a pressed steel pan which acts also as the oil reservoir. On the right is carried the Splitdorf gear-driven generator, with the ignition distributer mounted in unit, and on the left is the starting motor, also a Splitdorf unit. It connects to teeth in the flywheel face. The right side being the valve side, the manifolds are placed here, with the carbureter mounted quite high up so that there is no interference with reaching the tappets.

Rear-Axle Gearbox

Since the gearset is not in unit with the engine, but occupies a position as a part of the rear axle, the flywheel is uninclosed.

With direct oil feed to the bearings and gears, the lubrication system is a combination of splash and force feed. The oil pump is positioned on the right forward side of the crankcase and is driven off the camshaft. The oil leads to the gears and sight feed gage run outside on the right. In accordance with usual practice for this kind of oiling, the troughs under the connecting-rods are kept supplied, and the rod ends throw the oil up into the cylinders and onto the various bearing surfaces, from which it eventually drains back into the crankcase. To tell the height of the lubricant in the supply, there are two indicating levers located on the right side of the motor just below the oil pump. There is also an indicator which tells whether or not the oil is flowing as it should. This occupies a rather unusual position, in that it protrudes through the toeboard within sight of the driver, and ahead of the control levers. Thus it is out of the way and can be readily seen, but the piping is reduced to the minimum, which is a commendable point. The oil filler and breather is in a new place too, it being forward on the right, and high up so as to be accessible for oil filling. It enters the cylinder block just below the exhaust manifold, and above the cover plate that houses the valve tappets.

Thermo-Syphon Cooling

In its adaptation of the thermo-syphon method of cooling, Briscoe has placed the engine sufficiently low as compared with the radiator to give proper thermal action. To further meet the demands of this simple cooling, the radiator top tank is large, and the water flows to it from the large water outlet connection that extends the length of the top of the cylinder casting, as already pointed out. There is also a large water inlet which is attached to the left side of the cylinder block, and extends all along it so as to give good water distribution, and further it is of sufficient size to insure against restriction of the flow. Thermo-syphon cooling is very efficient for engines of this size where it is properly applied, and Briscoe engineers have evidently been fully aware of the possibilities of correct fitting of the system, judging from the free passages, large size, etc. A four-bladed, pressed-steel fan is applied, driven from a pulley on the front end of the camshaft by a flat belt. The fan is mounted in a support that is integral with the cylinder casting, and there is provision for rocking the fan shaft so as to give the right belt tension.

Drive of the generator is unusual, for it is from the rear end of the camshaft through gear connection. The generator is positioned close to the flywheel on the valve side of the engine, and the gearing is housed in the extension of the right rear supporting arm of the engine. The ignition distributer is mounted on the front end of the generator unit, and there is bevel gear driving connection between its vertical shaft and the horizontal armature shaft, insuring positive and silent drive at all times.

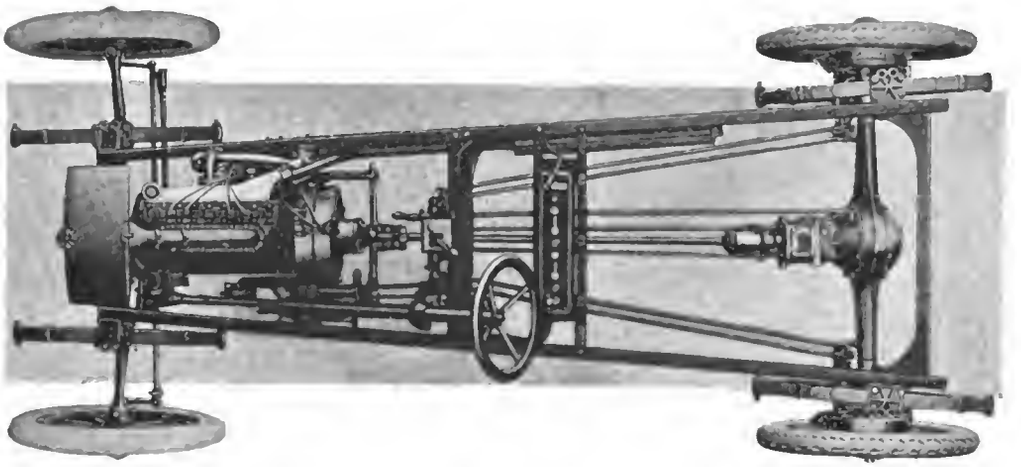
Passing to the clutch, this unit also presents some differences over average practice, principally in the fact that it is of the inverted variety. That is, instead of pulling back from the motor to release, it is shoved toward the cylinders, the action being just the reverse. The cone is leather faced, and is possessed of six spring plungers acting against the under side of the leather at equal intervals to insure easy action and prevent grabbing. As the throwout mechanism must act to push the cone inward when declutching, a simple universal coupling acting directly against the center of the cone and clutch spring is made possible. A forged arm extends out from either side of the engine support, and the pedal shaft is carried transversely by these arms, the center of this cross shaft having a simple leverage connection with the clutch coupling. The construction should make a pedal action that does not require undue foot pressure, although exerting a multiplied force on the cone.

Back of the clutch there is a universal joint and then the open driveshaft runs directly back to the rear universal that is just ahead of the gearbox. There is a light torsion bar running from the front of the axle housing to the intermediate frame cross member, this assisting in taking the torque and drive. Compactness is very noticeable in the gearbox, which has three speeds, with the countershaft mounted directly below the mainshaft. The latter runs on taper roller and ball bearings, while the countershaft is carried on plain bushed bearings. Control rods run parallel with the driveshaft from the H-gate that is attached for-

Briscoe four-passenger body, showing how the hinged upholstery in the center of the front seat back furnishes an aisleway to the rear seat

ward to the intermediate cross member of the frame. These control rods are of quite large diameter, and should not have any tendency to whip, and special provision has been made in their mounting so that there is no likelihood of rattle.

Although the pressed-steel rear axle presents no unusual features outwardly, it is fitted with the Bailey gearless differential, which acts through a series of ratchets and pawls, so that the wheel having the most traction gets the most power, in contradistinction to the standard differential in which the free wheel receives the bulk of the power. The axle possesses the qualities which put it in the floating class, in which the weight of the car is carried entirely on the axle tubes, with none to be sustained by the axle shafts, they being given the single function of driving the wheels. Hyatt roller bearings carry the axle shafts, acting in conjunction with ball-thrust bearings which care for the thrust.



Chassis of the new Briscoe, showing the taper frame, layout of the power plant, rear axle gearbox, and mounting of the springs

Easy Riding a Feature

Easy riding is featured in the new Briscoe, due largely to the use of full elliptic springs both front and rear, with special attention paid to the attachment of these suspending members so that they have free action. The rear pair are underslung from the axle, and substantially joined to the frame by brackets of ample proportions that extend out from the side frame rails in close proximity to the rear cross member, being the place where the frame is well braced to take care of the load imposed. The front pair attach similarly at the extreme front end of the side members.

A straight taper is given the frame from front to rear, thus allowing for a moderate turning diameter, and for rigid attachment of the narrow radiator that fits snugly between the side members. Besides, a sloping frame makes the best kind of support for the tapering body, holding it well along its entire length.

In this chassis, the storage battery support is given much attention. There are two cross members utilized as a cradle for the long and narrow U-S-L battery that extends up under the front seat of the body. The battery maker cannot find any fault with this rigid battery foundation, and it should be a factor for prolonging the life of the storage cells.

Four-Passenger Body

The four-passenger body is deserving of special mention on account of the originality displayed in the arrangement of the front seat back. Of the sociable type with the rear seat close up to the front the aisle between the two front seats which allows access to the rear seat, is normally closed by a hinged portion of the back of the forward seat. This, when in closed position, affords a back rest all the way across the front seats, but when it is desired to get into the rear compartment, the entire center upholstery section hinges out of the way and gives an aisleway that is amply wide to permit ready passage. The rear of the body has a torpedo shape, and altogether the four-passenger body should prove a very attractive model.

All the fitments and standard equipment of the modern machine are included in the makeup of the Briscoe, and while wood wheels are standard, wire wheels, which to many add a touch of distinction, may be had at an extra figure.

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129 Makes of Trucks in Kansas

ACCORDING to an analysis of the registrations of motor trucks in Kansas made recently there are 129 different makes of commercial motor vehicles in use in that State. Of the total of 1639 vehicles, Ford delivery cars lead with 488, International 286 and Buick 145. Reo has 96, Studebaker 47, Overland and G. M. C. each 36, Avery 31, Republic 28, Cadillac 26 and the rest, headed by Packard, Velie and Koehler with 18 each, range down to 56 makes with one each.

Ford	488	Mack	7	Auburn	3	Cunningham	1	Meade	1
International	286	Brush	6	Carter	3	Cameron	1	National	1
Buick	145	Chase	6	Franklin	3	Commonsense	1	Northern	1
Reo	96	Detroit	6	Glide	3	Cartercar	1	Oakland	1
Studebaker	47	Fuller	6	Gleason	3	Crow	1	Paige	1
Overland	36	Lambert	6	McIntyre	3	Diamond	1	Palmer	1
G. M. C.	36	Lincoln	6	Oldsmobile	3	Dorris	1	Premier	1
Avery	31	Pierce	6	Pope	3	Davis	1	Panhard	1
Republic	28	Chalmers	5	Speedwell	3	Dennison	1	Pullman	1
Cadillac	26	Federal	5	Seliers	3	Everitt	1	Rock Falls	1
Packard	18	Grabowsky	5	Thomas	3	Economy	1	Royal	1
Velie	18	G. V.	5	Alco	2	Electric-car	1	Reinbold	1
Koehler	18	Galloway	5	Commerce	2	Elmore	1	Stevens	1
Wilcox	15	Rapid	5	Garford	2	Grant	1	Sequoia	1
Kelly	15	Reliance	5	Jeffery	2	Giant	1	Sharon	1
Maxwell	13	Regal	5	Mason	2	Halliday	1	Truck-car	1
Kissel	10	Rambler	5	Modern	2	Hudson	1	Trumbull	1
Vim	10	Willys	5	Motorwagon	2	Henry	1	United States	1
Flanders	9	Waverly	5	Queen	2	Haynes	1	Victor	1
Smith	8	Wichita	5	Schacht	2	Krit	1	Winton	1
Dart	8	Decatur	4	Sternberg	2	Kopke	1	Ward	1
Saxon	8	Gramm	4	Argo	1	King	1	Wayne	1
Jackson	8	Indiana	4	Bingham	1	Lexington	1	Warren	1
E. M. F.	7	Sampson	4	Bauer	1	Marquette	1	Westcott	1
Locomobile	7	White	4	Case	1	Menominee	1	Zip	1
Mitchell	7	Autocar	3	Crawford	1	Marathon	1	Total	1639

Aland Sixteen-Valve Four

New Detroit Production To Have Racing Type Aluminum Engine—Diagonally-Connected Brakes on All Four Wheels

FOR the last few months there has been considerable talk of sixteen-valve four-cylinder cars, and the latest of these to be mentioned is the Aland, made by the Aland Motor Car Co., Detroit, Mich. This concern is just organizing and expects to be in a position to start manufacture about Dec. 1. The company is incorporating under the laws of Michigan with a total capital of $500,000.

The line will be made up of one chassis model with several body styles, but production will first be started on a five-passenger touring car and a two-passenger roadster. The paramount feature of the design is the use of a high-speed sixteen-valve aluminum engine, and in keeping with the intention to have the weight as low as possible throughout, the car will be characterized by a liberal use of high-tensile steel. Throughout the entire design the matter of price will be a secondary consideration and as a result this has not been definitely fixed, although in all probability the car will retail for about $1,500.

65 Hp. at 3200 R.P.M.

While rated at 14 hp., according to formula, the manufacturers state that the engine will develop more than 65 hp. at 3200 r.p.m. The cylinders are cast in a single block and made with the crankcase as an integral part. This is an aluminum casting and the cylinder walls are provided with cast-iron sleeves which are pressed into place. The bore of the engine is 3 in. and the stroke 5½, giving a piston displacement of 155.5 cu. in. and, according to the maker, 1 hp. from every 2.39 cu. in. of displacement. This high efficiency is explained by careful attention to balance and to the high volumetric efficiency due to the extra large valve areas and the fact that there are four valves per cylinder. Each of these valves is 1 7/16 in. and opens directly into the combustion chamber being operated by an overhead camshaft which is located in the alley between the valves. One cam operates two valves through double rocker arms which are provided with roller followers at both ends to minimize friction. The rockers are offset 2 to 1, so that, while the cam lifts the rocker but 9/64 in., the valve is lifted 9/32 in.

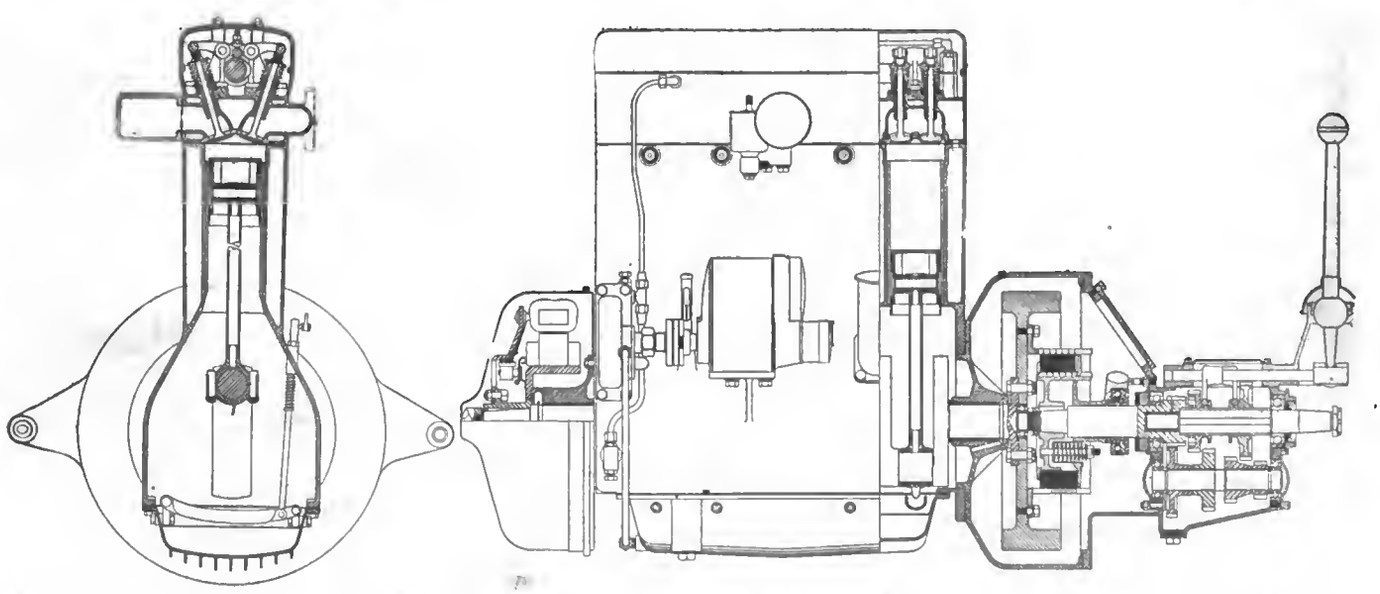
An aluminum alloy casting is also used for the cylinder heads. It is held in place on the cylinder block with twelve 7/16-in. nickel-steel studs placed in such a position as not to interfere with water circulation and to be accessible. This cylinder head casting contains the valves, springs, guides, brackets, camshaft, etc., and forms a separate unit which can be removed without disturbing any adjustment. A feature of importance is that the entire valve mechanism runs in a bath of oil and is protected from dust by means of an aluminum cover which fits over the entire top of the engine block.

Tubular Connecting-Rods

Aluminum alloy is used for the pistons which are provided with three rings, two above and one below the wrist pin. A groove is cut in the piston below the bottom upper ring with six small holes drilled into this as an extra precaution against superfluous oil.

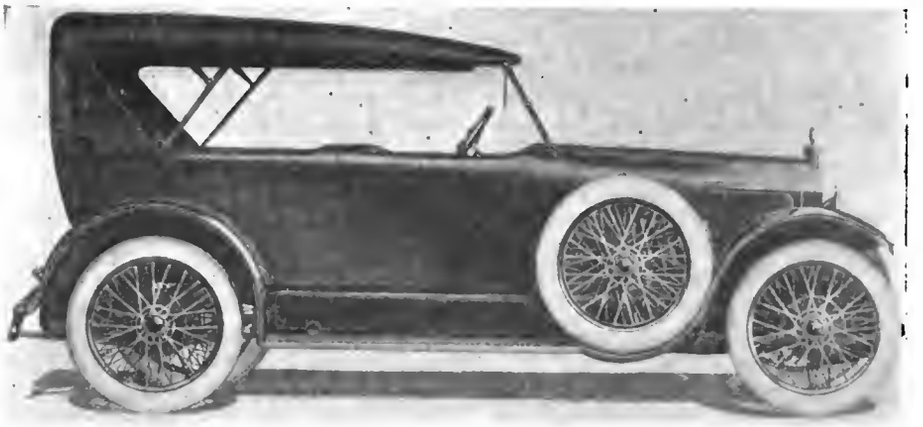
A nickel-steel wristpin is used and this is free to oscillate in either the connecting-rod or the piston. A small steel ring fits into a groove on either side of the wristpin and prevents it from working out to one side and scoring the cylinder wall. The upper end of the connecting-rod is provided with a bronze bushing and the connecting-rods themselves are of tubular type made from chrome vanadium steel. In manufacture it is purposed to pay particular attention to the balance of these parts and also to make them secure against breakage. Nickel-steel bolts are used to hold the cap on the lower end of the connecting-rod and throughout the sections are such as to provide a good factor of safety.

Three bearings support the crankshaft. This is of chrome vanadium steel, heat treated and balanced so as to be in



Showing the simple character of the Aland overhead camshaft engine. Observe the U. S. L. starter at the front end of the crankshaft

running equilibrium at 4000 r.p.m. The shaft is machined all over and at the rear is fitted to a cast-iron flywheel, while in front is the U. S. L. starting and lighting system, which is not in this case a flywheel installation. The unusual installation of the U. S. L. starting and lighting system on the front end of the crankshaft is quite accessible and in this case a stamped steel housing incloses it.



Aland four-cylinder, five-passenger touring car

Has Diagonal Brakes

Another novelty in American design is the use of diagonally connected brakes on all four wheels. This system was originated by the Argyll company in Scotland and operates as follows: The right rear and front left brake are interconnected and operated by either foot or hand, while the left rear and right front are operated by the other control. The effect of this is that, when applying one brake, there is left on either axle one wheel which is rolling free and therefore has the maximum ability to keep the car traveling in a straight line. With this diagonal arrangement it is possible to lock one wheel on each axle and still have control over the steering. The four brakes are all expanding types and act equally well whether the front wheels are straight or at an angle.

Naturally with such a high speed engine, lubrication has been carefully studied. Oil is first pumped from the cast aluminum pan which has a capacity of 6 qt., to a distributer tube cast intregal with the cylinder block. On the top of this tube is located the pressure regulator for the overhead compartment, and a small tube delivers oil to the camshaft bearings and other valve parts. A vertical lead directly over the center crankshaft bearing carries the oil back from the overhead compartment to the crankshaft, lubricating the center bearing. In addition there are adjustable troughs beneath the crank throws which take care of the wearing surfaces within the motor and the front and rear main bearings are oiled by separate leads from the oil pump distributer. Beneath the troughs and extending the entire length of the crankcase is a strainer which is readily removable for cleaning.

Three point suspension is used with each point allowed to move, as each is mounted on a swivel. The two rear points are fastened to the steel stamped supports by means of self-lubricating bolts. The front end is bolted to a cross member at the center and the flywheel is completely housed within the cast aluminum bell housing, the gearbox and clutch case bolting directly to this to form a complete unit power plant.

A Raybestos-faced multiple disk clutch is used with alternate disks of steel and the clutch release is provided with a ball bearing, so that only light pressure is needed to release the clutch. The gearbox is a three-speed selective type with gears and shafts of chrome-nickel steel. The shafts are mounted in large double-row, self-aligning ball bearings.

From the gearbox the drive is taken to the rear axle through a large diameter nickel-steel tube with universal joints at each end, both drive and torque being taken in Hotchkiss style through the springs. The rear axle is semi-floating and is equipped throughout with Timken bearings. The driving gears are spiral bevel and a bearing is located on either side of the pinion, giving a substantial mounting and also shortening the pinion shaft and decreasing the amount of axial movement of the rear universal joint.

A bottle neck frame is used, allowing a wide rear which conforms to the shape of the body sills, narrowed at the front to allow for a short turning radius; in fact, the makers state that the car is able to turn about in a radius of 16 ft. 4 in. In carrying out the construction all the frame cross members and brackets are hot riveted in place, the spring horns at both ends being provided with bronze bushings.

The springs are semi-elliptic all around and are designed to be approximately flat under load. The rear springs are 55 in. long and 2 in. wide and are underslung. The front springs are 37 in. long and 2 in. wide. The springs are attached to the frame by forged shackles and these also are provided with self-lubricating bolts. A full set of shock absorbers is provided as standard equipment.

Conventional steering is used with worm and full gear and adjustments to take up wear at different points. The steering wheel is an 18-in. walnut nobby grip and the control levers work on a full circle control plate instead of the conventional sector.

On this chassis, which has a wheelbase of 122 in., there will be several types of bodies which will be interchangeable. The five-passenger open touring and the two-passenger touring roadster will be the first in production. The five-passenger design is featured by a deep cowl with a built-in sloping windshield. The body is a double cowl style and is made of sheet aluminum over a sub-structure of wood. The seats are low and are tilted back to give ample leg-room. A great amount of attention has been paid to detail in equipment and the car is provided with five Rudge-Whitworth wire wheels with 33 by 4 tires.

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Efficiency versus Neatness

THERE is one respect in which many motorists of experience find a criticism for the modern speedometer despite its better durability and greater accuracy. This is in the nature of the dials employed. The almost universal style to-day is the horizontal indicator which brings different figures opposite a little "window" in the cowl board. This is much neater than the old style full dial with a moving pointer and the speed figures set around like those of a clock, but the latter scores heavily when the driver wants to read the dial quickly.

With the old pattern instrument it was not necessary to look directly at the dial. After using the car a short time the speed could be seen out of the corner of the eye, as the position of the pointer told the driver what speed he was making without his having to actually read the figures. With the modern design the figures must be read, and though this takes but an instant's glance, yet it does demand greater concentration of thought than did the old pointer.

The pointer pattern of dial could be made as neat as the other with a little ingenuity, and there are many who believe that its real superiority will bring it back again, even if not for some years to come.

Make and Break Both Positive

New Idea in Timer Distributers Has Contacts Brought Together and Separated Independent of Spring Action—Very Rapid Operation Possible

A BREAKER mechanism for an ignition distributer in which both the make and the break are positive mechanical operations, neither depending upon the rapidity of action of the spring, is the briefest possible description of a new device recently evolved by the Pittsfield Spark Coil Co., Pittsfield, Mass.

Despite its unusual action the device is extremely simple and it is explained by the series of diagrams in Fig. 2. The essential feature is the use of the two stout spring steel pieces *A* and *B*. It will be noticed that each of these carries a contact point and that *A* is longer than *B*. The cam shown is square with rounded corners, but it would be, of course, hexagonal for a six-cylinder engine, octagonal for an eight, and so on.

Striking radii from the center of the cam and considering the three *R*, R_1 and R_2, it is obvious that R_1 is the longest, while *R* and R_2 are of equal length.

As the corner of the cam sweeps past the free ends of the springs they will be lifted and, if the rotation is in the direction of the arrow, *B* will begin the lift first, while *A* will lift a trifle later. In the middle diagram of Fig. 2, the parts are shown in the position where the end of *B* is just in contact with the end of the radius line R_1. At the same instant *D*, the extremity of *A*, will be in contact with the cam at the end of the radius *R*. This means that with the cam in this position *B* has been lifted to the highest point which it will attain, while *A* still has some short distance upward to travel as the cam turns further around.

The clearances are so arranged that the amount of advance lift given to *B* is just sufficient to raise it until the platinum contacts meet. In other words, *D* is lifted out of contact with the cam just a hair's breadth when *B* is at its extreme limit of travel.

If the cam goes on turning it is obvious that *B* will fall again by the action of the spring, which would break the points apart, but this is not relied upon, as the spring cannot act quickly enough. Suppose *B* remains suspended in the air after the corner of the cam has passed on; that the spring only acts quite slowly. Now turn back to the middle diagram of Fig. 2 and consider *D*, the end of blade *A*. As soon as the cam turns into the position shown in the right-hand diagram of Fig. 2, *D* must be lifted, and blade *A* will thus be raised so high that the contacts will separate even if *B* has not adhered to the cam because of sluggish spring action.

Fig. 1—Pittafield distributer complete and with the breaker mechanism removed, the method by which the breaker box comes off is obvious. The coil is contained in the upper part of the body which is stationary, only the breaker moving to give advance

Putting this another way, in Fig. 1, first position, both *A* and *B* are resting on the side of the cam and the platinum points are not in contact. As the cam turns it first lifts *B*, bringing the points together. This causes *A* to be lifted, thus keeping the contacts together with a firm pressure. Immediately the point of the cam strikes *D* the circuit is broken,

(*Concluded on page* 191)

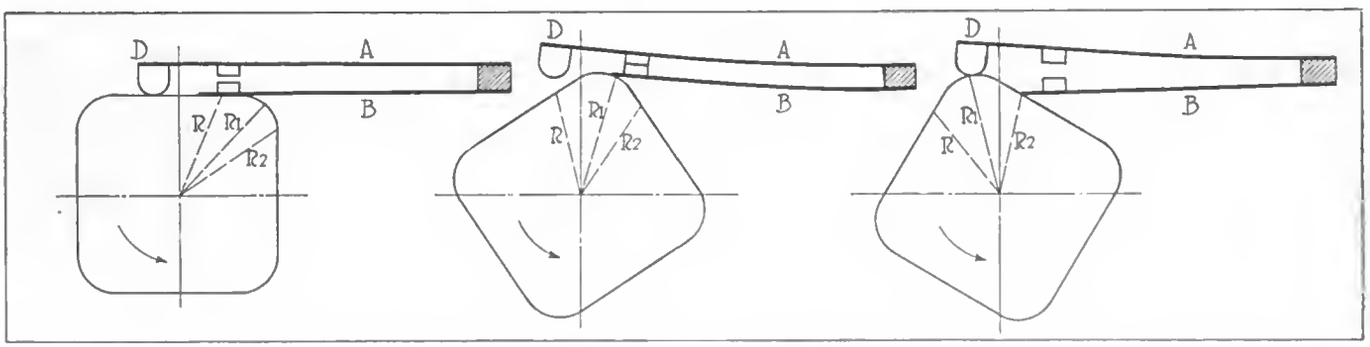
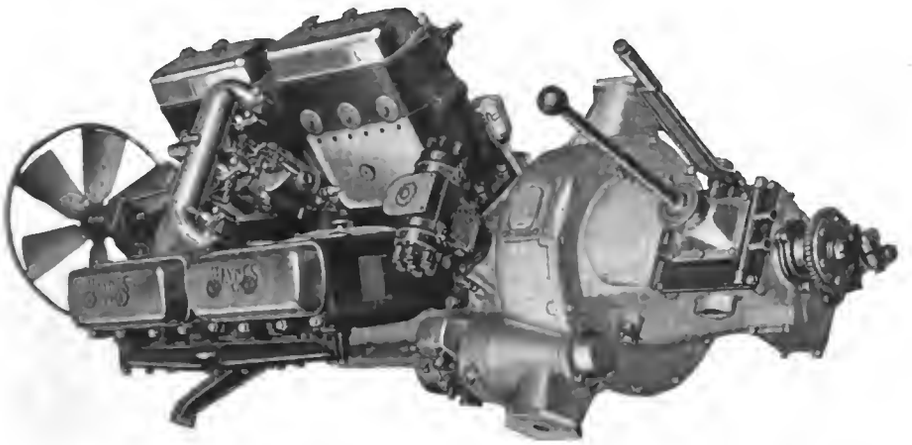


Fig. 2—Exaggerated diagrams showing the three stages of action in the breaker mechanism of the Pittsfield distributor for battery ignition

Haynes Light Twelve in Production

2¾ by 5-In. V-Power Plant Is Interchangeable with Six-Cylinder in One Chassis—Six Is Continued Without Change



Rear view of the twelve-cylinder engine used in the Haynes Light Twelve. It is 2¾ by 5 in. and has a piston displacement of 358 cu. in.

ALTHOUGH the Haynes twelve-cylinder motor was exhibited at the New York show and elsewhere on the circuit last January, production on a complete twelve-cylinder car has not been started until the present time. In producing this model, which has been given the title of the Light Twelve, the Haynes company has combined two existing units, the twelve-cylinder engine and the chassis used for the six-cylinder model, which has been continued without change.

Front view of five-passenger Haynes, showing caster-type front axle

Greatly increased floorspace, due to the addition of several new buildings, has increased the facilities of the plant to such an extent that the demand for the six can now be taken care of and the twelve also manufactured. The fact that the two power plants are interchangeable has also enabled the manufacturers to unify their production scheme to such an extent that all that is necessary in the way of more room is that required for the manufacture of the engine. Even the bodies of the two cars are similar.

In the design of the twelve-cylinder engine every attention has been paid to maintaining lightness. Throughout, all the requirements of high-speed motor design have been followed with particular attention being given to light reciprocating parts and ability to accelerate. The cylinders are cast in two sets of six and are of valve-in-head construction with removable cylinder heads. As required by twelve-cylinder timing, the two blocks are set at an angle of 60 deg. on the base. A piston displacement of 356 cu. in. is given by the twelve 2¾ by 5 in. cylinders. This gives a formula horsepower rating of 36.3.

Pistons Are Aluminum

In manufacture each of the cylinders are ground separately after the completion of the boring operation. The pistons are aluminum and this fact coupled with the small bore gives a very light stress on the bearings in transmitting the forces of the explosion strokes. Three patented rings are used on each piston and in addition there is an oil groove to prevent the flooding of the combustion chamber.

Owing to the light stresses due to the moderate bore and light reciprocating parts, it has been found practicable to use a side-by-side connecting-rod construction. With this arrangement the right set of cylinders is moved back the width of a connecting-rod bearing toward the cowl, thus giving an offset or staggered arrangement to simplify the lower rod construction The same type of crankshaft is used on the twelve as on the six. This is a three-bearing shaft drop forged from 0.40 to 0.50 carbon steel subjected to heat treatment and carefully balanced.

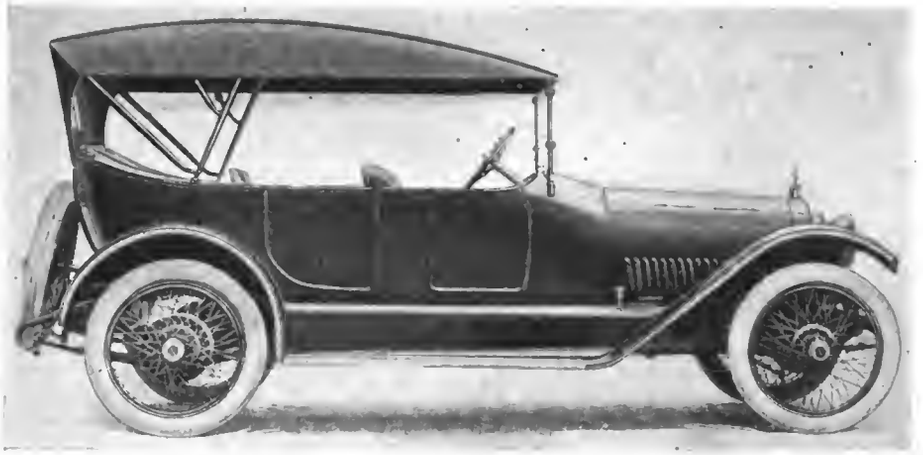
Valves Overhead

In working out the valve arrangement the overhead position has been selected, due to its accessibility and also for the advantages of combustion chamber shape. With the valves carried in the head the intake manifold is short and the exhaust is on the outside with the pipe at the center of the manifold. Thus the exhaust gases are carried straight down and back under the car at a sufficient distance from the driver's compartment to obviate the possibility of the heat entering the body. Another advantage gained by this arrangement is the neat layout of accessories permitted. The carbureter is hung from the short manifold in the center of the V in such a high position that it is quite convenient on lifting the hood. The ignition apparatus consisting of the timer and distributer is also mounted between the V and the water pump, generator and air pump are all accessibly mounted along the side of the engine and can readily be reached or even removed without interfering with any other parts.

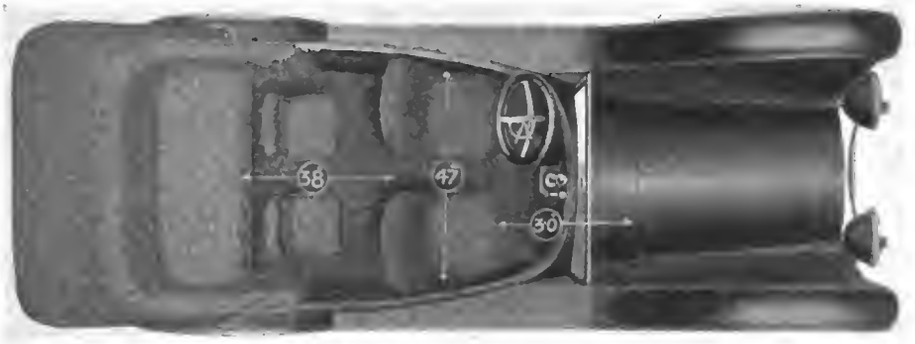
None of the parts of the valve action is in any way interfered with by the accessory mountings. The camshaft is placed at the center line so that the valves for both cylinders are driven off a single shaft. The valves are placed in the removable head and adjustments are readily accessible.

Pressure-Feed Oiling

Lubrication is by pressure feed, the lubricant being circulated by the gear pump through the hollow crankshaft. From this shaft there are outlets into all the bearings and those which are not reached by the crankshaft leads are fed



Haynes Light Twelve seven-passenger touring car which, with complete equipment, sells for $1,985. Wire wheels are regular fitments on this car. Goodyear 34 by 4½-in. tires are used



Plan view of the seven-passenger Haynes touring car, showing the seating arrangement and giving an idea of the liberal body dimensions, insuring comfort to driver and passengers

by small oil pipes. There is an indicator on the cowl which informs the driver of the condition of the lubricating system and of the pressure under which the oil is being fed.

Electrically the Haynes twelve is very much the same as the six. The Leece-Neville starting and lighting system is employed, while for ignition there is a double Delco distributer mounted as described. In the starting and lighting system the motor and generator are in separate units with a Bendix gear attachment for the starting motor which engages the flywheel. The generator is mounted on the same shaft which carried the water pump on the right side of the engine. A feature of the system is the use of an automatic circuit breaker which takes the place of fuses. As soon as a short circuit occurs on the line the circuit breaker opens, and after the trouble is remedied, the circuit breaker can be again closed by simply pressing a button. Gasoline is fed by the Stewart vacuum tank which is mounted in the V on the twelve.

On both the twelve and tbe six a three-plate-dry-disk clutch is used completely inclosed in the flywheel housing. It can be adjusted by the removal of a cover plate which incloses the mechanism so tbat it cannot be reacbed by water or dirt. A lining of Raybestos is mounted on a floating member to clean the plates of the clutch and this member takes all the wear. No oil is used on the friction surfaces of this clutch, so that it requires little attention, but when adjustments are necessary they can be made by lifting the floorboard of the front compartment, removing the cover plate and turning the two adjusting bolts. It is stated that adjustment can be made on this clutch in from 5 to 10 min.

From the clutch the power is transmitted to a three-speed selective gearbox, the gears in which are cut from drop forged nickel steel blanks and the shafts are also of nickel steel and are carried on large Gurney ball bearings. As is customary in unit power plants the shifter mechanism is all mounted in the cover plate. A ball-topped shifter rod is used pivoted at the floorboard line by a ball and socket joint.

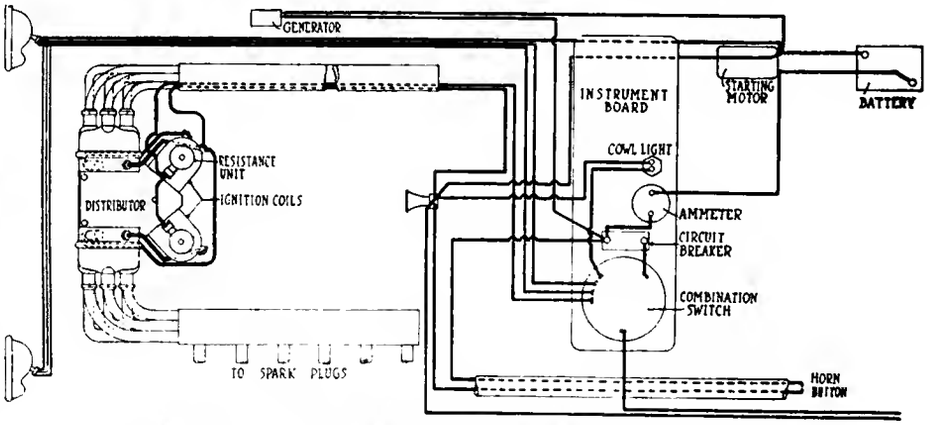
Axle Is Floating

Two universal joints are used in the drive, one being mounted at each end of the propeller shaft. The rear axle is floating and is a design which is manufactured entirely in the Haynes plant. Although the shafts do not carry any of the car weight, but only transmit the driving torque, they are of large dimensions, being 1½ in. in diameter and of heat-treated nickel steel. Spiral bevel drive gears are used with the pinion gear and shaft also of heat-treated nickel steel. A feature of the rear axle is that the entire differential can be removed by taking out four nuts that retain the bearings. This can be done without removing the axle. There are also adjustments in any direction for mesh between the driving pinion gear and the large ring gear on the differential.

Both service and emergency brakes are expanding and are set side by side on the inside of a 14-in. drum. With this arrangement they are both completely inclosed and protected from mud. The brakes may be taken up from the outside to compensate for wear of the shoes.

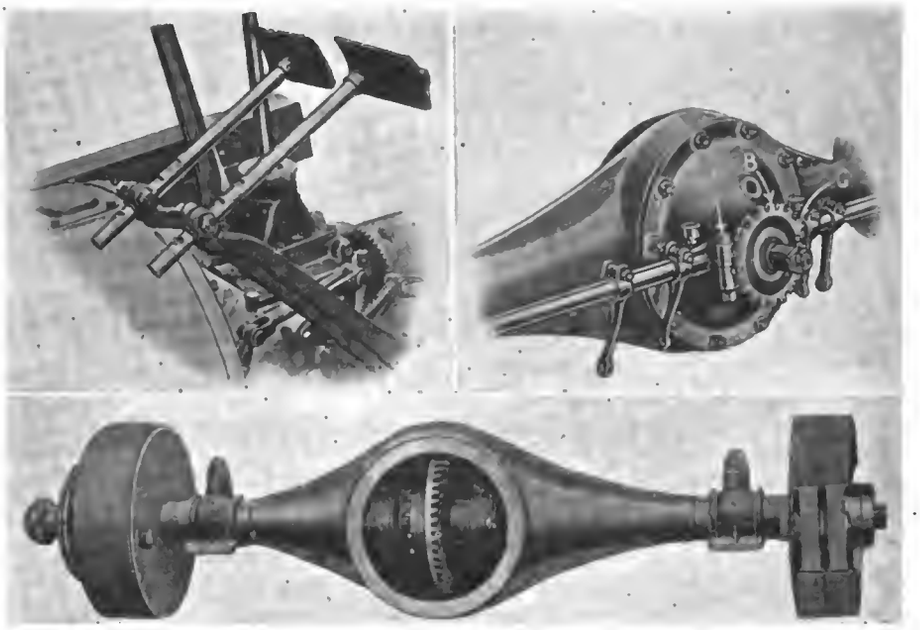
On the twelve, wire wheels will be part of the regular equipment. The tires are Goodyear cord 34 by 4½. The front axle is an I-beam, inclined to give a caster action to the wheels. The wheel spindles and steering knuckles are heat-treated, drop forgings of nickel steel. The front wheels run on two sets of bearings, one set containing ⅝-in. in the other ¾-in. balls. Both of these ball bearings are arranged to have a thrust or axial component as well as radial.

In equipment the twelve-cylinder cars are complete, being fitted with all the attachments customary on the up-to-date



Wiring diagram of the Haynes chassis for 1917, showing the connections for ignition, starting, lighting, etc.

car. In regard to convertible bodies or demountable tops, eitber the Haynes twelve or six can be so fitted in a short time. These tops are known under tbe trade name of De Luxe and are made up in both demountable sedan and coupé styles. The interiors are trimmed in gray whipcord. The back and side tonneau windows are fitted with roll silk curtains and there is an electric dome ligbt. The frame work of these bodies is made up of hard wood and the side panels and door frames are of ridged 2-in. stock. On the touring models the forward side panel is curved with the body line and ¼-in. polished bent glass is used in the windows. The demountable sedan tops for the five and seven-passenger touring cars and tbe coupé top for the roadster models are priced at $275.



A few details of the Haynes chassis, the illustration at the upper left showing the arrangement of the pedals, that at the upper right the differential pinion engagement and the one below depicting the floating rear axle which is made in the Haynes shops

Regular body styles for the twelve-cylinder model are five and seven-passenger touring cars and the three-passenger roadster. On tbe touring bodies there is an aisle between the front seats, and both tbese front seats are adjustible forward and back. The roadster is a clover-leaf with tbree individual seats and the center seat set directly back between the front seats. The wheelbases with these bodies vary, for the five-passenger touring car and three-passenger roadster it is 121 in. and for the seven-passenger touring car 127 in. The price for the five and seven-passenger cars and roadster is $1,985. This figure includes motor-driven tire pump, complete body equipment, full lamp equipment, horn, tools, wire wheels on the twelve and a Boyce Moto-Meter. The standard colors are Brewster green with black running gear and the finish of tbe car is of a high order of merit.

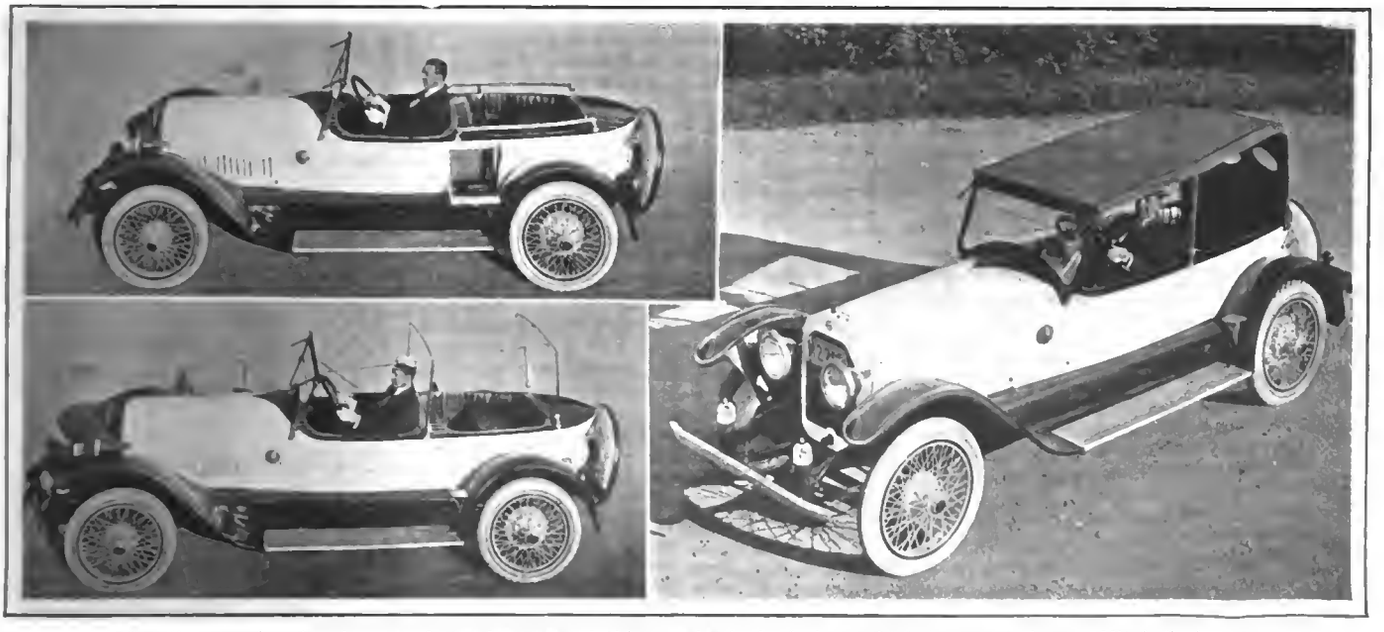
Boat Type Body on Mitchell Chassis

A BOAT body of unusual ingenuity has been designed by J. A. Clark of the Carl H. Page Co. for a Mitcbell chassis. The car was designed for the use of Mr. Page and will seat six passengers and a child. The lines follow those used in launch work, and the finish is in white enamel for the body with the upholstery and running gear of the same sbade of green. Wheels are Houk wire.

Ordinarily the car is adaptable for four adult passengers, the rear and front seats holding two apiece. In addition there are two concealed seats which let down from the sides of tbe body. There is also a child's folding seat in the forward compartment.

The top is invisible when it is not in use, and the bows which support it are folded down and are similar to the deck rails on the side of a boat. The top can be used as a sunshade, without the side curtains if desired.

Another ingenious feature is the single door entrance. A door back to the front seat, giving access to tbe rear.



The disappearing top is one of the features of this special body design, which is mounted on a Mitchell chassis

Advantages of Caterpillar Tractors

Special Work Can Be Done By This Type Which Wheeled Machines Cannot Accomplish — Type Worthy of Development—Automobile Engineering Experience Would Effect Vast Improvements

PART I

THE earliest systems of mechanical traction on a commercial scale were all steam operated, because at the time the steam engine was the only motive power which had been developed to a reasonable state of efficiency. Early types of road locomotives, both as tractors and steam wagons, were developed, principally in England, which country carried out the exploitation of the road steam engine to a far greater extent than one is able to find in other countries. Such a power unit was inherently cumbered by a large mass of metal, constituting the boiler and tanks, which caused its weight to grow out of proportion to its power production. In other words, the weight per horsepower of the steam-traction engine, fully loaded with fuel and water and ready to run, soon became of such proportions that its possibility as a commercial article was limited by reason of the conditions of roads and bridges. Some years ago it was obvious to the student of locomotion that such a type of tractor was doomed, except in a few special cases, and these are principally concerned with the question of fuel supply. It is a notorious fact that the steam-traction engine and the steam wagon will operate at a very low fuel cost as compared with other types of machines doing a similar class of work. On the other hand the steam-power unit requires considerably more attention and suffers from stand-by losses, which latter are nonexistent with the internal-combustion type of motor.

The fuel consumed by the steam tractor is of a bulky nature, and together with the water necessary for the boiler requires the services of three to five men and two to four horses for the haulage of supplies. The question of water becomes a serious one in a dry country, and there is also the delay in getting up steam pressure each day.

Against this the gas tractor can carry in its own tanks sufficient fuel and water for a day's run and one two-horse load of fuel will be sufficient for several days' working of the engine. Further, one operator cannot only attend to the tractor, but frequently is able to work the agricultural appliance as well.

Weight Prohibits Steam

Although we are not at the moment concerned with a comparison between steam power and anything else, it has been necessary to make this slight digression in order to appreciate one important line of development which has been necessary as the power unit increased in weight. The large steam-traction engines made in England have a weight as high as 60,000 lb., which is principally carried on one pair of driving wheels. Such a weight as this is entirely unnecessary in the construction of any machine of the internal-combustion type built in accordance with modern practice and giving the power output that is usually demanded from a single unit.

When we consider weight, two factors must be borne in mind. The first is the provision of a sufficient amount of material in the general structure of the machine to give it the necessary rigidity, and, second, such a weight must be provided on the driving means that sufficient adhesion is present under all ordinary conditions of working to transmit the maximum power of the engine through the lowest gear ratio without slip occurring between the ground surface and the surface of the driving means.

There is one other point of great importance that must also be remembered, and this is that the application of the weight of the machine to the surface must be carried out in such a manner that the intensity of local stress at the point of contact is reduced as far as possible. This statement also infers that the area of loading should be as large as possible. A round wheel theoretically makes line contact with a hard surface; in practice this line assimilates width and becomes an elongated rectangle. As the diameter of the wheel increases, so does the width of the rectangle, which fact has led builders of wheels to increase the diameter of the wheel in order to reduce the intensity of loading at the point of contact with the road.

Advantages in Caterpillar Principle

Incidentally a wheel of larger diameter with its reduced intensity of loading causes a smaller depression upon a road as it rolls along, and is therefore easier to propel. Adding width to the wheel is another step in the general endeavor of the manufacturer of a round wheel to surmount many of the difficulties which are attendant upon the use of a wheeled tractor where the road surface is soft or rough. Wheels became of such colossal dimensions that the very largest machines were impracticable upon many of the roads and bridges provided for the accommodation of the ordinary traffic of the country, and other means were therefore sought to relieve the situation.

For many years past various firms engaged in the manufacture of agricultural appliances and engines for the propulsion of the same have been engaged in experimental work with a view to the development of some form of support for a heavy, self-propelled vehicle. Emulating the means provided by nature to the elephant, large sums of money were expended upon walking machines of the "pedrail" type. Theoretically such a system embodies many desirable features, as the loaded surface is directly applied to the road and its plane is parallel to the road the whole time. More than one loaded surface can be in contact with the road simultaneously and the area of contact can be anything

within reasonable limits. In such an appliance, the mechanical contrivance corresponding to the ankle was of some complexity and the whole system has been recently abandoned in favor of the continuous track system.

The necessity for some means of cultivating large tracts of unbroken prairie land in the western States of America was one of the reasons for the development of the caterpillar tractor. In such country, the ground is rough and covered with brushwood, and other serious obstacles to cultivation, requiring a considerable amount of power for their removal.

It is obvious that in the first place trees should be uprooted bodily and this work can be done by the direct pull of the caterpillar. This pulling power is obtained by reason of the high coefficient of traction of the caterpillar tread upon the ground, which is scarcely affected by the uneven contour. We know from experience that were a round wheel engine to attempt work of this nature, the result would be that the wheels would dig channels in the ground and the machine would bury itself up to its rear axle.

In Reclamation Work

Reclamation projects have almost entirely depended upon caterpillar power for their attainment and in the delta land of California, for example, no other machine but the caterpillar can be used on certain tracts. In these districts there are large areas of peat formation which have at one time been below the level of the water. This land has a very soft upper surface, so soft in fact that the foot sinks down in walking over it. There is not only this softness of the surface to contend with, but the whole ground is seared with fissures, so great in some instances that a man or a sheep can sink readily into one and disappear.

Even after some years of cultivation and continuous packing by the passing over the surface of agricultural implements and tractors, these fissures are still present to a considerable extent and it is impossible for horses to operate. True it is that some round wheel engines are used on parts of this land and also some round wheel harvesting machines, but in such cases the wheels are of colossal dimensions.

The large gas tractor has developed very slowly in Europe. The cost of a volatile liquid fuel there almost precludes it from industrial application on a large scale, and it is only in countries where distillates from petroleum can be obtained at a comparatively low price that large internal combustion engines can prove attractive in competition with a coal-fired steam engine on the point of cost. We therefore find that it is in America that the large internal combustion power unit of the track-laying type has been the most fully developed. In this country we find a considerable number of firms making track-laying machines, all of which are very closely allied in general design, and it must therefore be assumed that the type of track and the method of rolling thereon have been proved to be the most satisfactory of the undoubtedly large number of experimental designs that have been tried out. From an impartial standpoint, the main characteristic of the track-laying machine is its apparent crudity as compared with the motor truck; a finely developed mechanical production, which is a vehicle of almost similar requirements. This characteristic is probably due to the fact that track-laying machines are generally made by firms who are engaged in the construction of agricultural implements and who have not been required to produce apparatus having that fine finish which is so necessary in automobile practice.

Special Abilities of the Caterpillar

In spite of this apparent crudity, there is no doubt that the best type of track-layer, such as the caterpillar, gives extraordinarily good service, and, in a word, whatever may be doubtful about it, it certainly does work easily, which no other type of machine can attempt. This shows that the caterpillar is in a class by itself, and it undoubtedly must be built to meet many extraordinary conditions in working, of which the layman is unaware.

The caterpillar fully comprises the chief advantages of a tractor for farm work from the point of view of the operator, which are:

Ability to do heavy work rapidly, thus covering the desired acreage within the proper season.

The saving of manual labor.

Upper left—Caterpillar tractor uprooting tree by direct pull. Center—Caterpillar harvesting machine working in barley where the softness of the ground renders it impossible to use a round wheel. Right—Steam tractor, showing enormous wheels required. Lower left—Caterpillar tractor pumping for irrigation at Lovelock, Neb. Lower right—Use of the caterpillar in harvesting on a side hill

Upper left—Caterpillar tractor hauling fifty-two cords of timber at Fairbanks, Alaska. Right—Caterpillar used in logging. Lower left —Hauling hay in California. Right—Use in hauling equipment and material for a water development in Los Angeles, Cal.

The ability to plow to a good depth, especially in hot weather, but it does not suffer from the great disadvantage of other tractors, namely, the packing of the soil when damp.

There is one other disadvantage cited against tractors for farm work and that is the difficulty of efficient operation, but in the caterpillar this is reduced to a minimum, and particularly in those types which can be turned around practically in their own length. Like any other machine, and particularly of the internal combustion type, where the power of the engine is limited, it is particularly necessary in choosing the size of a caterpillar that three factors be borne in mind:

1—A machine that will produce enough power to do the work in the best possible way.

2—That will produce enough power to do all the work at the time when it should be done.

3—With enough power to do the work in the right way and at the right time, and when pulling a normal load and not an overload.

Need for Data on Required Power

So far as agricultural requirements are concerned, it is almost impossible to obtain definite data of the drawbar pull necessary for the various appliances, in different soils and working at different depths in the case of plows. Certain firms are experimenting at the present time with the object of determining some of the conditions to be fulfilled by an agricultural tractor as regards drawbar pull. The purchaser, however, specifies his requirements and the number of plows he requires to operate, and the following table, obtained from the experiences of owners in Illinois, will give some idea as to the size of the tractor required for various sized areas under cultivation:

Farms having 200 acres or less of crops—a 3-plow tractor.

Farms having from 200 to 300 acres—a 4-plow tractor.

Farms having from 300 to 450 acres—a 4-plow or larger.

For 450 to 700 acres of crops, the 4-plow is given slight preference, although the 5- and 8-plow sizes are recommended by 22 per cent of owners.

A farm of 140 acres is the smallest upon which the smallest size tractor in common use may be expected to prove profitable.

Fuel Consumption 2½ Gal. per Mile

It must not be supposed that the purchase of a caterpillar will lower the working cost of any farm, but its purchase must be justified by increased returns. No matter what be the size of the machine, a general average may be taken of fuel consumption at the rate of 2½ gal. of gasoline and 1/5th of a gallon of lubricating oil per one acre of ground plowed 7 in. deep. This figure will, of course, vary with the working conditions and with the skill of the operator, as obviously the fuel consumption will be approximately proportional to the load on the engine when a good carbureter is used. This is indicated by the following general figures for the fuel consumption of a 75 hp. caterpillar engine, which at full load has a rate of fuel consumption of 0.63 to 0.66 lb. per hour; at half load 0.75 to 0.80 lb. per b.h.p. hour; and at quarter load 0.9 to 1.1 lb. per b.h.p. hour.

The caterpillar, like other apparatus of a somewhat novel type, has of necessity some drawback, and in this instance it is that of loss of power in the transmission system and in the tracks. In the case of the largest caterpillars, this total loss is of the order of 42 per cent on the direct gear and 48 per cent to 53 per cent on the high gear. This total loss is not entirely frictional, but it includes possibly as much as 10 per cent of the b.h.p. of the engine, which is to be held in reserve to overcome sudden emergencies. If the drawbar is too heavily loaded and a rough spot is met on the road there is otherwise no means of meeting the sudden demand for an increase of power, as the engine is controlled by a governor of a somewhat slow acting type. As an indication of the tractive power of a 75 hp. caterpillar, the following figures may be of interest:

Drawbar Pull Over 8000 lb.

With the direct gear in operation in the transmission at a speed of 2.01 m.p.h., the drawbar pull was 8500 lb., giving a horsepower on the drawbar of 45.9. When the speed was increased to 2.07 m.p.h. by running the engine slightly faster, the drawbar pull was reduced to 8200 lb. and the drawbar horsepower to 45.3. The road speed of the caterpillar is limited to about 3½ m.p.h., principally by reason of frictional loss as the speed increases above this figure, and tests have shown that, whereas at a speed of 2 m.p.h. the frictional loss amounts to 13 hp., this increases to approximately 20 hp. at 3 m.p.h., and 27 hp. at 3½ m.p.h. For agricultural purposes a direct geared machine at 2 m.p.h. is working under the most advantageous conditions, but for road haulage it is convenient to gear up on the indirect.

The 60-hp. caterpillar is a similar type to the 75-hp., but having an engine of half an inch smaller bore gives a draw-

bar horsepower of 38 at a road speed of 2.2 m.p.h., producing a mean pull of 6500 lb. An equal mean pull is obtained by the 45-hp. machine when running at a speed of 1.47 m.p.h., and under these conditions the drawbar horsepower is 25.6. With the same machine running in the direct high gear at a speed of 2.1 m.p.h., the drawbar horsepower is 28 and the pull 5000 lb. These average figures for drawbar pull are between the limits of about 1000 lb. on either side, as in actual working there is considerable vibration and variation due to the loading.

Let us for a moment look at the work which such a machine is called upon to do in actual usage, and consider why caterpillar traction is not only advisable but practically imperative when full return is required from an initial capital outlay:

Effect of Deep Plow on Harvest

Definite experiments have shown that by increasing the depth of plowing from 3 in., which is common practice, to 7 in., the yield on a 3 years' average increased to the extent of 6.33 bushels per acre. Experiments made by the University of Wisconsin show that to double the depth of plowing requires an increase of 70 per cent in power.

President J. H. Worst of the North Dakota College of Agriculture says: "It requires approximately $7 per acre to grow a crop. By adding an additional dollar's worth of labor to each acre there is little question but that the average profit will be doubled. In other words, as much profit should be realized from one additional dollar's worth of labor as is now realized from $7 worth of unavoidable labor and investment."

It might seem that the investment in a tractor only working for less than one-third of the total number of days in the year, might be unprofitable. Let us see:

Taking a four-plow machine which works on an average of 60 days per annum, the estimated average life of this machine is 510 days, while with a larger tractor, say a six-plow machine, working 70 days per annum, its average life is 735 days. These figures will appear low at the first glance, but it must be remembered that when horses are employed they are only occupied about 100 days per annum doing farm work, so that when both horses and tractor are used, even though the number of horses is reduced, the tractor will not have employment for so many days per annum as did the horses.

A 60-hp. caterpillar purchased in 1912, doing farm work, in 1914 harvested 3200 acres, in 1915 2200 acres, also plowing for beets 12 to 14 in. deep in grain stubble that had never been plowed before, and pulling four 14-in. Killifer plows. The price paid for this plowing is $4 per acre, and this particular machine has been in almost continuous use for 45 months and has plowed 9000 acres, disked 12,000 and harvested 10,000, besides doing miscellaneous work. During its life it must have traveled at least 18,000 miles.

Herewith are illustrated various types of caterpillars performing this class of work and, generalizing on the impression to be gained from the inspection, one cannot help being impressed by the width of the strip which is under cultivation behind the caterpillar. Naturally this width must vary in accordance with the implement hauled and with the nature of the ground in which it is working and as this may present such a number of different conditions, it is quite impossible to give any definite figures with regard to the number of plows, for example, that any type of caterpillar will haul.

Disadvantages of Round Wheels

It may be contended that a round wheel machine can do similar work and this is quite true in a measure and under certain conditions. The contention, however, is that a round wheel engine, by reason of its intensity of loading, leaves wheel tracks which show up particularly when harrowing as the harrows do not obliterate these tracks. The result is that the grain will show up in uneven rows at harvest time and such grain as has been planted in the tracks will not mature to the same extent as the rest of the field. The intensity of loading on the caterpillar track does not exceed 7 lb. per sq. in. and can be reduced to half that pressure if necessary by fitting wider tracks.

(To be concluded)

Upper left—Caterpillar tractor hauling an eight-bottom plow. Note the deep furrows. Right—Another application with a gang plow. Lower left—Caterpillar tractor hauling a disk plow. Right—Use in pulverizing and disking ground

Martin Aviation Engine Unique Design

Special Cylinder Construction and Very Accurate Workmanship Give Light Weight—Design Is Very Compact

THAT the aviation engine has now to be a very different kind of product from the conventional automobile motor, even of the highest quality, is an accepted fact. To obtain the ability to stand up to as severe stresses as a racing car engine and to hold up for many hours of continuous service a class of workmanship is required which would be absurd in an automobile engine. Cost, at least as long as governments are the principal buyers, is of little moment.

Of all the special requirements of the aviation engine that of ability to stand up is the most difficult to meet, and it can only be met, in conjunction with light weight per horsepower, by the use of exceptionally strong materials. One of the most troublesome parts of an engine in which to combine strength and lightness is the cylinder, as this has to do many things besides sustaining the combustion pressure, and the cylinder construction is quite one of the most striking features of the Martin engine. This motor is made by the Griffith Machine Works, Los Angeles, Cal., and is designed by Glen H. Martin in conjunction with E. C. Griffith and Caleb Bragg. It is an eight-cylinder V job with the cylinders at 90 deg., using the forked type of connecting-rod assembly.

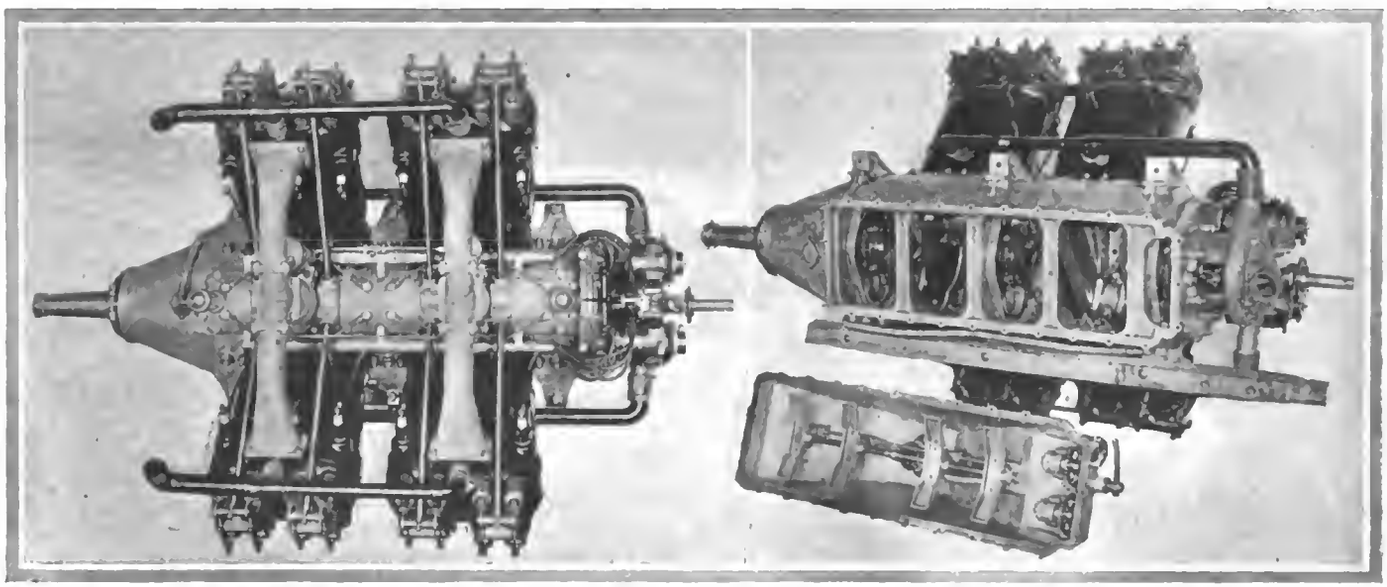
Built-up Steel Cylinders

However, to return to the cylinders, these are all steel and something like the Mercedes type. That is there are several parts of steel welded together. A difference occurs in the extent of this welding, for the Martin engine cylinder is built up from more pieces. The cylinder wall and the head, where the valves seat, are both machined all over to an even thickness, there is no more metal just back of the valve seats than anywhere else, thus the cooling is as nearly perfect as it could be made. Next, the jackets are stamped from a quite large number of bits of sheet steel the junctions being welded. The work is so neat that the pairs, into which the cylinders are formed by the jackets, look like very high grade castings, and the economy of metal is shown by the weight of the cylinder being only 24 lb., despite a bore of 4⅞ in. and stroke of 7 in.

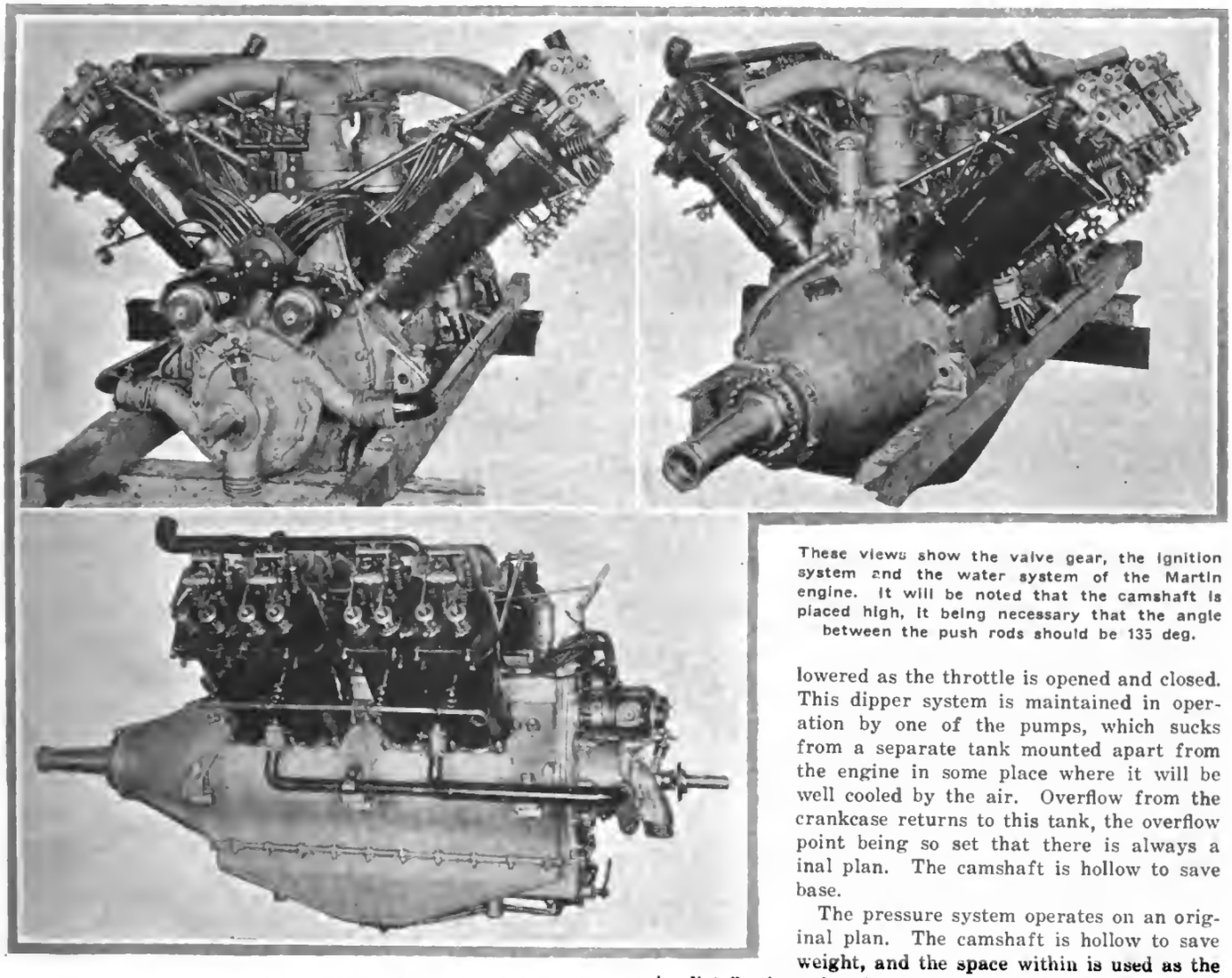
Push and Pull Valve Action

The valve operation is unusual as can be seen from the illustrations. Double ended rockers swing on pivots placed above the cylinders and linked to the camshaft by a single steel tube. The cams are duplex and the tappet is of stirrup form, so that the camshaft first pulls the operating rod, so opening the two intake valves, and then the second cam pushes the rod upward, thereby depressing the pair of exhaust valves. This design calls for very careful workmanship, but granted this, it eliminates a number of parts and so saves weight. It will be noticed that the double cam takes care of all the inertia forces in the push rod and tappet piece, all that the valve springs have to do is to close the valves themselves.

Using one push rod for both valves and one pair of cams for opposite cylinders necessitates a high mounting for the camshaft. Since the pistons are operating with 90 deg. between each two of a V pair, and since the camshaft runs at half the crankshaft speed, it moves through only 45 deg., while the crank is covering 90 deg. If the engine is running clockwise the right hand piston will be going up on the exhaust stroke when the left hand piston is at the top of the compression stroke. At this moment the left hand intake valve will have been closed for 180 deg. of crankshaft or 90 deg. of camshaft movement and the right hand intake valve will have to open at the end of the next 90 deg. of crankshaft or 45 deg. of camshaft movement. Adding 90 to 45 it follows that the angle between the push rods will have to be 135 deg.



Plan and base views of Martin aviation engine, showing the tubular valve operating rods, the dip troughs which move in conjunction with the carbureter throttles and the great rigidity of the crankcase construction



These views show the valve gear, the ignition system and the water system of the Martin engine. It will be noted that the camshaft is placed high, it being necessary that the angle between the push rods should be 135 deg.

The rigidity of the crankcase can be appreciated from the view taken with the oil container removed. As can he seen, it is wehbed strongly, the crankshaft and all the bearings being introduced from the rear end. Stiffness in the case is especially necessary in aircraft motors, because of the considerahle twisting stresses arising from the propeller. If there is too little rigidity in the "nose" of the crankcase, and insufficient stiffness behind the nose in the body of the engine, the propeller can sometimes set up a weave which will result in a broken crankshaft. As shedding a little light on this matter it may be mentioned that unexpected trouhle with the thrust bearings hack of the propeller has been quite usual in aircraft engines, and investigation has shown the gyroscopic action of the propeller can, under some circumstances of flight, set up stresses of remarkable magnitude.

The Martin engine does not use a geared head, but mounts the propeller on a shaft which is an extension of the crankshaft to which it is bolted. This means that the motor is not intended to run at a very high speed as speeds go in automobile work. On a government test at Washington the peak of the power curve appeared at 1326 r.p.m. when the power developed was 183 b.hp. this corresponding to a piston speed of 1500 ft. per minute in round figures. The hrake mean effective pressure for the 183 hp. is 116 lh. per square inch, a very high value.

Effective lubrication when operating at all angles in the air, has been another difficulty in aviation engine construction. In the Martin motor there are two oil pumps, one caring for a pressure system and the other for splash. Under each connecting-rod there is a dip trough which is raised and lowered as the throttle is opened and closed. This dipper system is maintained in operation by one of the pumps, which sucks from a separate tank mounted apart from the engine in some place where it will be well cooled by the air. Overflow from the crankcase returns to this tank, the overflow point being so set that there is always a inal plan. The camshaft is hollow to save base.

The pressure system operates on an original plan. The camshaft is hollow to save weight, and the space within is used as the main distributing pipe for the pressure oil. The pump delivers oil to one end of the camshaft and holes, registering with passages in the crankcase, carry the oil to the main crankshaft bearings and thence to the crankpins. Smaller holes give oil to the cylinders direct, and to the cams and tappet mechanism. On this oil system there is a throttle, connected to the carhureter control, so that both pressure oil and splash oil are fed in proportion to the demands.

Two Magnetos Used

On the rear end of the camshaft there is a special high-tension distributer which is duplex, sixteen wires coming from it to the two independent sets of spark plugs. On either side of this distributer is a magneto, driven by gearing at twice crankshaft speed, and either machine will run the engine satisfactorily, though an increase in power is shown on the dynamometer when hoth are operating together.

The water pump, which is a double-discharge type, is mounted on the end of the crankshaft just beneath the magnetos and gives a direct supply to each cylinder pair through pipes connecting at the lowest points in the jackets. Two carbureters are employed, mounted in the V.

It will be noticed that aluminum alloy is used in this engine to no greater extent than in a conventional automohile motor. The crankcase, heing so rigid in form is of thin section and the steel cylinders are claimed to be lighter than if of aluminum. Pistons are aluminum alloy, of course, and are strongly rihhed beneath the heads. The motor has undergone severe tests for the United States navy, and also at the Automohile Cluh laboratory, with conspicuous success.

The Rostrum

Building Over a Regal Into a Raceabout

EDITOR THE AUTOMOBILE:—I have a 1912 Regal model T underslung which I would like to change over into a raceabout. The first question is, what gear ratio shall I put in so that I can travel from 60 to 70 m.p.h. on the level? Where can I get these gears; that is, the bevel gear and the drive pinion? I think by changing these and not disturbing the transmission I can get the speed I wish.

2—Please tell me how I can lower the steering wheel post.

3—What firms manufacture bucket seats?

4—Where can I obtain a large capacity oval gasoline tank and an oval oil tank for a rear deck?

5—Will it be possible to have enough gravity without a vacuum system on it?

6—Kindly suggest a body design with seat and tanks on it that would be suitable for this model.

Barre, Vt. A. M. F.

—If properly tuned up one of these cars should be able to do better than 60 m.p.h. with a 3 to 1 ratio. These cannot be furnished by the Regal company, but if you will take the matter up with the Weston Mott Co., Flint, Mich., the builder of these axles, they may be able to furnish them.

2—The only way that this can be done is to remount the clamp which is bolted over the tubular motor sub-frame. Any good repairman can do this for you or tell you how to do it if you show him what you wish done.

3—Any large supply dealer can furnish you bucket seats and tank. If you cannot buy these directly from your dealer, they may be ordered from any of the mail order concerns.

4—Answered under No. 3.

5—By keeping the carbureter low and the tank high, you can probably get a gravity feed.

6—The so-called Mercer type body ought to be satisfactory, with the tilted bucket seats, then the gasoline tank with the oil tank on the platform behind.

Wiring Diagram of 1914 Cadillac

Editor THE AUTOMOBILE:—Kindly publish wiring diagram of a 1914 Cadillac, omitting the following devices: dry battery, ignition system, circuit breakers, horn and carbureter heater. Where should an ammeter be installed?

Mandan, N. D. J. G. B.

—The wiring diagram you ask for is shown in Fig. 1.

The connections for installing an ammeter are illustrated at the upper right of the diagram, Fig. 1. You must, of course, be careful that the ammeter is connected the right way around for the direction of current flow.

Crankshaft Speed and Engine Efficiency

Editor THE AUTOMOBILE:—What seems to be the best crankshaft speed for a four or six-cylinder engine to peak at from the viewpoint of service, reliability, consistency and general performance? I refer to a touring car or roadster weighing between 2300 and 3300 lb., preferably from 2500 to 2700 lb., fully equipped.

2—What is the balance between piston displacement and crankshaft speed? By this I mean that a 275-cu. in. engine will permit of a higher crankshaft speed than a 450 or 600-cu. in. engine. The point I wish to know is, what is the best balance to make between piston displacement and crankshaft speed? Give piston displacement and crankshaft speed

3—Which engine will show the longer life, both being correctly handled, a 250 to 300-in. engine of the small bore, long stroke class having large valves and peaking at say 2400 to 2500 r.p.m., or a 350 to 425 in. engine which peaks at from 1700 to 1800 r.p.m.? I refer to four-cylinder engines mainly.

4—Kindly advise me why a sixteen-valve racing type engine identically like the Wisconsin, Stutz, or the 274-in. Peugeot but made to peak at from 2400 to 2500 r.p.m. would not be a decided success in the touring car? Couldn't a sixteen-valve, four-cylinder engine be made as easily and as cheaply as a sixteen-valve, V-type eight-cylinder engine?

5—Why, in a four-cylinder engine, would not cylinder dimensions of 3 2/3 by 6 2/3 be far preferable in a touring car than say 4¼ by 4⅞ for approximately the same displacement? Peugeot touring cars have cylinder dimensions very near identical to their racers and all modern racing cars have the small bore and long stroke not far from 3.7 by 6.6, and these cars stand much more severe treatment than touring cars. I would like to get actual existing conditions regarding this.

6—Kindly give me the average proportion of power increase as the compression is increased in the engine? For example: how much more power will a 3½ by 5 engine having 85 lb. compression have over one having 60 lb. compression at the same crankshaft speed.

7—In a six-cylinder engine does the use of two carbureters prevent dividing the gas stream by two intake valves being open at once as in the case when only one carbureter is used?

Beemer, Neb. G. S.

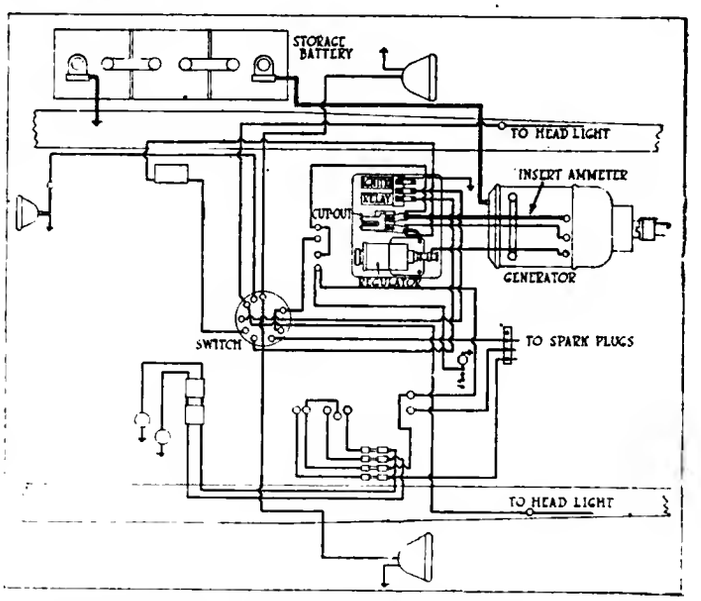


Fig. 1—Wiring diagram of 1914 Cadillac, showing the connections for installing an ammeter. In installing this instrument care must be taken to see that it is done correctly with respect to the direction of current flow

—Between 2000 and 2500.

2—You can employ practically the same piston speed for any bore of automobile engine between 2½ and 4 in., which covers nearly all the sizes in use to-day. Crankshaft speed bears no relation to piston displacement but simply to stroke. A good engine should deliver a little more than its formula rating at a piston speed of 1000 ft. per min. It should be able to run at a piston speed of 2000 ft. per min. and it is not unusual to find the peak of a horsepower curve just about coincident with a piston speed of 2000 ft. per min. It is only when the stroke is 6 in. that this means a crankshaft speed of 2000 r.p.m.

3—There should be no difference.

4—The advantage of a very large opening given by sixteen valves does not begin to be apparent until well above 1500 ft. per min. piston speed. The sixteen-valve four, owing to the elaborate nature of the lifter mechanism, will probably be more expensive than an ordinary eight.

5—The reason that the most highly developed engines used in Europe are a small bore and long stroke is that taxation and racing rules have forced the development of this type. The large-bore short-stroke engine has never been highly developed. The general opinion of engineers in Europe and America is that the best ratio of stroke to bore lies between 1.3 and 1.6.

6—This subject has been investigated by many people, but it is so complicated that no reliable formula has ever been worked out. The following table shows a series of values of mean effective pressure obtained with varying compression under similar conditions, compression is one series and M. E. P. is the other series.

Compression	Mean Effective Pressure
222	86
175	92
124	82
87	72

7—This is the theory for fitting two carbureters.

Information on 1914 McLaughlin-Buick

Editor THE AUTOMOBILE:—Kindly give power and torque curve of 1914 four-cylinder 35-hp. McLaughlin-Buick car.

2—What is the ratio of the different gears?

3—What speed can this car travel when in good order?

4—How far apart, in thousandths of an inch should the platinum points of the Delco timer be?

5—Please give way to adjust the Marvel carbureter which is attached to that car.

6—What is the right clearance between the valves and the valve tappets?

7—Would you advise an extra air inlet on that car?

Montreal, Que. A. L. H.

—The curves which you ask for are not obtainable.

2—The gear ratios are: First, 13.5 to 1; second, 6 to 1; third, 4 to 1; and Reverse, 17 to 1.

3—The car should be capable of about 50 m.p.h.

4—Breaker points of the Delco distributer should be set 0.0018 in. apart when opened.

5—There are two main adjustments of the needle valve *A* which controls the size of the needle, and an air adjustment *B* which controls the air. After the engine has started close the throttle to moderate speed, which means nearly closed. At this point close gasoline needle *A* a very little at a time until motor runs smoothly, allowing the engine to run until thoroughly warmed up before making final adjustments. The next step is to get proper adjustment of the air valve. To accomplish this, air valve adjusting screw *B* should be turned to the left to back out and release the air spring about one-eighth of a turn at a time until the engine begins to slow down. This indicates that the air valve spring is now a little too loose, whereupon it should again be tightened a little by turning to the right one-eighth of a turn at a time until the engine runs smoothly. Next advance the spark one-

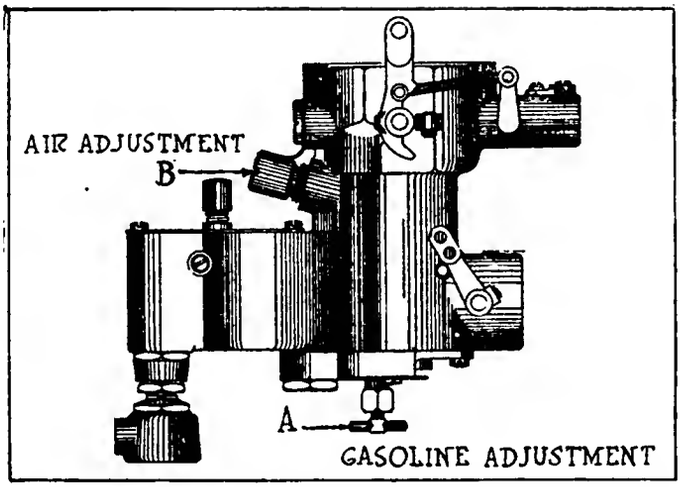


Fig. 2—Marvel carbureter used on the 1914 four-cylinder 35-hp. McLaughlin-Buick, showing points for adjusting the gasoline and air intakes

third of its entire travel. Now open the throttle quickly and as far as possible; upon doing this the motor should speed up promptly and quickly. If it hesitates, or popping back is heard a little more gas should be released at the needle valve *A* by turning to the left a very little at a time, and it may also be necessary to tighten the air screw a little more, but this should not be done unless absolutely needed. Wait for the engine to settle and again open the throttle quickly as before. Repeat these trials until the proper adjustment is obtained, the object being to have just enough gas to allow the engine to pick up promptly and smoothly when the throttle is suddenly opened, the spark, as mentioned before, being at about one-third of its advance or travel. The highest economy of fuel will be obtained by adjusting with the air screw *B* released to the left, and the gas valve *A* closed to the right, as nearly as possible to obtain the desired results.

6—When valve tappets are properly adjusted there should be a clearance of 0.005 in. between valve stems and rocker arms.

7—We would not advise installing an auxiliary air inlet except for racing purposes.

Make and Break Both Positive

(*Continued from page* 180)

and thus the cam mechanically makes and immediately afterward mechanically breaks the circuit. Since both the make and break are made by the cam, both are equally positive, and the contact can neither fail to make nor fail to break and the strength of the springs does not affect the action.

Owing to the short duration of the contact, current consumption is small and the positive action is claimed to permit the distributer to operate perfectly at speeds in excess of the highest engine demands.

The whole distributing outfit is made up into single units 6 in. high by 3½ in. diameter. It includes the coil and condenser in symmetrical arrangement, so that the only external wire is a single lead to the battery in addition, of course, to the high tension leads to the spark plugs. The latter are stationary since the breaker box is moved independently of the cables. The distributer coil and condenser may be conveniently removed in one piece, uncovering the interrupter mechanism for adjustment and at the same time showing up a set of complete printed instructions for operating the same. The manufacturers are at present prepared to furnish this igniter for four, six or eight-cylinder engines, and they will shortly be in a position to supply a twelve-cylinder distributer.

The FORVM

REVOLVING MOTION OF WHEEL AROUND STATIONARY AXIS AND ITS ROLLING MOTION ON GROUND IN RELATION TO MOVING AXIS COMPARED—TWO-CYCLE POSSIBILITIES

Motion Analysis of Rolling Automobile Wheel

By C. V.

THE analysis of the rolling motion of a wheel brings forth several interesting facts. Taking an automobile wheel as example, particularly instructive is the comparison between the revolving motion of the wheel around a stationary axis and its rolling motion on the ground, in relation with a moving axis.

Let us take a 36-in. automobile wheel rolling in a straight line, in a vertical plane, upon a smooth horizontal plane or ground. Let us suppose that the tire is sufficiently inflated so the total diameter d of the wheel remains constant. Referring to the diagrams in Fig. 1, point 0, the wheel center, is also its axis. Starting from the point A, where the ground line AB is tangent with the diameter AE, let us give the wheel one complete revolution, that is, rolling the wheel till the point A again meets the ground at B. The axis 0 will have traveled a distance $00' = AB = d\pi = 3 \times 3.1416 = 9.4248$ ft., while the point A will have described, in a vertical plane, in the same time, a trajectory resembling the upper half of an irregular ellipse whose small diameter is $2d = 2CD$ and large diameter equal to AB and also to $d\pi$.

Any point x, below center 0 will describe an irregular curve similar to xy (dotted curve) on line xy, the curve portion below the axis line $00'$ will be sharper than the one above $00'$; in fact, both curves will gradually flatten out for every point as we get nearer to 0, where the dotted line will finally assume the shape of the straight line $00'$ which coincides with the line of axis travel. The sharpness of the lower curve of the dotted line xy will increase as we get nearer to point A, where, figuratively speaking, this lower curve, growing gradually smaller, will be eliminated and become a dead stop or dead center A, which, if the wheel is rolling according to the previously stated conditions, will coincide at equidistant points along the ground line AB.

Let us find the length of the elliptical line ACB. The simple formula given below allows us to figure with a fair degree of accuracy the perimeter p of an ellipse, viz:

$$= d\sqrt{\frac{D'^2 + d'^2}{2} - \left[\frac{D' - d'}{8.8}\right]^2},$$

Where D' = Large diameter
d' = Small diameter.

Substituting, $D' = 9.42$ ft., and $d' = 6$ ft., we find $\frac{1}{2}p = 12.26$ ft., approximately.

In one revolution, with our 36-in. wheel, the point A will then have traveled, in the vertical plane of the wheel, a distance $ACB = 12.26$ ft., giving us a ratio, or constant of $12.26 :: 9.42 = 1.3$ (approximately). Therefore, in the case of a racing car traveling 100 miles in 1 hr., the point A will have described, in the same time, a number of half elliptical motions, the total length of which will reach 130 miles.

Since the curved line ACB belongs to an ellipse and supposing that the rate of speed of the axis $00'$ is constant, it results that the rate of speed of the point A, along the plane ACB, is not uniform, even if the curve AC is symetric to the curve CB; if we divide the parallelogram $AEFB$ in four equal parts or four equal parallelograms, the time necessary for one complete revolution of the wheel is also graphically divided into four equal parts or periods.

A glance at the parallelograms $AEIG$ and $GICD$ easily shows that the curve AH is longer than HC. A further study of the elliptical line ACB also shows that, this curve being at its sharpest near the dead stops or dead centers A and B, the point A will reach its maximum speed when approaching or leaving the ground. Couple this fact with the inertia-like effect occurring around the dead center A, ad also the destructive action of the tractive force applied at A in the case of the driving wheel, and one will easily understand the incredible amount of punishment that an automobile tire is subjected to at racing speeds.

On each revolution of the rolling wheel, the point A must come to a full stop, at point A which coincides with the ground, in order that the wheel may exercise its tractive power under correct conditions. These points of coincidence must be equidistant in accordance with the value $d\pi$. Hence, if the ratio between the length of the curved line ACB and straight line AB is not $\frac{1.3}{1}$, evidently the wheel is not running properly: if, during the time required for the axis 0 to travel the distance $00'$, the point A happens to travel, in the wheel plane, a distance longer than $1.3 \times AB$ (or $1.3\ d\pi$), the wheel is *slipping;* if the point A travels a shorter distance, in the same period of time as above, than $1.3 \times AB$, the wheel is *skidding.*

If the front wheels of a car are out of line, slipping must necessarily occur since point A travels in this case along a helical plane, in relation to place ACB. Then A's travel is longer than $1.3\ d\pi$; same thing happens in the case of a wobbling wheel (through bent axle or rim), since point A's travel cannot remain within the plane ACB. In the case of a differential-less axle turning a corner, point A's travel will be either $> 1.3\ d\pi$ or $< 1.3\ d\pi$, which means *slipping* or *skidding* for *either* wheel. All the above cases will cause friction with the ground, loss of power and abnormal wear on tires.

When driving around a curve, the relation $1.3\ d\pi$ remains true, but the centrifugal force will cause extra wear on the tires on account of the side thrust unless the curve happens to be banked in proportion to the speed of the car. It must be also remembered that under ordinary conditions,

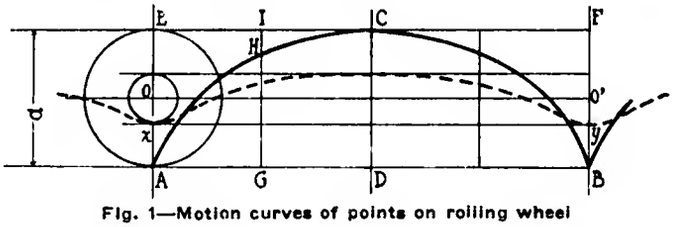


Fig. 1—Motion curves of points on rolling wheel

the wear on the front tires will be smaller than on the rear ones because the former are only subjected to a rolling action while the latter must stand also a propelling and braking action; careless use of brakes is particularly destructive to tires.

Driving through sand or soft dirt gives the same impression as if the brakes were applied to all the wheels; these must make their own tracks as it were, before the car may make any headway. It is very dangerous while driving fast on a smooth road, to drive suddenly on the soft dirt (if there is any on either side of the road), as the steering will be seriously interfered with by the wheel striking the dirt.

In actual practice, we are far from the theoretical conditions of a perfectly round tire meeting a perfectly smooth ground at only one point of contact. A pneumatic tire flattens down to a certain extent, offering an oval surface the size of which is in direct proportion to the weight applied to the wheel and in inverse proportion to the inflation of the tire and the non-resiliency of its material. Among the most important factors upon which depend the tractive possibilities of a given tire are the weight acting on the wheel, the condition of the ground, the design of the tread and the inflation pressure.

Two-Cycle Engine Development Neglected—Its Possibilities

By E. W. Roberts, M. E.

I HAVE noted with considerable interest the letters in the Forum for June 8 on the subject of the two-cycle engine. I have had some 14 years' practical experience with this type, having designed over fifty and built them by the thousand. My experience covers their use in automobiles, motor boats and aeroplanes. In addition I have done a great deal of work in the capacity of consulting engineer in helping others perfect engines of this type.

My experience, which is confirmed in some measure by the opinions expressed in the majority of the letters referred to, is that the average engineer is very much inclined to jump at conclusions with regard to the two-cycle. Notions get abroad that are taken as truths, and many writers state them as a matter of fact. Take the one matter of the crankcase acting as a scavenging pump, and its effect on the lubrication. The notion is abroad that it will cut the oil and interfere with the lubrication. This notion has absolutely no foundation in fact. It is easily shown to be a fallacy by the fact that the very best way to lubricate a two-cycle of this type is by mixing the oil with the gasoline. I have tried every other possible method, and found that this one not only gave me the best results, but was economical of oil. There is no more fool-proof oiling system imaginable.

Limitations as to Speed

Another false notion is the two-cycle's limitations as to speed. If the same amount of intelligence is put into the design of a high-speed two-cycle as is applied to the four-cycle, equally good results may be obtained. The same rules apply as to intake and exhaust areas, weight of reciprocating parts, etc., as in the four-cycle type, with this to be kept in mind. The crank angle during which the passages to and from a two-cycle cylinder are open, is about half that in the four-cycle. On this account it is better for extremely high speeds to lengthen the time of admission to the base by the use of some such device as a rotary sleeve valve.

Even running of the two-cycle at low speed is simply a question of port design. Just as in the four-cycle, flexibility and smooth running at low rotative speeds means sacrifice of power at very high speeds. There is nothing to be gained by avoiding base compression. Differential pistons, separate air pumps, and like schemes only complicate the engine, and the final result in horsepower per pound of engine shows no material gain. It further takes away one of the best points in favor of the two-cycle, its extreme simplicity.

No Loss of Power

Another false notion that has crept into the minds of the many regarding the two-cycle is loss of power with use, due to leaks by the bearings. Careful design, supported by good workmanship, practically eliminates this feature. It is an actual fact that, in spite of the great care taken in fitting and preliminary running in, I found my aeroplane engines to gain in power with use.

Mr. Gunn speaks in his letter of "The various devices put on, to make the two-cycle motor operate in a satisfactory manner." If these various devices were to be thrown into the junk heap and forgotten, the two-cycle would have a better chance of getting the recognition it deserves. It is these devices and the freak designs of this type that have done more to hold it back than any one thing. My experience is that the first thing the average designer does, when designing a two-cycle, is to devise a number of "improvements" to correct faults that do not exist outside of his imagination. If the engineers, who are now wasting their time with these absurd contraptions, will devote an equal amount of energy to the study of the base compression two-cycle, the type will make some progress.

There is nothing the matter with the base-compression type of two-cycle. What has been holding it back has been poor design coupled with a class of workmanship that would not be tolerated in a country garage. With one or two exceptions, the class of workmanship on the two-cycle cars that were formerly on the market was nothing less than atrocious. Many of the two-cycle marines were, and are to-day, little better in this respect, but the builders of the marine two-cycle have learned more from experience than the builders of two-cycle automobile engines did in the past.

Given equally careful study, with the elimination of false notions from our investigations, the two-cycle may be made fully equal to the four-cycle in flexibility, fuel economy and ease of starting. This is not a wild statement, based on prejudice in favor of this type, but is founded on the fact that I have seen and operated a two-cycle automobile engine which completely fulfilled these requirements. The engine was a base-compression type, and the results were due to a carefully conducted series of tests on the road, backed by careful design and good workmanship. It was particularly unfortunate that the promoter of this car was unable to get sufficient financial backing to place it upon the market.

In conclusion I wish to refer to the fear expressed in the letter of F. N. Nutt that "The present low-test gasoline will cause considerable trouble with the two-stroke motor." This is a very good example of the tendency to jump at conclusions on matters pertaining to the two-cycle. Low-test fuels are the two-cycle engine's long suit. It is the best kerosene engine of the two types. On California distillate, it will operate fully as well as on gasoline.

Tony Jannus in his flight over the Missouri and the Mississippi rivers from Omaha to New Orleans in the Fall of 1912 found the gasoline getting worse, the farther south he went. After leaving Memphis, he got a grade that he stated was almost kerosene. Yet his two-cycle engine worked equally on these grades, and the only difference apparent was greater difficulty in starting.

Two-Cycle as Ultimate Type

I venture to prophesy that after the two-cycle has been stripped of the utterly baseless notions in regard to it that now prevail, and the same amount of careful research has been applied to this type that has brought the four-cycle to its present state of perfection, it will be selected as the ultimate type of automobile motor.

The History of the Pneumatic Tire—13

Use of Rubber Tires of Bicycle Type on Sulkies and Hansom Cabs—Carriage Tires Developed in 1892—Pneumatic Wins Popularity on Bicycles

The History of the American Automobile Industry—40

By David Beecroft

PRACTICALLY all this early tire activity centered around the bicycle but the carriage began to attract attention as a market for rubber tires, also. The track sulky for speed purposes using bicycle wheels and tires and ball-bearings was found to be faster than the old form with high wooden wheel with plain bearings, and its adoption dates from about 1892, although a much smaller sulky, driven by a boy and drawn by a dog, had been exhibited in a great many cities in 1891. Sterling Elliott, the maker of hickory-wheeled bicycles, was largely responsible for this movement, and Bidwell tires were fitted in 1892, as were also Sercombe-Bolte tires, and others.

First Commercial Carriage Tires

Some British hansom cabs were fitted with two rims and springs or cushions of rubber rings between them in 1892, but this form did not survive, although somewhat lighter and less noisy than the steel springs of Whiting. The real commercial development of the carriage tire seems to have been begun in 1892 by the Springfield Rubber Tire Co., of Ohio, which first put out a round tire with a hole through it in which was a wire, a form on the market practically ever since. Later, this was followed by the D-shaped tire having two holes in the base for wires which was found to retain the rubber much better than a single wire. It was put on the market in 1894 by the Rubber Tire Wheel Co., of Springfield, Ohio, and a modification by the Victor Rubber Tire Co., of the same place, about 1896, in which the wires were covered with fabrics or encasements.

Improvements in Construction

Later, a further improvement in these solid tires was introduced by making ledges along the base in which the retaining wires could be placed by being forced over the edge of the rim. The result of this construction was a slightly wider rim in proportion to the width of the tire above the rim, but the great advantage was that the rubber was firmly held at its very edge by these wires and could not be rocked or rolled out of the rim. Further, the tire could be made endless and thus avoid a joint which frequently gave trouble and the wires could be welded or brazed together before being applied instead of this being done by holding open the joint for this purpose as is common with the two internal wires.

Solids for Motor Buggies

These forms, while in constant use on carriages to-day, did not find much acceptance on automobiles. Perhaps the experience of one pioneer is typical of others. The *Chicago Times-Herald* race winner, Duryea, was fitted with round, single wire cushion tires when first put on the road in March, 1895, or a little earlier. These were quite large as tires went in those days but the excess weight and service cut them out in a few weeks and they were replaced with 2-in. single tube pneumatics in May or June, 1895.

The solid tires had quite a boom for use on motor vehicles in connection with the motor buggy industry that began about 1900 and grew quite rapidly just before its slump in 1909. The attempt to secure cheapness in these buggies resulted in undersized tires being used and they wore out quickly. They also failed to protect the cheap, flimsy machinery too often used and were simply another example that, in the early days at least, or with poor constructions, the pneumatic tire was a necessity for a motor vehicle which was operated to the ordinary extent.

Pneumatic Comes into Its Own

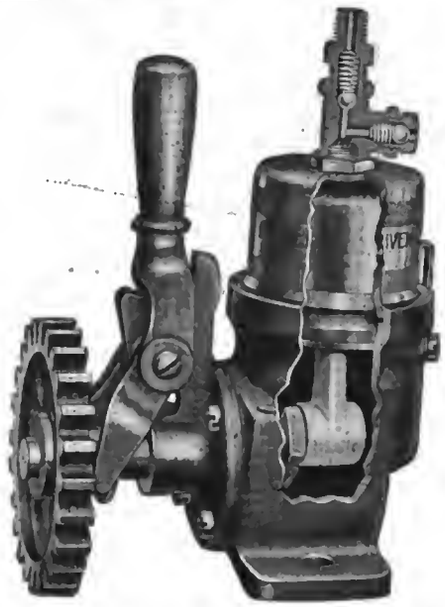
To continue a list of the various proposed designs of pneumatic tires, brought out in 1892 and 1893, would be a publication of names rather than any particular addition to information. Generally speaking, the solid or cushion tire had disappeared from the bicycle by 1892 or the latter part thereof and the pneumatic tire had taken its place. Three fairly well-accepted forms of the double tube pneumatic tire rapidly went to the front and their competitors of wide variety dropped by the wayside. How many of these there were is partly illustrated by the wide variety of rims shown in the advertisement of Warwick, a British manufacturer, in the Nov. 3d issue of *Referee*, 1893. Of these three forms, the cemented tire was cheapest and most common, its casing being split for a short distance on the base to permit inserting a tube having closed ends.

ACCESSORIES

Crane Power Tire Pump

IN the Crane single-cylinder power tire pump a special patented alloy packing ring is used instead of the piston rings usually employed in power tire pumps, the manufacturer stating that this ring is so arranged between the piston and the cylinder walls that leakage cannot occur and oil is prevented from getting into the compression chamber, and hence cannot reach the inner tube. It is claimed the efficiency of this construction is 97 per cent.

Pumps can be supplied for any make of car and the work of installing may be done by the car owner, no drilling of holes or machine work being necessary, as the brackets are designed for attachment to bolts or studs already on the engine. The question of drive connection is solved by the use of split gears designed to fit the car on which the pump is to be mounted. With hose and pressure gage, the pump sells for $8.—Bay State Pump Co., 275 Congress Street, Boston, Mass.



Crane power tire pump, showing patented alloy packing ring

Badger Gage for Fords

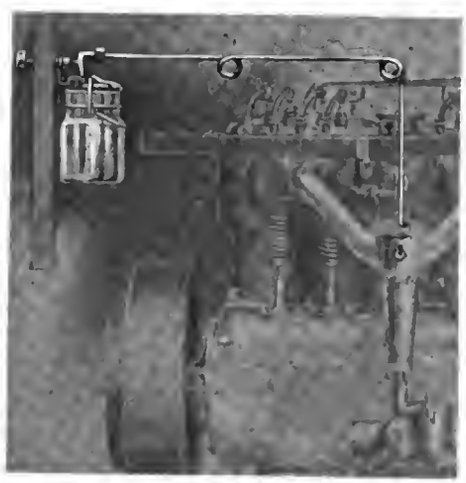
This device is combined with the filler cap and screws into the opening in the tank. The dial is marked for gallons and registers up to 10. Price, $1.25.—Badger Crafts Shop, Sheboygan, Wis.

J. B. D. Resilient Wheel

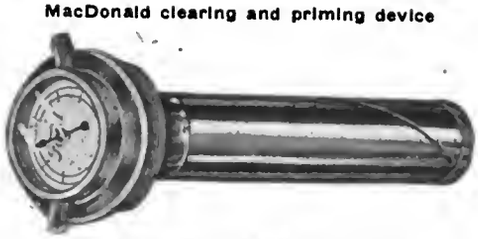
A housing built around the hub of the wheel contains a set of nine rubber disks arranged in a circle; the hub carries a plate with notches fitting the disks and a corresponding plate is carried by the wheel, the drive passing from the inner to the outer plate through the disks. The housing is of malleable iron, the wheel proper of wood and the disks of a special rubber which the makers state is good for from 15,000 to 20,000 miles and can be replaced for 20 cents each. The only attention required is the application of graphite three or four times a year. For Fords and other light cars. Price for four wheels without tires, $60.—J. B. D. Resilient Wheel Mfg. Co., Milwaukee, Wis.

MacDonald Cleaner and Primer

This engine-cleaning and priming device consists of two glass containers. These are interchangeable, and are connected, through a needle valve, by a copper tube to the manifold. The valve is governed by a button and the whole apparatus is fastened to the dash. For priming, a solution of 1 pt. of high-test gasoline and ½ oz. of commercial ether is placed in the container. The charge is released by the button and passes, by the syphon process, to the cylinders just after the engine is stopped. It remains in the cylinders until the engine is turned over, when it is fired instantaneously. For cleaning purposes the second container is used when filled with a solution of salt and water. As the contents of the jar are released, the extreme heat of the motor superheats the salt, which oxidizes the light carbon dust. The water is vaporized when it hits the firing chamber and becomes superheated steam, which drives the oxidations through to the exhaust.—F. A. MacDonald, Grand Rapids, Mich.



MacDonald clearing and priming device



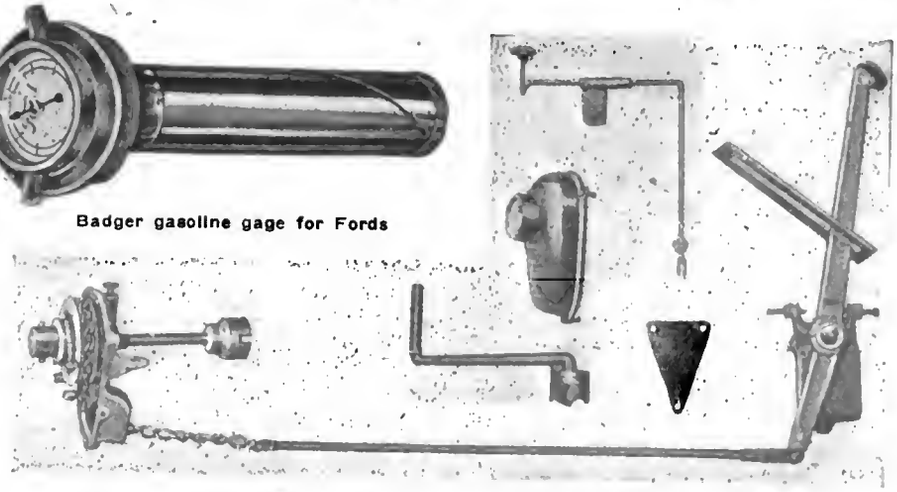
Badger gasoline gage for Fords

Shur-Go Starter

This is a pedal-operated starter designed for Fords, and consisting of a ratchet pulley attached to the crankshaft and which is rotated by a chain passing over another pulley and connecting to the lower arm of the pedal by a long rod. Price, $17.50, installed.—Peoria Specialty Co., Peoria, Ill.

Cutler-Hammer Rheostats

Two small rheostats to control the charging of starting-lighting storage batteries when a charge from an outside source is necessary, or charge lighting batteries when there is no generator on the car. The smaller model is for wall mounting; it has several resistance units inclosed in a sheet-iron case, and a slate panel carries several contact buttons, switch lever and binding posts. The smaller model, G, is made in two capacities—2½ and 5 amp. and 5 and 10 amp. respectively—based on 115-volt direct-current supply and the usual three-cell 6-volt battery in series. The larger model is particularly suited for service in garages and will charge any number of cells up to forty-four lead type and sixty Edison on 115-volt supply, or eighty-eight lead and 120 Edison on 230-volt supply. The larger model has a sheet-metal cas-



Shur-Go pedal-operated starter for Fords

Cutler-Hammer garage rheostat

ing for wall mounting, containing the resistance units and carrying a slate panel on which is a movable arm working over thirty contact points. When required, a double-pole knife switch for the main line, an ammeter and a voltmeter can be mounted on the panel. The ammeter is permanently connected in series with the rheostat and indicates the charging current at all times. The voltmeter has a 15-volt scale and is intended for use with flexible leads so that the voltages of separate cells can be obtained at any time.—Cutler-Hammer Mfg. Co., Milwaukee, Wis.

Searchlight Oxy-Acetylene Outfits

A complete oxy-acetylene outfit for welding and cutting is put up in a case, the set including the following items: 20-in. welding torch with seven tips and hose connections, 3½-in. acetylene regulator with 300-lb. and 50-lb. gages and connections, 3½-in. oxygen regulator with 3000-lb. and 150-lb. gages and connections, 10-ft. high-pressure black acetylene hose and clamps, 10-ft. high-pressure white oxygen hose and clamps, wrench, goggles and instructions. The weight of the outfit is 28½ lb. The oxygen regulator may be used in connection with a cylinder decarbonizer, which is furnished at extra cost. Price, $50.—Searchlight Co., Chicago, Ill.

Ames-Ton Truck for Fords

Worm drive is the particular feature of the Ames-Ton attachment for converting a Ford into a 1-ton truck. A heavy channel frame to support the truck body is bolted around and to the rear of the Ford frame. The weight of the truck is carried on half-elliptic springs; 3-in. expanding brakes are fitted. The wheelbase is 120 in., tires 32 by 3½, and rear wheels are of hickory, with 2-in. spokes. Tread is 56 in. and the loading space, back of the driver's seat, 8½ ft. It weighs 1100 lb., which added to the weight of the Ford chassis brings the unit up to 2000 lb. The gear ratio is 6.2 to 1. The price is complete with all fittings, and the change may be made in a few hours, it is said. Price, $395.—Ames Motor Car Co., Owensboro, Ky.

Cutler-Hammer small rheostat

Searchlight oxy-acetylene outfit

Amco swiveled spotlight

Amco Spotlight

This light is mounted on a swiveled bracket attached to the windshield. The front glass is 5 in. in diameter, and at the rear is a 4-in. plate-glass mirror. Light is supplied by a 6-volt 15-candlepower nitrogen bulb. The clamp will fit any standard windshield. The body of the lamp is made of heavy sheet copper and the finish is velvet-black, except the rear part and hanger, which are nickeled. Weight, 20 oz. Price, $7.50.—Art Metal Mfg. Co., Cleveland, Ohio.

Aerofram Air Valve

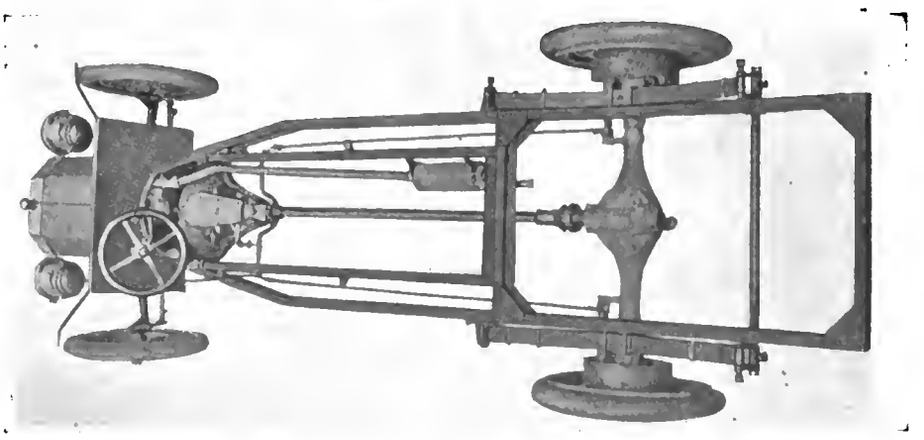
The Aerofram is a small spring-loaded automatic air valve which screws into the intake manifold and supplies extra air to improve the vaporization of the gasoline and to furnish the extra oxygen made necessary by the improved vaporization. There is nothing to adjust and the valve can be applied in a few minutes. It sells for $1.—The Aerofram Co., Inc., Boston, Mass.

Voss Auto Watch

The Voss Auto Watch attaches to the steering post by means of a clamp and spring bracket. It may be set at any angle desired. No screws or bolts are required and it can be put in place quickly or wound while the car is in motion. New watches may be obtained and secured in the case to replace an old or damaged watch. Price, $2.—Voss Auto Watch Co., Des Moines, Iowa.

Letter-Pack-It

An envelope for carrying a letter and a small bag for carrying merchandise sewed together, end to end, form a single package and avoid the necessity for sending the two separately. Spaces are provided on the envelope for first-class letter postage for the letter and parcel post stamps for the merchandise. Three sizes are made.—Letter-Pack-It System, Detroit, Mich.



Ames-ton worm-driven truck attachment for Ford cars

The Automobile

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Caterpillar Tractors

THE article dealing with the good points of caterpillar type drives for tractors, of which the first part appears on page 184, is a result of experience extending over 11 months of use. Admittedly, the author, although entirely unconnected with the tractor industry, has had more to do with the caterpillar type than with wheeled tractors, and he may probably underestimate the advantages of the latter over the former.

Both the wheeled design and the caterpillar tractor are as much in their infancy as was the passenger car in 1900; we do not even know whether the truck type of engine is going to win out in competition with the heavy stationary gas engine sort. It is highly improbable that it will take 16 years to bring the tractor as near finality as the past 16 years have brought the passenger car. Rather, may we expect 6 years to settle the more vital questions, or even a shorter time, perhaps.

Meanwhile, it is experience that is needed; proper accounts of work done and money expended; full lists of troubles and repairs. Such will soon be available from the many farmers who are trying the modern method of cultivation. Just as we have more than one type of automobile so, no doubt, there will be more than one type of tractor always, and the caterpillar, even if it has great drawbacks, does seem able to perform some remarkable feats.

Exports Highest Yet

THE value of automobile exports from the U. S. for the year ended June 30, 1916, are only a trifle less than double the value for the previous year. Especially noteworthy is the fact that this is not due to the large exports of commercial vehicles, for of a total increase of $52,000,000, commercial cars only account for a little less than $18,000,000. Parts, excluding tires, have increased $15,000,000, leaving the balance of $19,000,000 to be credited to the passenger car increase.

In regarding this remarkable figure it must be remembered that Europe has been a closed market by reason of high tariff and, subsequently, prohibition of imports, since October, 1915. The detail figures for June, 1916, give the answer to the question of where these extra cars are going, for they show that the British colonial empire is buying a very large quantity and that the South American countries added together make a big total. It is obvious that America now has a firm hold on the markets which have been in the habit of buying largely from Europe, and it is a credit to the American industry that the loss of the important European market has been so much more than offset by the increase in other fields.

Ford

AT a time when raw materials are at the highest price ever known, and with the highest paid labor in any factory in the world, Ford drops his price 18.2 per cent. Why is it that such a thing can be done when almost every other motor car maker is *raising* prices?

The answer is that Ford has had a single aim, a single system, a steadfast purpose; unchanging for year after year. At the very start Ford's ambition was to do just one thing, and to do it better than anyone else in the world; his aim to-day is just the same as it was in the beginning. Ford has always stuck to the highroad of his choice, has never been led off down a side turning. His progress is something like that of a man who starts to drive across a strange city; he has made best time by choosing just one of the many avenues and sticking to it. He has never tried to cut across into another because of a rough patch ahead, on *the chance* that the unknown street would be smoother.

Ford stands as a great example, not only to the automobile industry, but to all industry, a great example of the enormous success obtainable from one thing done well. The temptation to depart from the original idea must many times have been enormous; that no such departure could possibly have been advantageous admits of no argument.

His work recalls those immortal lines of Owen Meredith:

"The man who seeks one thing in life—and but one—
May hope to achieve it ere life is done.
But he who seeks all things wherever he goes
Only reaps from the hope which around him he throws—a harvest of barren regrets."

Australian Industries Are Prosperous

Financial Conditions Throughout Continent 95 Per Cent Normal—Over 60,000 Cars in Use and Market Growing—Three Tire Plants—Body Building Progresses

NEW YORK CITY, July 29—Financial conditions in all of Australia are approximately 95 per cent normal, according to Peter McIntosh of McIntosh & Sons, Ltd., Sydney, who has been visiting in this country for several months. In spite of the war Australia is enjoying more than ordinary prosperity, largely due to the wartime prices being paid for so many of her natural products, such as grains, meats, wool, etc.

The financial situation in Australia is best demonstrated, according to Mr. McIntosh, by the quick subscribing for the different war loans. The first war loan of $25,000,000 was oversubscribed, there being $65,000,000 actually offered. The second war loan of $50,000,000 was subscribed to the extent of $110,000,000, and the new loan of $250,000,000 which is being talked of will be more than doubly subscribed, according to present indications. These facts indicate that there is plenty of money in Australia.

Nearly 70,000 Cars

Automobile business is suffering more or less because of the high ocean freight rates and the inability to get ships, as well as to the high price of gasoline. Australia has between 60,000 and 70,000 cars. Approximately 20,000 were sold during 1915. As in America, 70 per cent of the cars sold in Australia are going to the farmers. The term farmer must be interpreted somewhat differently than in this country. Many of the Australian farmers are large property owners and have huge herds of live stock. Others are engaged solely in mixed farming. Ford is the biggest seller, and is followed by Overland, Buick, Studebaker, Dodge, Chevrolet, Maxwell and others.

Due to the fact that gasoline is selling wholesale at Australian seaports at 60 cents per gallon—the imperial gallon is used—it is necessary to talk gasoline economy in making sales, and those dealers engaging in quantity business must be capable of showing 23 to 30 miles per imperial gallon. The imperial gallon is approximately one-sixth larger than the gallon used in this country. All of the gasoline used comes from the island of Borneo and is handled in 5-gal. cans, with two cans crated together. This method of handling is expensive and there is a movement on hand to introduce the bulk system, the same as used in the United States.

Lubricating oils are much more expensive than here. The price in such cities as Sydney, Melbourne, Adelaide, Brisbane, New Castle and Perth averages $1.50 per gallon, as compared with 50 cents here.

Three Tire Plants

Australia is not an automobile-manufacturing country, but has made much progress in the manufacture of pneumatic tires and also of car bodies. The three tire factories employ from 3000 to 4000 men and are producing upward of 2500 pneumatic tires per day, which is sufficient to practically care for all of the cars in the country. Tires sell for approximately twice as much as they do in North America. Because of the manufacture of tires in Australia the majority of the Australian dealers buy their cars from the United States without tires, this being to develop the tire business in Australia and assist the three tire factories there. The majority of Overland and Cadillac cars, however, are shipped with tires. Australia uses metric sizes, and the majority of tires are clincher type. Some straight-side types are being introduced into Australia; but there seems to be a preference for the clincher type, a condition naturally favored by the Australian manufacturers. One of the tire factories is the Dunlop, which is a branch of the English company; the other two are local organizations.

Body Building Important

Body building in Australia is an important industry and is a development of the old carriage trade. The Government has recognized this body-building industry and is protecting the local manufacturers by a heavy import duty. The present duty on a five-passenger body is $125. Because of the local body-building industry many Australian dealers prefer to buy stripped chassis in the United States and have bodies fitted in Melbourne or Sydney, where the body-building interests are centered. A good five-passenger body costs approximately $450 in these cities. There is not much economy in having the body built as compared with buying the chassis fitted with the standard factory body. In purchasing chassis without bodies from the American manufacturer approximately 50 per cent of the real cost of the body is generally remitted by the manufacturer.

Australian dealers and garagemen are generally well fitted to handle all matters with regard to car repairs, etc. When electric lighting and starting were introduced there was some difficulty at the start in obtaining efficient help, but the work of the Delco company in having its representatives visit all Australian cities for the purpose of educating dealers and garagemen in caring for such apparatus helped very materially. It is not now difficult to obtain good electrical experts, who generally are of French or Swiss parentage.

Battery Troubles

During the past season the battery question has been giving more trouble than perhaps any other, and it is not yet settled. Australia has a climate which is fairly severe on batteries, in that the summer is particularly hot; and with a temperature of 125 deg. Fahr. in the interior during the summer months of December, January and February, there has been more or less trouble with plates warping from the heat so that positives and negatives squeeze the separator so as to form a short circuit. In the coast cities, such as Sydney, the summer temperature rarely rises above 80 deg., so that there is no difficulty in such places.

Some of the battery manufacturers are improving their batteries by extending the separators a certain distance below the plates, thereby making it impossible for the bending of the plates to bring positives and negatives together and cause short-circuiting.

Lack of Standardization

The major complaint that many Australian dealers have with regard to batteries for starting and lighting is the lack of standardization, particularly in terminals, which makes it difficult to meet all the exigencies. With the present lack of standardization it requires about forty different models of batteries to care for all of the different American cars in Australia, so that any Sydney or Melbourne dealer or supply house aiming to be ready to meet any exigency in the battery field would have to be stocked to that extent.

It has been suggested that if greater standardization of terminals were accomplished four or six different models would suffice. This would make it much easier for the automobile supply man in Australian cities.

Mr. McIntosh when speaking on this subject said:

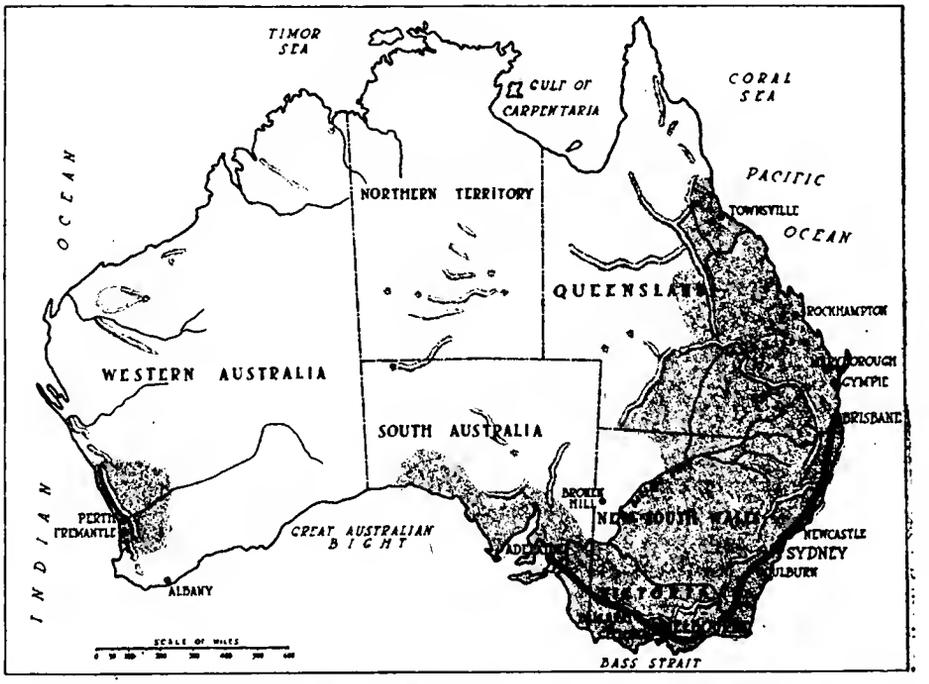
"There are three sizes of batteries that would serve at least sixty or seventy makes of American cars, and after close investigation there are not three different makes out of this number that could be connected up to any one battery model without making alterations in terminals or connections. If standardization were carried out a dealer or service department in a foreign country could replace the battery of almost any American car out of a stock of four sizes. As matters stand to-day, it requires a stock of forty different battery models, and then the dealer is not absolutely certain that he can do it."

A Growing Market

Australia as an automobile market is going to increase. At present it has been absorbing cars at a satisfactory rate in proportion to the population. With a population of 5,000,000, it has, say, 70,000 cars. On this ratio, with a population of 105,000,000, which is the same as that of the United States, it would have 1,470,000 cars. Australia's ratio of cars to population is thus scarcely one-half of that of the United States. Australia has a particularly homogeneous population. Colored races have largely been barred, and it is due to such prohibition that the population of the continent is not higher. With its present almost pure white population the buying capacity is higher than it ordinarily would be with heavily mixed races. There are islands in the Pacific Ocean with populations of 30,000,000 but which cannot be compared with Australia in purchasing capacity.

Australia has not yet taken up the road-building movement as it should. There are approximately 1800 miles of substantially improved highways. Between Sydney and Melbourne, a distance of 600 miles, there is a good road. These cities have populations of 800,000 and 700,000 respectively. From Melbourne to Adelaide, another stretch of 600 miles, there is a good road. The population of Adelaide is 200,000. From Sydney to Brisbane, 660 miles, there is another good macadam road. Brisbane's population is 150,000.

These three links of roads are all connected in the form of a huge crescent, as these four cities are located in the southeastern part of the continent, and, starting from the left-hand side of the crescent and going to the right-hand, the cities in order are Adelaide, Melbourne, Sydney and Brisbane. All are seaport places. All of this 1800 miles of highway



Map of Australia, showing the 1800 miles of substantially improved highways composed of the 600-mile stretch between Sydney and Melbourne, another 600-mile stretch from Melbourne to Adelaide, and a third of 600 miles from that city to Brisbane. Road development in other sections has been slow. Shaded portions indicate automobile districts.

was built some years ago and, owing to the present government system of roads, improvement has not been rapid since that date. The motorists are working for improved systems so that trunk highways will be extended into the interior. Considering the present road system in Australia and the population of the continent, the sale of cars has been particularly heavy.

Dealers' Expenses Heavy

The United States car manufacturer may find difficulty in realizing the cost to which the Australian dealer is put because of ocean freights, import duties, etc. Take a typical United States car that would retail in this country for $750. It costs approximately the same amount to get this car into the dealer's salesroom in Melbourne or Sydney. Some of the major items are freight from New York to Melbourne or Sydney, freight from the factory to New York, packing at the factory, duties of various sorts, etc. The following tabulation gives some conception of these expenses:

Packing at factory	$26.00
Freight, factory to New York	30.00
Freight, New York to Melbourne	320.00
Duty on body	125.00
Chassis duty, 10 per cent	50.00
Tires, 60 cents a pound	50.40
Duty, lamps and accessories	28.00
Duty, top and windshield	30.00
Exchange, commission, insurance, etc.	70.00

The question of exchange, commission, insurance, etc., is one that is generally little understood with American dealers, as they have not to bother with it. It costs approximately 2½ per cent for conversion from United States currency into Australian; that is, the Australian dealer pays approximately this much on his bill. In addition, exchange costs 2½ per cent between Melbourne or Sydney and New York. Marine insurance costs approximately 2 per cent. If the Australian dealer operates through a New York shipping house or exporter he pays 2½ per cent for his service. All told, there is 10 per cent added because of these four items. It is possible to eliminate the 2½ per cent commission to the exporter if the Australian dealer can do his business direct with the United States.

Freights have gone up very materially on the ocean because of the war. Before the war freights were $8 per cubic ton, and since the war they have risen to $40 and $45. During the past few days there has been a reduction of approximately $10 per cubic ton. A cubic ton is equivalent to 40 cu. ft., and a medium-price car selling around $800 occupies approximately a 9-ton space, or 360 cu. ft. Freight rates from Liverpool to Sydney before the war were $8 per cubic ton and are now $30. These figures apply, of course, to automobile shipments.

Armored Cars for U. S. Warships

WASHINGTON, D. C., July 29—Armored automobiles cradled on the decks of warships, in seagoing rafts, for the use of detachments of the United States marine corps in shore operations, may soon be added to the regular equipment of naval vessels.

Experiments at the Boston navy yard have demonstrated that these cars can be stowed aboard by the means of electric cranes on war vessels in a few minutes and take up small deck space.

Quotas and Their Use in Salesmanship

System Makes Use of Estimates Each Year Based on Past Performance, Business Conditions, Business Population, Size of the Company's Organization and Factory Capacity

IN his talk on Quotas at the recent World's Salesmanship Congress at Detroit, F. H. Dodge, sales manager of the Burroughs Adding Machine Co., Detroit, Mich., stated that his company is a firm believer in the use of quotas in salesmanship. In developing the quota system the company estimates at the beginning of each year the amount of business it should be able to secure, this estimate being based on past performance, business conditions, business population, size of the company's organization and factory capacity. In further explaining the application of the quota system, Mr. Dodge said:

For example, let us suppose our quota for this year to be $10,000,000 or 400,000 points; $25 worth of business represents a point; about twelve points represents an average sale.

Our first move would be to split these 400,000 points into 121 sections, because there are 121 Burroughs agencies in the United States and Canada. Quota sections vary in size according to the sizes of the agencies—as based upon territory values.

Agency Quotas by Months

Our next move would be to distribute the agency quotas by months. Agency quotas are not divided into twelve equal parts, for experience has proven, in our case, that with a corresponding effort more business can be secured in December than in January. Our June business has, also, always exceeded our July business. Other variations in monthly quotas are likewise necessary.

The proportion of our year's quota assigned to each month is as follows:

January	8%	July	7%
February	7%	August	7%
March	8%	September	8%
April	8%	October	8%
May	8%	November	9%
June	10%	December	12%

Our only stipulation in assigning salemen's quotas is that 720 points shall constitute a minimum year's quota for a salesman. We made the minimum quota 720 points, or $18,000 worth of sales, because that is the minimum account of business we expect a fair salesman to produce in a year.

A smaller business does not yield a profit sufficient to attract the class of salesmen we wish to employ.

When we find a sales manager has cut territories so small that, if properly worked, the salesman cannot secure a 720 point business in one year, we insist that the salesman's territory be increased in size.

I have now explained how we establish the company quota, how it is distributed by months and agencies and by sales managers to salesmen, but I have not touched upon another important condition in our quota scheme; that is, territory valuations.

How to determine with reasonable accuracy the various territory values has been one of our real problems.

We do not claim, even after twelve or thirteen years' experience of quota building, that we have the problem solved, but each year we are getting nearer to the ideal situation.

The deeper we go into the subject of quotas, the more certain we are that it is worth while and that there is much to learn about scientific quota building.

In the early days, we used population as the basis for determining territory values. Population is still used in our quota plan, but not alone.

To obtain a good guide to territory values, it was found necessary to supplement population figures with other statistics and data.

The sales value of population varies in different sections of the country; at least we have found it so. For example, 10,000 population in Texas, California, and in the Northwest was proved to be of greater sales value to us than the same population in the Central States or the East Coast States.

Reasons: Extensive credit systems in use in the South require more bookkeeping, consequently more adding machines for each unit of population.

In California and the Northwest, more young men educated to modern business methods are conducting the business of those sections.

These and other conditions naturally account for the variation in population values to which I have referred.

Accessibility of Prospects

To supplement the influence of these variations in population values, we later took into account past performances, accessibility of prospects, business conditions, and business or trade population.

The accessibility of prospects was found to be an important factor because this governed, to a certain extent, the amount of time salesmen could spend in the presence of each P. B., prospective buyer. Thickly settled territories should naturally carry larger quotas than sparsely populated territories.

Business population was our next important addition to the group of quota factors. It was in 1909, I believe, that we started to analyze territories to determine their business population. The Rapid Addressing Machine Co., of Chicago, made our first tabulation of business prospects.

Analysis of Previous Sales

Our first move toward this tabulation was to analyze carefully our previous sales to determine the most productive fields. We were then making a rather respectable showing in ninety-six lines of business. We gave this list of lines of business to the Rapid Addressing Machine Co., and this firm in turn made a tabulation of their lists by states, by lines of business and according to certain financial ratings which we specified. Their list was compiled from Dun's and Bradstreet's supplemented by other sources of information with which we were not entirely familiar.

In those days we had fewer agencies, and State lines, to a certain extent, became our agency boundary lines. Our lists were, therefore, compiled according to the business population of each State.

During the next two years, we did considerable cutting of territories and then, of course, found need for a business population tabulation by counties.

We purchased this information from the Boyd's City Dispatch, New York, at a cost of $1,000 plus an additional cost for copy work. I do not recall the cost of the copy work.

The second list was much better than the first, because with business population by counties to guide us, we were in better shape to ascertain the actual territory values.

In 1909 we were compelled to prorate values according to business population where two or more agencies were within one state.

Prior to 1909, the year business population by counties was introduced, it was not always easy to convince the sales manager that quotas were fair. Since that time, we have had very little trouble of that nature; for, generally speaking, the field men know that we know, prob-

ably better than they, the actual quota value of their respective territories. We have the real figures to prove the values. There is, consequently, not much excuse for fault finding.

In the early days of our quota experience, we were making only a few models of machines. We now make nearly 200. Therefore, a further refining of our quota plan was necessary to obtain good representation for the models of the long line. Various machines in the long line now carry separate quotas as do certain very productive special fields or lines of trade.

The more recent refinements in our quota scheme are necessarily more complex and would not be readily understood by one familiar with our business.

Quota enters into many phases of our business building plan. The per cent of quota secured indicates to a certain extent the relative ability of salesmen. Without these figures we would not be able to determine as well as we can now the men who are most entitled to promotion.

Friendly rivalry within an organization, if properly inspired, helps business. We use it extensively.

It would not be possible to use this rivalry as we do if we had no agency and individual quotas.

Our sales bulletin is issued each month and contains quotas, points secured, and the per cent of quota made. We make a practice of featuring in sales bulletins creditable records of individuals and agencies.

105,488 Cars in Bay State

Registrations for 6 Months Compare with 102,533 for Entire Year of 1915

BOSTON, MASS., July 29—Massachusetts registrations for the first 6 months of 1916 show a great jump over the same period of 1914 and over the entire 12 months last year. There was listed July 1 here 105,488 motor vehicles. For the same period in 1915 there were only 83,868 booked, a gain of 26 per cent, or 21,620 machines. During the entire 1915 period there were 102,633 cars registered so that the gain to date over all of last year is 2855 cars. And it is expected that there will be at least 125,000 machines registered in Massachusetts before the year ends due to the big demand the dealers are having now. The gain in trucks shows to greater advantage comparatively. Of the registrations above 14,800 were commercial vehicles. For the same 6 months of a year ago there were 9900 registered, a gain of 4900, or about 50 per cent. For the entire 12 months of 1915 there were 11,960 registered so that to date there are 2940 more registered than all of last year. And the trucks sales are increasing. As a result of the increases the State has been enriched also in fees. During the first 6 months of 1915 there was paid in to the Highway Commission $999,254.90. Up to July 1 this year the State has received $1,232,164.63, or $252,639.63 more than for the same period of 1915, and $29,744.44 more than all the fees gathered in the 12 months of last year. Herewith are the figures.

Of the cars registered it is surprising that nearly 65,000 of the total is covered by just sixteen different makes. There are that many that have more than 1000 cars listed, the Ford standing far ahead, with 22,640. That is about 20 per cent of the entire registration. According to the figures as compiled by the Auto List Co. up to June 24 the cars are listed as in the table below.

Allen Holds Dealer Convention

FOSTORIA, OHIO, July 29—The dealers of the Allen Motor Co. held their annual convention at the factory last week. New cars were inspected and business and sales sessions were held.

Massachusetts Registrations for 6 Months in 1915 and 1916

	To July 1, 1915	Entire Year 1915	To July 1, 1916	Gain Over First 6 Months 1915	Gain Over Entire Year of 1915
Automobiles....	83,868	102,633	105,488	21,620	2,855
Trucks	9,900	14,733	14,800	4,900	2,940
Fees	$999,524.99	$1,205,420.19	$1,232,164.63	$252,639.73	$29,744.44

Analysis by Makes of Massachusetts Registrations in 6 Months of 1916

Ford	22,640	Flat	168	Paterson	34	Cutting	12
Buick	6,711	R. C. H.	160	Motorcar	31	Havers	12
Overland	5,693	Interstate	150	S. G. V.	31	Johnson	12
Cadillac	4,987	Anderson	138	Atlas	30	Mercedes	12
Studebaker	3,509	Grant	137	Briggs	30	Buckeye	11
Hudson	3,171	Krit	136	Ohio	30	Parry	11
Maxwell	2,733	Abbott	125	Dalmler	29	Partin	11
Packard	2,531	Simplex	123	Lexington	29	Republic	11
Chalmers	2,178	Amer. Mot.	121	Marquette	28	Elkhart	10
Dodge Bros.	2,012	Pullman	121	Bergdoll	27	Lion	10
Reo	1,810	Apperson	113	Pathfinder	27	Royal	10
Metz	1,594	Everitt	105	Nyberg	24	Standard	10
Pierce	1,364	Bailey	104	Clarke-Carter	23	United	10
Chevrolet	1,230	Columbia	102	Grout	23	Daniels	9
Oakland	1,118	Imperial	101	Hereshoff	22	Isotta	9
Jeffery	1,020	Thomas	101	Matheson	22	Sears	9
Hupp	989	Marion	97	Lyons	21	Cameron	8
Stevens	980	Auburn	94	Woods	21	Davis	8
Oldsmobile	878	Case	88	Corbin	19	Sampson	8
Franklin	821	Briscoe	87	De Tamble	19	Austin	7
Stearns	714	Empire	83	Knight	19	Buffalo	7
Paige	694	Little	81	Lancia	19	Cunningham	7
Chandler	650	Warren	79	U. S.	19	Gen. Veh.	7
Stanley	617	Baker	76	Crow	18	Linscott	7
Pope	606	Renault	75	Moyer	18	Royce	7
Peerless	605	Elmore	73	Penn	18	Detrolter	6
Saxon	601	Allen	67	Babcock	17	Gen. Mot.	6
Winton	543	Michigan	66	De Dion	17	Henry	6
Mitchell	533	Trumbull	66	Elec. Veh.	17	Hotchkiss	6
Jackson	522	Rauch-L	64	Garford	17	Itala	6
Regal	451	Speedwell	63	Napier	17	McIntyre	6
Locomobile	425	Crawford	61	Pilot	17	Am. Cycle	5
White	412	Westcott	59	Acme	16	B. C. K.	5
Velie	408	Waverley	56	Herff-Brooks	16	Bell	5
Cole	399	Autocar	54	Monroe	16	Chadwick	5
E. M. F.	382	Selden	54	Welch	16	Enger	5
Kissel	326	Moon	53	Detroit	15	International	5
Haynes	325	Cartercar	52	Milburn	15	Lewis Spg. Ax.	5
National	324	Amer. Loco.	50	Vulcan	15	Mora	5
Stutz	324	Palmer-S.	43	Am. Volturette	14	Panhard	5
Knox	320	Dort	42	Columbus	14	Pickard	5
Dayton	295	Flanders	42	Consolidated	14	Rochet	5
Marmon	239	Henderson	41	Easton	14	Staver	5
Premier	222	Moline	38	Owen	14	Wayne	5
Mercer	211	Brush	36	Benz	13	Willys	5
Lenox	200	Berkshire	35	Courier	13	40 mfrs. each 4	40
Scripps-Booth	199	Marathon	35	Lewis	13	15 mfrs. each 8	45
Lozier	186	L. P. C.	34	Mutual	13	39 mfrs. each 2	78
King	183	McFarlan	34	Schacht	13	163 mfrs. each 1	163

To Define Truck Requirements

Automobile, Military and Naval Men Study Mobilization Problems

WASHINGTON, D. C., July 31—Another meeting was held this week at the War College here to discuss plans for mobilization of troops and supplies in time of war, particularly so far as civilian organizations are concerned. Major Palmer E. Pierce of the General Staff Corps presided at the meeting, Lieut. Col. Chauncey B. Baker being present to represent the Quartermaster General's office. Representatives of the Naval Consulting Board, the National Automobile Chamber of Commerce, the Society of Automobile Engineers and the American Automobile Assn. committees were in attendance.

Information is being collected as to just how many government departments need a large motor truck equipment, in order that suitable specifications can be developed for each type of truck required. The Truck Standards Division as well as other Divisions of the Standards Committee of the Society of Automobile Engineers will, as in the past, take a leading part in this work. Serious attempts will be made to develop specifications of proper length, that is, neither too long nor too short, covering adequately the requirements of the government, which it is felt will eventually harmonize to a greater extent than has been expected heretofore with the needs of private users of commercial motor vehicles. Some well qualified experts feel that within 2 or 3 years the commercial product will approximate what according to the best opinion will be suitable for operation in all except special cases of government service. This is undoubtedly the best line of procedure, as it is not likely that a subsidy plan will be established in this country in connection with truck manufacture. Both the truck manufacturers and the government want to improve the current truck specifications.

Trucks Severely Tested

It is agreed that the tests to which trucks have been subjected on or near the Mexican border are the most severe that have been had in any part of the world. The conditions of service have been abnormal in that the lines of communication have been maintained without the use of railroads. The performance of some of the trucks has been wonderfully good, but there is room for further beneficial specification in various respects. The necessary engineering study is now being made, many of the S. A. E. members going to the Mexican border to view at first hand the unusual conditions of weather, sandy grit and alkali encountered.

The development of suitable tractor types of motor vehicle will also be given attention.

Regulations are being prepared for use in the organization of officers and enlisted men of the Reserve Corps recently authorized by Act of Congress. There will be a mobilization of the reserve organizations of a fortnight's duration each year. Reserve Corps officers will be appointed in sufficient number to make possible the assembly of troops at local points and transporting them to strategical points.

For Transportation

Past-president Wilson of the American Automobile Assn. announces that over 90 per cent of the millions of American pleasure car owners would very willingly and quickly tender the use of their vehicles under any suitable plan of mobilization. This will make possible immediate transportation preparedness which would be wanted in case of emergency. It is stated reliably that in many districts large bodies of troops can be mobilized by motor cars before the railroads operating in the respective districts can get sufficient cars ready to transport them. Demonstrations which have been made readily show that troops can be moved by automobile faster than by train.

Suitable types of armored cars for use by the ordnance department as well as types meeting the needs of the engineers, the signal and the artillery corps will be developed.

Emphasis was again placed upon the vital importance of good roads. It was pointed out that $225,000,000 was spent on good roads in this country last year and that in some of our territory we now have the best road systems in the world. Those in attendance at the meeting were:

Major Palmer E. Pierce, General Staff Corps.
Lieut. Col. Chauncey B. Baker, Quartermaster Corps.
Major L. P. Williamson, Medical Corps
Howard E. Coffin, Chairman Industrial Preparedness Committee, Naval Consulting Board.
Bion J. Arnold, Chairman Transportation Committee, Naval Consulting Board.
Alfred Reeves, Chairman Military Transport Committee, National Automobile Chamber of Commerce.
George W. Dunham, Member Military Transport Committee, Society of Automobile Engineers.
A. L. Riker, Member Transportation Committee, Naval Consulting Board.
H. D. Church, Chairman Truck Standards Division of Standards Committee of the S. A. E.
Wm. P. Kennedy, Member Military Transport Committee, S. A. E.
John A. Wilson, Chairman Military Preparedness Committee, American Automobile Association.
Amos G. Batchelder, Member Military Preparedness Committee, A. A. A.
J. S. Marvin, Manager Traffic Department, N. A. C. C.
W. H. Allen, Member Tire and Rim Division of S. A. E. Standards Committee.
Coker F. Clarkson, Chairman Military Transport Committee, S. A. E.

Gasoline Prices Down 1 Cent

New Jersey, the Carolinas and Part of Ohio Affected—Crude Lower

NEW YORK CITY, Aug. 2—The price of gasoline has been reduced 1 cent a gallon in New Jersey, North and South Carolina, Virginia and at most of the filling stations in Cleveland, and the Standard Oil Co. has dropped the price 1 cent in the Cincinnati section. Gasoline is now selling for 22 cents in New Jersey; 23 cents in Cleveland; 24½ to 26½ cents in the Carolinas; 22½ to 24½ in Virginia.

3-Cent Reduction

A close investigation of petroleum market conditions discloses the fact that within the last year there has been an enormously increased production of crude oil not only in Oklahoma and other Western fields, but in such oil districts as Pennsylvania and Ohio, and that as a result of this the price of gasoline may drop from 1 to 3 cents under the present market price.

In Pennsylvania alone 60,000 old oil wells have been uncovered and reworked with satisfactory results. Wells producing 6 to 8 barrels of crude per day were not worth working when crude was selling at 40 cents per barrel, but when it rose to $2.65 per barrel, as it did in Pennsylvania, such wells proved very profitable. In Ohio 25,000 old wells were reworked. In Oklahoma wells were sunk deeper and in other oil producing States similar conditions prevailed.

As a result, the market is not prepared to take care of this increased supply and storage facilities to care for 100,000,000 barrels of crude will soon be ready. This supply is practically equivalent to a 6 months' consumption of gasoline.

The greater use of the cracking process in gasoline refining as introduced by Doctor Burton of the Standard Oil Co. of Indiana, 5 years ago has made it possible to get practically double the quantity of gasoline from the crude.

The manufacture of gasoline from natural gas has greatly aided in relieving the situation, as the high price of gasoline made it possible to produce fuel from the gas by either the compressor or vacuum processes.

Further relief in the crude market is in sight due to the building of 50 tank steamers to be used in transporting crude from Mexico and the Gulf fields to the refineries.

Reductions in crude oil prices have been announced in the Mid-Continent, Ohio, Texas and Louisiana fields, falling from $1.55 to $1.25.

Studebaker To Add 40,000 Ft.

Extra Floor To Be Added To New Building—Plans Other Additions

DETROIT, MICH., July 27—The Studebaker Corp. has awarded contracts for construction work that will add 40,000 sq. ft. to the floorspace of the Studebaker factories. An extra floor, 50 by 300 ft., is to be added to one of the three-story buildings at present used as a warehouse for materials, so that the Studebaker plants may be better prepared to stock up on materials in advance of immediate needs.

A new one-story building to be used in connection with final assembly work is to be erected on the site purchased by the Studebaker company in May, adjoining plant No. 3 on the west side of Detroit. With the annexing of this property the total floorspace occupied by the Studebaker factories has been increased to 150 acres.

Authority to add ½ mile more of railroad siding has also been given, which will be in the nature of double railroad platforms, each one-fourth of a mile long.

The value of the construction work that has been authorized will run close to $100,000.

New Armleder Truck Prices

CINCINNATI, OHIO, July 29—Armleder trucks are now sold at a new scale of prices, as follows:

Model	Tons Capacity	Drive	Price
HC	2	Chain	$2,200
EC	2½	Chain	2,350
HW	2	Worm	2,400
KW	3½	Worm	3,250

A new series of the 2-ton worm-driven model will be announced very shortly. This new series is designated HW-2, and will be similar to the old series except for minor refinements of detail.

New Moreland Delivery Car

LOS ANGELES, CAL., July 25—The Moreland Motor Truck Co. has announced a new model, a light delivery truck, the chassis to sell at $990. This new model is a 1500 lb. capacity rapid service utility truck equipped with Wisconsin motor, Timken axles and roller bearings, three-speed transmission, and with solid or pneumatic tires optional.

Auto Body Co. Addition

LANSING, MICH., July 28—A further enlargement of the plant of the Auto Body Co. will occupy a large tract of land purchased adjacent to the factory, where a three-story factory extension will be built. It will front 75 ft. on Turner Street and run back 200 ft. west of Turner. The company has also made an arrangement with the New York Central railroad for the installation of a direct freight siding with that railroad from its plant.

Corman Is Denneem Sales Manager

CLEVELAND, OHIO, July 29—E. W. Corman has been appointed sales and advertising manager of the Denneem Motor Co., this city, maker of the Denmo truck. Mr. Corman left a similar position with the Elgin Motor Car Corp., Chicago, Ill., and was formerly with the Saxon Motor Car Co., Detroit, Mich.

Prine a Pathfinder Representative

INDIANAPOLIS, IND., July 29—H. W. Prine has been appointed district sales representative for eastern Pennsylvania for the Pathfinder Co., this city. Mr. Prine will specialize on carrying out the company's educational work among its dealers. He will make his headquarters in Philadelphia.

Devlin Joins Elgin Corp.

CHICAGO, ILL., July 29—F. X. Devlin has resigned as purchasing agent of the Federal Motor Truck Co., Detroit, Mich., to become identified with the Elgin Motor Car Corp., this city. Mr. Devlin has been connected with the Federal company since its formation 6 years ago.

Hastings Is Empire Consulting Engineer

INDIANAPOLIS, IND., July 27—Don T. Hastings has recently moved to this city from Detroit to act in the capacity of consulting engineer to the Empire Automobile Co. Mr. Hastings was previously assistant chief engineer to the Hupp Motor Car Co.

Smith to Manage Buda Motor Sales

HARVEY, ILL., July 29—L. R. Smith, Indianapolis representative of Eisemann magnetos for several years, has resigned to become general sales manager for the motor department of the Buda Co., this city.

Budd Starts Plant Addition

PHILADELPHIA, PA., July 29—The Edward G. Budd Mfg. Co., this city, is having a factory addition built at Twenty-fifth Street and Hunting Park Avenue for the making of automobile bodies.

Kentucky Revivo Battery Petitions

LOUISVILLE, KY., July 29—Pursuant to a resolution adopted by the directors of the Kentucky Revivo Battery Co. Monday a voluntary petition in bankruptcy was filed for the concern July 25.

U. S. Tests Armored Truck

New Type Mounted on King Chassis Tried Out for Power and Speed

WASHINGTON, D. C., Aug. 1—An official test was conducted here to-day with the King chassis fitted with a new type of armored body. The tests were supervised by two members of the Marine corps and some army officers. The car was first given a hill-climbing test on a short steep hill on Thirty-fifth Street; it was then given another similar test on the road leading to Fort Myer; at Fort Myer it was driven through a prepared ravine through which water was flowing; lastly it was given a speed test at 30 m.p.h. at Fort Myer. The test continued from 2 o'clock until 5.

On Wednesday the car will be driven to Annapolis to be tested through 6 miles of sand and on Thursday it will be driven to Camp Biddle, Philadelphia, where it will be loaded on a transport and taken to sea. It will be out several days, during which landings will be made with the car intact and in five units.

Scripps-Booth Corp. Organized Under N. Y. Laws

NEW YORK CITY, July 29—Announcement is made by C. H. Booth, president of the Scripps-Booth Co., of the organization under the laws of the State of New York of the Scripps-Booth Corp., with a capitalization of 70,000 shares, no par value, of which 25,000 shares are to be offered for public subscription at $50 per share.

The Scripps-Booth Corp. is a consolidation of the Scripps-Booth Co., Detroit, and the Sterling Motor Co., also of Detroit.

The corporation will have no bonds or preferred stock and no floating debt.

Plant extensions are planned which will permit an output of 12,000 cars for 1917. The Sterling company has made the engines for Scripps-Booth cars since they were first built and now becomes a unit of the organization. The Scripps-Booth capital was increased from $100,000 to $350,000 early in the year following the entrance into the concern of Clarence H. Booth, who will head the new corporation.

Truck Man Home from War

NEW YORK CITY, Aug. 2—Granville A. Pollock, who has represented the Pierce-Arrow Motor Car Co. at the war front in Flanders, France, during the past 18 months, arrived home last week. Mr. Pollock had charge of anti-aircraft trucks.

Stutz Announces New Roadster

Bulldog Continued—Wire Wheels, Improved Carbureter and Roomier Bodies

INDIANAPOLIS, IND., July 31 — The Stutz Motor Car Co., this city, announces that its new models will have wire wheels as standard equipment, improved carbureters to take care of the present low-grade fuel, longer rear springs and roomier bodies. There will be an entirely new roadster model. A standard wheelbase of 130 in. has been adopted for all models, which will consist of the Bulldog Special with four and six-passenger bodies, and the new roadster. The price of $2,550 for the Bull Dog is the same, while the new roadster price is $2,275, an increase justified by a longer wheelbase and many refinements. The new roadster has a modified turtle deck with a depression in it for carrying the spare wheels, instead of the exposed tank and trunk as formerly.

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Buffalo Pressed Steel Co. Expands

BUFFALO, N. Y., July 29—The Buffalo Pressed Steel Co., this city, has leased the John R. Keim mill property on Kensington Avenue, owned and operated but recently vacated by the Ford Motor Co. This property is particularly suited to the company's work and permits of substantial expansion.

—

Union Truck Elects Officers

BAY CITY, MICH., July 26—At a meet- of stockholders and others interested in the new Union Truck Co., directors and officers were elected. James R. Tanner, is president of the company; H. E. Woodworth, vice-president and general manager; E. C. Tibbetts, secretary and George Beaulier, treasurer; these officers and H. E. Buck, W. H. Boutell and C. E. Chatfield, form the directorate. The plant formerly occupied by the Marine Iron Works, Water and Second Street, has been secured and the Union truck is to be made there on a large scale. It is said that the new concern has ample capital.

—

Bowser Promotes Four

FORT WAYNE, IND., July 29—Four important promotions in the sales department of the S. F. Bowser Oil & Tank Co., this city, become effective Aug. 1. L. P. Murray, sales manager, is made mid-West manager; J. G. Rodman, executive assistant, promoted to central manager; E. J. Little, New York office manager, is named eastern manager, and E. H. Briggs, factory sales manager, becomes executive assistant.

Mr. Murray who has had charge of the store and garage sales department at Fort Wayne, will now have jurisdiction over the Chicago, Denver, St. Louis and Dallas offices. Mr. Rodman will supervise the offices in Ohio, Indiana, Michigan, Louisville, Memphis and Atlanta. Mr. Little will have charge of the offices in New York, Albany, Harrisburg and Washington. Mr. Briggs will now have charge of the sales promotion work. Clarence W. Kroener, machinist for the Bowser company, has been promoted to the position of superintendent of construction at Boston, Mass.

—

Four Wheel Tractor Co. Elects

CLINTONVILLE, WIS., July 31—The Four Wheel Tractor Co., a new Wisconsin corporation organized at Antigo, Wis., recently, and later purchased by Clintonville interests, has perfected its organization by the election of the following officers and directors: President, Charles Topp; vice-president, W. H. Finney; secretary, A. B. Mayhew; treasurer, L. C. Larson; directors, F. M. Hyde, Henry Zarling and Alex. Stewart. A plant is now being provided and production will start within 30 days.

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Taber with Asbestos Protected Metal Co.

PITTSBURGH, PA., July 29—Melbert W. Taber, formerly manager of maintenance and construction of the Packard Motor Car Co., has been appointed manager of the Detroit office of the Asbestos Protected Metal Co., located in the Penobscot Building.

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Tay-Miller Increases Capital

PHILADELPHIA, PA., July 29—The Tay-Miller Mfg. Co., this city, has increased its capital stock to $100,000 of a par value of $10 per share. The additional capital is to provide facilities to take care of the increased business in the company's patented Hand-I-Wash combination of water, soap and towel in a compact case.

Cassidy Gets Kimball Jack Sales

Takes Long-Term Contract for World—To Expand Production at Once

NEW YORK CITY, Aug. 1—The Edward A. Cassidy Co., this city, has completed arrangements with the F. W. Mann Co., Milford, Mass., to market the Kimball ball-bearing automobile jack throughout the world on a long-term exclusive sales contract.

Plans now under way for a rapid extension of manufacturing facilities will increase production to an annual output of 150,000 Kimball jacks, and it is understood that still further extensions will be made as conditions warrant. The Kimball jack will be standard equipment on the Franklin car, the H. H. Franklin Mfg. Co. having contracted for 10,000.

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New Directors for K. C. Tire

KANSAS CITY, MO., July 28—At the annual meeting of the shareholders of the Kansas City Tire & Rubber Co., the following directors were elected for the ensuing year: P. E. Werner, F. A. Werner, W. W. Wuchter, L. J. Smith, Harry Goodman, W. R. Swissler and William Gould. A meeting of the board of directors will be held in Kansas City, and the business of organization and election of officers will be taken up thereat.

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Locomobile Gains $1,000,000 in Quarter

BRIDGEPORT, CONN., July 29—The gross value of the domestic business of the Locomobile Co. of America, this city, for the quarter ending July 30 exceeded that of the corresponding period in 1915 by about $1,000,000.

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Lee Tire Repeats Extra Dividend

CONSHOHOCKEN, PA., July 29—The Lee Tire & Rubber Corp. has declared its regular quarterly dividend of 50 cents per share and an extra dividend of 25 cents,

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.58	.58	.58	.58	.58	.58	...
Antimony	.13½	.13½	.13	.13	.13	.13	...
Beams and Channels, 100 lb.	2.67	2.67	2.67	2.67	2.67	2.67	...
Bessemer Steel, ton	40.00	40.00	40.00	40.00	40.00	40.00	...
Copper, Elec., lb.	.26½	.26½	.26½	.26½	.26½	.26½	...
Copper, Lake, lb.	.26½	.26½	.26½	.26½	.26½	.26½	...
Cottonseed Oil, bbl.	9.40	9.18	9.00	9.21	9.18	9.13	— .32
Fish Oil, Menhaden, Brown	.55	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime	1.05	1.05	1.05	1.05	1.05	1.05	...
Lead, 100 lb.	6.20	6.20	6.20	6.20	6.20	6.20	— .15
Linseed Oil	.69	.69	.69	.69	.69	.69	...
Open-Hearth Steel, ton	42.00	42.00	42.00	42.00	42.00	42.00	...
Petroleum, bbl., Kans., crude	1.45	1.45	1.45	1.45	1.35	1.35	— .10
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.50	2.50	— .10
Rapeseed Oil, refined	.92	.92	.92	.90	.90	.90	— .02
Rubber, Fine Up-River, Para	.66	.65½	.65½	.65½	.66	.66	...
Ceylon, First Latex, lb.	.56	.57½	.57½	.57½	.57½	.57½	+ .01½
Sulphuric Acid, 60 Baume	3.00	3.00	3.00	3.00	3.00	2.50	— .50
Tin, 100 lb.	38.25	38.00	38.25	38.25	38.25	38.25	...
Tire Scrap	.05½	.05½	.05½	.05½	.05½	.05½	...

both payable Sept. 1 to stock of record Aug. 15. The payment of the same was the initial dividend of 3 months ago. It is reported that net earnings for the first 6 months of 1916 amounted to approximately $300,000 or twice the amount required for dividends. The company's new factory for miscellaneous rubber business is nearly completed and operations will begin early in August.

Dividends Declared

B. F. Goodrich Co., quarterly of $1.75 per share on preferred, payable Oct. 2 to holders of record Sept. 21. Also quarterly of $1 a share on common, payable Nov. 15 to holders of record Nov. 3.

Lee Rubber & Tire Corp., quarterly of 50 cents a share and an extra of 25 cents per share, payable Sept. 1, 1916, to holders of record at the close of business Aug. 15, 1916.

Daniels Capital Now $250,000

READING, PA., July 29—The Daniels Motor Car Co., this city, manufacturers of the Daniels eight, has increased its capital stock from $100,000 to $250,000.

Salisbury Wheel Doubles Capital

JAMESTOWN, N. Y., July 29—The Salisbury Wheel & Mfg. Co., this city, has increased its capital from $500,000 to $1,000,000.

Muskegon Foundry Grows

MUSKEGON, MICH., July 26—A three-story addition, 150 by 50 ft., will be erected by the Enterprise Foundry Co.

Stock Prices Are Dull But Firm

General Motors and Packard Show Gains, But List Is Inactive

NEW YORK CITY, Aug. 1—The automobile securities, both on the exchange and the curb, reflected the general tone of the entire list practically throughout the past week, although there were some brief fluctuations, the tendency as a rule being toward lower prices, although in almost every case recoveries took place, leaving the stocks in almost the same position as at the end of last week. The only issues to show material gains were General Motors, which picked up 20 points on the common and 5% on the preferred, and Packard common which gained 7 points. Other slight gains were 1½ points for J. I. Case, 1 point for International Motor common, and 1 point for Studebaker common.

Chevrolet headed the list of losers, having dropped 8 points, while Chandler declined 3½ and Willys-Overland common lost 2⅜. Ajax Rubber, Goodyear common and Springfield Body common each lost 2. There were several other minor losses, but a good share of the issues registered no change at the end of the week.

The Stromberg Carbureter issue was over-subscribed, and while the general attitude toward automobile and allied securities was one of watchful waiting, as in the case of practically all the other stocks, there seemed to be no difficulty in disposing of these issues, although the volume of trading was small.

The characteristics of the New York market were naturally reflected in the quotations on the Detroit exchange, although no losses were shown by active stocks in Detroit, General Motors common gaining 20 and Maxwell common 4½, with Maxwell first preferred up 1½ points and the second preferred 1 point higher than last week's. Among the inactive stocks Kelsey Wheel registered a loss of 100 points.

Lower Crude Features Markets

NEW YORK CITY, Aug. 1—The automobile materials market, like the securities quotations, showed very little change this week, the most important changes being a tendency to lower gasoline prices due to the drop of 10 cents a barrel in crude and advices from London to the effect that crude rubber prices were lower, manufacturers being indifferent to offerings and the same being true of sellers. This may reflect a decreased scarcity of rubber resulting in somewhat lower prices. Cottonseed oil was weak, closing 32 cents a barrel lower than last week, while rapeseed oil was 2 cents lower. Sulphuric acid lost 50 cents and lead was 15 cents cheaper per hundred pounds. The only increase in price noted was that of 1½ cents per pound and Ceylon first latex. All the other prices remain steady.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co. (new)	..	..	62	66	—2
J. I. Case pfd	70	79	85	90	+1½
Chalmers Motor Co. com	90	92½	175	185	..
Chalmers Motor Co. pfd	96	97½	98	101	..
*Chandler Motor Car Co	..	..	104	106	—3½
Chevrolet Motor Co	..	..	208	212	—8
Fisk Rubber Co. com	..	..	..	160	..
Fisk Rubber Co. 1st pfd	..	..	114	126	..
Fisk Rubber Co. 2d pfd	..	..	120	..	..
Firestone Tire & Rub. Co. com	506	512	915	930	..
Firestone Tire & Rub. Co. pfd	109	111	111	115	..
*General Motors Co. com	177	179	500	524	+20
*General Motors Co. pfd	103	105	115½	116	+5⅛
*B. F. Goodrich com	51	53	72⅛	72¾	—1
*B. F. Goodrich pfd	103½	104½	113¼	114	+ ¼
Goodyear Tire & Rubber com	268	271	223	230	—2
Goodyear Tire & Rubber pfd	105	106½	105	108	—1
Grant Motor Car Co	..	..	9	11	..
Hupp Motor com	..	..	6½	7	..
Hupp Motor pfd	..	..	80	100	..
International Motor Co. com	15	17	6	9	+1
International Motor Co. pfd	37	42	18	25	—1
*Kelly-Springfield Tire & Rub. com	..	..	71¼	72	+1
*Kelly-Springfield Tire & Rub. 1st pfd	84½	87	95¼	97	+ ¾
Kelsey Wheel pfd	..	..	100⅛	100⅛	+ ⅛
*Lee Rubber & Tire Corp	..	..	43½	44½	—1½
*Maxwell Motor Co. com	33	34½	81¼	81½	+ ¼
*Maxwell Motor Co. 1st pfd	82	83	87	87½	— ½
*Maxwell Motor Co. 2d pfd	29	31	57	57⅞	— ¾
Miller Rubber Co. com	196	199	200	215	..
Miller Rubber Co. pfd	104	106	104	106	..
Packard Motor Car Co. com	110	115	175	185	+7
Packard Motor Car Co. pfd	..	100¼	100	104	..
Paige-Detroit Motor Car	..	..	44	47	—1
Peerless Truck & Motor Corp	..	..	22	24	—1
Perlman Rim Corp	..	..	..	..	..
Portage Rubber Co. com	36	37½	113	116	..
Portage Rubber Co. pfd	92	95	115	117	..
Regal Motor Co. pfd	..	..	17	21	..
Reo Motor Truck Co	17	18½	36¾	37¾	— ½
Reo Motor Car Co	30¾	32	42	43	—1½
Saxon Motor Car Co	..	..	74	77	—1
Springfield Body com	..	..	75	80	—2
Springfield Body pfd	..	..	116	120	..
Standard Motor Co	..	..	5	6	..
Stewart-Warner Speed. com	63	64½	102	104	—1
Stewart-Warner Speed. pfd	105	107	..	..	..
Stromberg Motor	..	..	41½	41¾	— ½
*Studebaker Corp. com	84	85	127½	127¾	+1
*Studebaker Corp. pfd	101	102½	109	111	..
Stutz Motor	..	..	64½	64½	+ ¾
Swinehart Tire & Rubber Co	88	92	85	87	..
United Motor Corp	..	..	67½	68½	—1½
*U. S. Rubber Co. com	45	46	52¼	53¼	—1⅛
*U. S. Rubber Co. pfd	101¾	103	108⅛	108⅜	+ ⅛
White Motor Co. (new)	103	108	53¼	53¾	— ⅜
*Willys-Overland Co. com	134	135½	58⅛	58⅜	—2⅜
*Willys-Overland Co. pfd	103	105	105	106	— ⅜

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid 1915	Asked 1915	Bid 1916	Asked 1916	Wk's Ch'ge
Auto Body Co.	..	..	36½	38½	..
Chalmers Motor Co. com	..	90	..	180	..
Chalmers Motor Co. pfd	95½	97½	..	103	..
Continental Motor Co. com	225	..	..	36½	..
Continental Motor Co. pfd	82	86	..	10½	..
Ford Motor Co. of Canada	1475	..	..	345	..
General Motors Co. com	176	181	490	540	+20
General Motors Co. pfd	104	106	112	116½	..
Maxwell Motor Co. com	32	35	80	82½	+4½
Maxwell Motor Co. 1st pfd	81½	84	85½	88½	+1½
Maxwell Motor Co. 2d pfd	29	31	56	59	+1
Packard Motor Car Co. com	110	115½	174	180	..
Packard Motor Car Co. pfd	..	100¼	102	104	..
Paige-Detroit Motor Car Co	..	..	44	50	..
W. K. Prudden Co	20¼	..	..	44¾	..
Reo Motor Car Co	32¼	33½	..	43¼	..
Reo Motor Truck Co	..	18	..	38	..
Studebaker Corp. com	83½	86	126	129	..
Studebaker Corp. pfd	100	103	105	..	..
C. M. Hall Lamp Co	..	..	..	31	..

INACTIVE STOCKS

Atlas Drop Forge Co	25¼	..	..	40	..
Kelsey Wheel Co	205	..	350	..	—100
Regal Motor Car Co. pfd	..	21	17	..	..

*At close July 31, 1916. Listed New York Stock Exchange. Quotations furnished by John Burnham & Co.

Indianapolis Race Sept. 9

Date Advanced from Sept. 4 Because of Conflict with Cincinnati Race Date

INDIANAPOLIS, IND., July 28—The local speedway officials have advanced the next racing date from Sept. 4 to Sept. 9 on account of the opening of the Cincinnati Speedway on that date. The Harvest Auto Racing Classic, as the event will be called, will be run in three races for cars known as non-stock and having piston displacement of 300 cu. in. or less. The races will be at 20, 50 and 100 miles.

The prize money will total $12,000. In the 20-mile event first prize is $400; second, $300; third, $200; fourth, $100. Two thousand dollars will be the amount the drivers will struggle for in the 50-mile event and will be divided as follows: $700 for first, $500 for second, $400 for third, $300 for fourth, and $100 for fifth. The 100-mile race, which may be run off as a championship event, permission having been asked the A. A. A. Contest Board, will be divided as follows: first, $3,500; second, $2,000; third, $1,200; fourth, $1,000; fifth, $600; sixth $400 and seventh $300.

19 Entries for Tacoma

TACOMA, WASH., July 31—While there is still more than a week in which to make entries in the Montamarathon and Golden Potlatch trophy 300-mile race to be held on the Tacoma Speedway, Aug. 5, indications point to a field of more than 20 starters.

The following entrants had signed July 26:

DePalma	Mercedes
Henderson	Maxwell
Chandler	Crawford
Rawlings	West Duluth Special
Moore	Peusun
Barsby	Hudson Special
Milton	Duesenberg
Frauchi	Delage
Un-named	Gandy Special
DeAlene	Duesenberg
Rickenbacher	Maxwell
DeVigne	Delage
Lewis	Crawford
Sorenson	Morse
Taft	Omar
Johnson	Crawford
Un-named	Gandy Special
O'Donnell	Hoskins Special
Price	Gandy Special

Marmon Breaks Record

(*Continued from page* 168)

The object of Mr. Stevens' trip was to demonstrate the value of good roads in quick military mobilization. Mr. Stevens is chairman of the Motor Reserve Division of the American Defense Society. The car was a Marmon stock model 34 roadster and is the privately-owned vehicle of Mr. Stevens, although the co-operation of the Nordyke & Marmon organization was afforded the car and drivers across the country.

The speed at which the car traveled may be judged from the fact that although it left New York at 1.30 a. m., it had arrived in Buffalo at 2.50 p. m. on the same day, having covered the 450.4 miles at more than 33 m.p.h. average. The car was in South Bend at 4.10 a. m. the second day and arrived at Merrillville, its nearest point to Chicago, at 7 a. m. the second day, having covered the 993 miles by the northern route in 30 hr. and 30 min. The car arrived at Omaha at 1.10 a. m. on the third day., Cheyenne at 4.50 p. m. on the third day, Salt Lake City 7.40 p. m. on the fourth day, Reno 5.30 a. m. on the fifth day.

Five Drivers

Five drivers divided the time, the greater part of the distance being driven by Mr. Stevens. The other drivers were Walter Bieling, Robert Creighton, Wm. Binz and Fred Barbour. The car was driven from New York to Syracuse by Mr. Barbour, from Syracuse to Cleveland by Mr. Stevens, Cleveland to Chicago by Mr. Binz, Chicago to Omaha by Mr. Stevens, Omaha to Cheyenne by Mr. Barbour, Cheyenne to Evanston by Mr. Stevens, Evanston to Ely by Mr. Bieling, Ely to Reno by Mr. Creighton and Reno to San Francisco by Mr. Stevens. A message was carried from Major-General Wood, commanding the Department of the East, to Major-General Murray, commanding the Department of the West.

Before the trip was started a schedule was laid out like that of a railroad timetable. This was closely adhered to until some difficulties of a mechanical nature and road irregularities were encountered toward the end of the trip. The car left Rawlins, Wyo., 35 min. behind schedule on account of muddy roads. The roads between Evanston and Salt Lake City were in bad condition and a wire from Salt Lake City reported that a torque rod socket had been broken in Parley's Canon, 16 miles from Salt Lake City. Repairs were soon made, however, and Bieling left with the car at 7.40 p. m. from Salt Lake City on July 27. Rain and washouts delayed the car just before entering Ely, and due to poor roads a broken wheel resulted along the same stretch. Due to the misguiding of a pilot 3 hr. were lost on the desert.

The trustees of the American Defense Society were keenly interested in the experiment and as chairman of the Motor Reserve Division Committee Mr. Stevens made the test directly under the auspices of this society. The drivers were under instruction not to exceed 50 m.p.h. at any time and the fact that the high average was maintained under these instructions gives a remarkable demonstration of regularity.

Pathfinder High Gear Run Ends

Twelve Crosses Continent Sealed in High—Makes 60 M.P.H. on Track

NEW YORK CITY, Aug. 1—The Pathfinder twin six which left San Diego, Cal., on July 3 to cross the continent on high gear arrived here to-day. The car was met by a delegation of Pathfinder owners and officials of the American Automobile Assn., being conducted to the Sheepshead Bay Speedway, where it was run over a measured course at 60 m.p.h. as a final demonstration.

The car was officially sealed in high gear by the A.A.A. through its representative, Al. G. Waddell of Los Angeles. The seals have been inspected frequently throughout the route by A.A.A. officials and officers of the Lincoln Highway, over which the car was operated throughout the entire distance. The mileage covered was 4921 at the completion of the mile test on the Speedway. After this it was taken to the New York agency and re-measured by officials to check up as a stock car.

Speed No Object

No attempt was made to acquire a high speed average, as the average distance traveled daily was 200 miles and no night driving, to any extent, was done. Four days were spent at various points along the trip in idleness, so that altogether the trip occupied 28 days. The car is geared 5 to 1 on high, this being the standard ratio that is sent out with cars to hilly territories.

Walter Weidely, son of George Weidely, designer of the engine employed in the car, drove practically the entire distance. He was checked in and out of every town of consequence along the way by hotel keepers, chambers of commerce, etc. The worst point along the route was Lucky Boy Mountain, Nev., where it required strenuous efforts to pull the car over on high gear. Rain was encountered at Rock Springs and Laramie.

10.2 M. P. G. Fuel

A gasoline consumption of 10.2 miles to the gallon was averaged over the route. The car carried a driver, mechanic and a number of spare parts, including a clutch and extra live axles which were never used. Two of the tires, both on the left side, had California air in them when the car arrived at New York. The right tires were changed along the route. The highest price paid for gasoline along the route was at Fish Springs, Utah, where it was 65 cents.

(*Continued from page* 169)

aging sign, for it makes plain that such contracts are not being signed merely on momentary enthusiasm or because of a type of hysteria peculiar to gatherings of the kind. Generally, careful investigation precedes the making of contracts.

That the demonstration will stimulate sales there seems no doubt. Of late, owing to a long-continued drought and to partial failure of wheat and corn crops, implement dealers and automobile men handling tractors have assumed a condition of lethargy which has not augured well for sales. In fact, sales have fallen off quite noticeably since the first of the year and tractor manufacturers look to this demonstration to bolster up the courage of dealers and to inject new life into the trade.

Stimulating Sales

The absence of rain throughout Kansas is having somewhat of a double-barreled effect. In the first place it has retarded the corn crop to such an extent that dealers state that if no rain falls within a short time fully two-thirds of their accounts will have to go over until next Spring. And in the second place it has left the ground almost stony hard where uncultivated, and given tractor manufacturers the hardest kind of plowing to do. A supplementary effect, and an altogether important one, is that no one of the tractors has failed to make good in the demonstration. Thus, farmers and dealers who would be impressed by tractor plowing under ordinary conditions are doubly impressed by the good work being done under the present adverse conditions.

It is true that during the first day of plowing many more or less tortuous furrows were plowed and that in some cases it was necessary to have as many as three men on a gang of three plow bottoms in order to get the plows in and to keep them in. But notwithstanding, this is not held against the tractors but is rather taken as an indication of their ability; for it is realized that horseflesh *could not* plow under similar conditions —that is, without at least four horses to a bottom instead of the usual two.

Make Dynamometer Tests

This year, tractor manufacturers and those who view the demonstrations have a definite means of knowing exactly how much work a tractor must do to pull its plows. Each morning, before the plowing is started dynamometer tests are made to ascertain the average draft per plow bottom in various parts of the field. These figures, obtained with a hydrostatic dynamometer developed and operated by the Hyatt Roller Bearing Co., are then posted at the test furrow where they are obtained. Knowing the power of the tractor, which is displayed

Tractors Make Hit in Kansas

on a sign carried by the machine, and the number of plow bottoms pulled, spectators can then refer to the test draft figures and make allowance, if necessary, for the condition of this part of the field. The average draft per bottom on Tuesday, the first day, was 710 lb. However, the draft varied widely over various parts of the field, some spots being almost stony hard and very dry and other parts being quite sticky.

The character of the soil is quite different from that in Texas and moldboard plows are used almost exclusively. It is admitted that better results might be obtained, at least insofar as the tractors are concerned, if disk plows were used, but Kansans are wedded to moldboards and they are used in the demonstration for this reason. In Texas it is almost impossible to use a moldboard because it will not scour, due to the sticky soil.

Value of Deep Plowing

Does Kansas need the tractor? Will the tractor prove a success in Kansas? These two questions are perhaps best answered by referring to the work done a year ago in the demonstration. But first let us examine conditions in Kansas up to about a month or two ago. There had been exceedingly heavy rains, so heavy in fact that in the great wheat belt the land was left soggy and entirely full of water. This naturally retarded the wheat. Subsequently there has been a month-long drougbt which has dried out that water very quickly and left the ground very hard. The net effect has been that whereas Kansas had a banner year last year, getting an average of nearly 30 bu. of wheat to the acre, this year's average is expected to be between 6 and 9 bu. an acre.

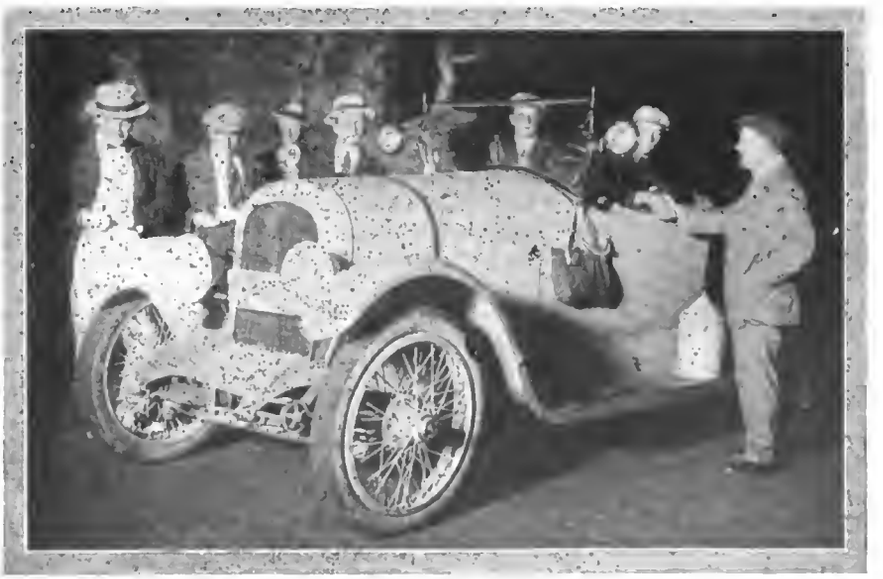
Now examine into what the tractors did last year.

The field that was plowed last year in the demonstration already has yielded an average of 24½ bu. of wheat to the acre as against the figure of 6 to 9 bu. for adjoining fields.

What better argument could be wanted for the genuine need of the tractor in Kansas? Why this great difference, you say? Briefly stated, the reason is deeper plowing made possible by the tractor.

The Kansas farms which this year are yielding only between 6 and 9 bu. of wheat per acre were plowed only between 5 and 6 in. deep last year. The demonstration field that has given a crop of 24½ bu. to the acre was plowed to a depth of 9 to 10 in.

In short this has proved a great object lesson on tbe benefits of deep plowing in Kansas. It has shown farmers and dealers that deep plowing not only provides for excessive rain by permitting the ground to soak it up, but that it provides equally as well for drought by permitting the ground to give up this stored moisture when it is needed. Not all land can be economically plowed as deep as this. Where there is a layer of clay beneath the top soil it may prove detrimental to throw this up over the good soil. For example, the United States Department of Agriculture experimental station in Texas has demonstrated that 7 in. is about the proper depth for Texas. This department has compiled figures on nearly every farmed area in the country and the figures are easily available. But they are not always as easily lived up to unless the



The record-breaking Marmon. Left to right—H. H. Wagner, Binghamton Motor Car Co.; A. G. Faulkner, Los Angeles agent; Dr. Brown, Philadelphia; Arthur Schaefer (former N. Y. Giant baseball player); J. W. Newman, mechanic; Fred Barbour, driver; and F. E. Moskovics, commercial manager Nordyke & Marmon Co.

plowing is done with a practical tractor.

This city has been admirably chosen as the scene of the Kansas demonstration. Reno county is virtually the center of the great Kansas wheat belt. Within a circle having a radius of 75 miles and having its center at Hutchinson there is grown fully 65 per cent of the Kansas wheat production and 42 per cent of its corn. Also, one-third of the population of the State is in this area.

Reno county itself last year averaged between 20 and 30 bu. of wheat to the acre but this year the average will fall below 9 bu. in the estimation of crop experts. Farther west in the State, however, conditions are more nearly normal. Corn has suffered to such an extent that the crop will be from one-third to one-half of last year's.

Kansas is one of the few States which have made a census of their farm tractor users, though the figures are not strictly accurate owing to the difficulty of getting returns and because of the constant influx of new machines. The census shows that Kansas had about 2500 tractors at the first of this year but that number may have increased to 3500 and in the estimation of quite a few probably has done so.

It is difficult to estimate, or even to guess, how many tractors Kansas will absorb this year. What with poor crops and poor tractor sales last year dealers are not inclined to be optimistic.

Gasoline is used here to a slightly greater extent than was the case in Texas. Strictly speaking, however, it is not gasoline, but is better styled naphtha. Gasoline here is defined as having a gravity higher than 58. Gasoline tractors, however, are burning fuel which measures about 57.3 Baumé. This fuel costs 18.3 cents per gallon. Kerosene measures about 44 and is selling this week for 7.3 cents.

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G. M. C.—121,113 Cars

(*Continued from page* 167)

being taken. Officers of the company say that the prospects for the new season are better than they ever were and they believe 1917 will show a similar big increase in business, as did the present year compared to the previous one.

Collins Elected to Board

NEW YORK CITY, July 28—At a meeting of the board of directors of the General Motors Co. yesterday R. H. Collins, Flint, Mich., was elected a director to fill the vacancy caused by the resignation of Thomas Neal of Detroit. Mr. Collins has been general sales manager of the Buick Motor Co. Mr. Neal, who was also a vice-president of the General Motors Co., withdrew because it is said he desires to give all his attention to the Signal-Commerce Motor Truck Co., of which he became the active head when the Signal and Commerce companies were merged.

There have been quite a number of changes on the board of directors of the General Motors Co. during the past few months. At the present time the members of the board are the following: F. L. Belin, J. H. McClement, W. C. Durant, J. S. Haskell, L. G. Kaufman, Charles S. Sabin and A. H. Wiggin, New York City; Pierre S. du Pont and J. J. Raskob, Wilmington, Del.; W. L. Day and F. W. Warner, Pontiac, Mich.; W. C. Leland, Detroit; A. G. Bishop, W. P. Chrysler, R. H. Collins, C. S. Mott and C. W. Nash, Flint, Mich.

—

Ford Prices Cut 18%

(*Continued from page* 167)

April, 1913. At the present time the facilities permit of a daily output of 2000.

In 1912 the prices of the Ford cars were $600 for the touring car and $525 for the roadster. These were reduced to $550 for the touring and $500 for the roadster on Aug. 1, 1913. On the first of August, 1914, the Ford company announced another cut in prices and the touring car was brought down to $490 and the roadster to $440. In addition it was promised that should the company sell 300,000 cars before Aug. 1, 1915, a profit-sharing rebate would be given to each purchaser. As this production was more than reached, the Ford company paid out over $15,000,000 in rebates to car buyers, or $50 per car. In June of 1914, a big cut on Ford parts was made, prices for these being lowered from 10 to 25 per cent.

Starting with Aug. 1, 1915, the prices of Fords were cut another $50 per car, bringing the touring model to $440 and the roadster to $390. These prices have prevailed up to the present time and will be changed when the new announcement takes effect on Aug. 1. There was a mid-year reduction on Ford closed cars in November, 1915, which materially lowered the prices on some of these models. The sedan, which was formerly $975, was cut to $740. This price has again been lowered and is now $645. To put the reductions for the last four years in a nutshell, the touring car which was priced at $600 in 1912 will sell for $360 for 1916.

Canadian Ford Prices Lower

FORD, ONT., July 31—The Ford Motor Co. of Canada, Ltd., has reduced the price on its 1917 cars from $5 to $35. The new prices which go into effect Aug. 1 are as follows: Runabout $475 instead of $480; touring car, $495 instead of $530; coupelet, $695 instead of $730. The town car and the sedan will sell respectively at $780 and $890 as during the present season. The price of the chassis alone will be $450. Officials of the company say that the fiscal year ending to-day has been much better than they had anticipated. For the season 1917 the output is expected to be about 60,000 cars, or at least 20,000 more than were built and sold during the fiscal year 1916.

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Elgin Capital Now $3,500,000

CHICAGO, ILL., Aug. 2—The Elgin Motor Car Corp., this city, has increased its capital from $1,000,000 to $3,500,000. This is in line with the concern's policy of expansion. The Elgin corporation recently took over the New Era Motor Car Co., Joliet, Ill.

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Victor Rubber Capital $750,000

SPRINGFIELD, OHIO, July 28—At a recent meeting of the board of directors of the Victor Rubber Co., this city, it was voted to increase the capital stock of the company from $300,000 to $750,000 in order to provide facilities to double the production of pneumatic tires.

A 100 per cent stock dividend on the common stock was declared, this having been made possible by the company's earnings last year.

—

Caples Goes to Overland

TOLEDO, OHIO, July 29—R. C. Caples has resigned as general traffic manager of the Western Maryland Railway to become associated in a confidential position with John N. Willys, president of the Willys-Overland Co., this city.

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Pullman Dealers in Convention

YORK, PA., July 29—Wholesale and retail dealers of the Pullman Motor Car Co., from this country and abroad to the number of 125 assembled here this week to attend the annual dealers' convention July 27, 28 and 29. Prospects for 1917 were discussed and the new Pullman models were thoroughly examined. Special entertainment features were provided by the Pullman Motor Car Co. and the York Motor Car Co. H. W. Hayden, Pullman general manager, presided at the business sessions.

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Swinehart Recalled to Republic Plant

YOUNGSTOWN, OHIO, July 29—B. C. Swinehart, for the past 3 years manager of the Philadelphia branch of the Republic Rubber Co., has been recalled to the main factory of the Republic company at Youngstown, where he will take charge of the solid tire sales.

H. D. Worthington, assistant manager of the Philadelphia branch, succeeds Mr. Swinehart as manager.

Factory Miscellany

New Building for Lee Tire—The Lee Tire & Rubber Co., Conshohocken, Pa., has placed a contract for another building at its Conshohocken plant.

On the general floor of this building will be installed the necessary large dipping tanks used in the manufacture of rubber gloves, etc., the object being to take this part of the industry out of the main plant and provide considerable additional space for the manufacture of tires. By the erection of a separate building somewhat removed from the others the serious fire menace caused by the gasoline-laden atmosphere around the dipping tanks will no longer threaten more than the contents of this one structure.

The building measures 80 by 120 ft. in plan and will for the present contain but two stories. The foundations and reinforced concrete columns on the first floor are designed, however, for several additional stories.

To Concentrate on Accessories—The Peters & Heron Dash Co., Columbus, Ohio, engaged in the manufacture of dashes and other vehicle parts, has sold its dash business to the McKinnon Dash Co. of Buffalo and Troy, Ohio, for the purpose of devoting its entire attention to the manufacture of dimmers, robes, top covers and other accessories.

Bowser Mutual Benefit Assn. Formed—The S. F. Bowser Oil Tank & Pump Works of Fort Wayne, which some time ago promised its employees $10,000 to start a mutual benefit association when the plans for the organization had been made by the employees, made good its promise in a most substantial way when 10,000 silver dollars were turned over to the treasurer of the newly-organized Bowser Mutual Benefit Assn. The plan is $40 per month will be paid a member unable to work on account of illness or accident; survivors of an employee who dies will receive $125 for burial expenses and $25 per month for 3 years; old age pension will be $30 per month.

Jackson-Church-Wilcox Adds—The Jackson-Church-Wilcox Co., Saginaw, Mich., manufacturer of the Jacox steering gear, has announced an addition to its plant on North Hamilton Street, work on which will begin at once.

The new addition, which will be of brick, one-story, and 120 by 208 ft., will practically double the output of the concern. Eight hundred men will be given employment in the enlarged plant, which in its entirety will cover nearly two city blocks. With the proposed addition the next year's production of the company is expected to reach the half-million mark.

Sparks-Withington Doubles Capacity—Additions to the plants of the Sparks-Withington Co., Jackson, Mich., maker of the Sparton horn, are well under way and when completed will practically double the size and production possibilities of the big factory. Paralleling the older plant, the new factory is 70 by 334 ft.; half being two stories and the rest one story. It is to be made of white brick and steel, and will be modern in every way. Much of the additional space will be devoted to radiator manufacture, it is stated. At present the factory is behind in its orders, though working 24 hr. a day.

Electric Storage Battery Adds—The Electric Storage Battery Co., Philadelphia, Pa., has bought forty-four dwellings near Nineteenth Street and Allegheny Avenue. The main office and plant are on the south side of Allegheny Avenue and Nineteenth Street. It is understood that several large additions to the company's plant will be built in the near future on the property acquired.

Robinson Machine Buys Ground—The Robinson Machine Co., Ecorse, Mich., has purchased a piece of ground west of Mill Street, where a factory will be erected to manufacture its new Truckford, for converting a Ford car into a 1-ton truck. Fifty men will be employed.

Ford Service in Yonkers—The Ford Motor Co., Detroit, Mich., will build a $100,000 service plant at South Broadway, Herriot and New Main Streets, Yonkers, N. Y. The structure will be used as a distribution center.

The Automobile Calendar

ASSOCIATIONS

Aug. 15—Metropolitan Section, S. A. E. Meeting at Automobile Club of America. Subject, "South America."

Aug. 28-Sept. 1—Milwaukee, Wis., Booster Tour of Milwaukee Automobile Dealers.

Sept.—Indianapolis. Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.

Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.

Dec. 2-9—Electricians' Country-wide Celebration.

CONTESTS

Aug. 5—Tacoma Speedway Race, Tacoma Speedway Association.

Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.

Aug. 12—Portland, Ore., Track Race, Hiller-Riegel Co.

Aug. 18-19—Elgin Road Race, Chicago Auto Club.

Aug. 26—Kalamazoo, Mich., 160-Mile Track Race.

Sept. 1-2—New York, N. Y., Sheepshead Bay Speedway, 24-Hour Race, Trade Racing Assn.

Sept. 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.

Sept. 4—Cincinnati, Ohio, Speedway, Cincinnati Speedway Co.

Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.

Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.

Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.

Sept. 9—Indianapolis Speedway Race.

Sept. 16—Providence Speedway Race.

Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.

Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.

Sept. 30 — New York City, Sheepshead Bay Speedway Race.

Oct. 7—Philadelphia Speedway Race.

Oct. 7—Omaha Speedway Race.

Oct. 14 — Chicago Speedway Race.

Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.

Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.

Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

SHOWS

Aug. 2-9—Hollywood and West End, N. J., Show, Atlantic Exhibition Co.

Sept. 2-9—Cleveland, Ohio, Show, Industrial Exposition and Fair, Edgewater Park.

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.

Sept. 4-8 — Hartford, Conn., Show, Connecticut Fair Assn.

Sept. 4-11 — Indianapolis, Ind., Show, Indiana State Fair, Indianapolis Automobile Trade Assn.

Sept. 10-16 — Milwaukee, Wis., Show, Wisconsin State Fair, Machinery Bldg.

Oct. 14-31 — Dallas, Texas, Show, State Fair.

Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 13-20 — Montreal, Que., Show, Montreal Automobile Trade Assn.

Jan. 27-Feb. 3, 1917 — Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb.—St. Louis, Mo., Show, Auto Manufacturers and Dealers' Assn.

TRACTOR

July 24-28 — Hutchinson, Kan., Tractor Demonstration.

July 31-Aug. 4—St. Louis, Mo., Tractor Demonstration.

Aug. 7-11—Fremont, Neb., Tractor Demonstration.

Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.

Aug. 21-25—Bloomington, Ill., Tractor Demonstration.

Aug. 28-Sept. 1—Indiana Tractor Demonstration.

Sept. 4-8—Madison, Wis., Tractor Demonstration.

Sept. 11-16 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Week in the Industry

Wisconsin News Items—E. A. Hatfield, for 5 years assistant secretary and director of sales of the Bain Wagon Co., Kenosha, has resigned to become the leading spirit in the organization of the Mississippi Valley Motor Car Co., with headquarters in St. Louis. The company will act as distributor of Oakland cars in the Mississippi Valley, the territory including the states of Louisiana, Mississippi, Arkansas, southern Illinois, eastern Missouri, western Kentucky, Tennessee and some other tributary territory. Associated with Mr. Hatfield in the project is F. W. A. Vesper, St. Louis, who has been Buick distributor in St. Louis and vicinity for some time.

The University Supply Co., 468 Jefferson Street, Milwaukee, Wis., has been appointed distributor of Hardman tires. H. B. Gehring is general manager.

It is reported on excellent authority that the Overland Wisconsin Co., Milwaukee, owned by George W. Browne, and state distributor of Overland and Willys-Knight cars, will soon establish a large branch house and service station for the benefit of the northern Wisconsin territory, at Wausau, Wis. The company has taken an option on a site, 60 by 120 ft., at First and McIndoe Streets, Wausau, and proposes to erect a 4-story building of that size. The investment will be about $50,000. It is stated that W. R. Stelling, Fort Atkinson, Wis., will have charge as branch manager.

The Auto Service & Supply Co., Milwaukee, specializing in Vesta batteries, has moved to new and larger quarters at 207 Fourth Street. Carl Aken has taken a financial interest and is vice-president and secretary of the concern.

The Marion Sales Co., Milwaukee, representing the Marion in Wisconsin, has granted the Stutz Motor Car Co. of Milwaukee the right to retail Marion cars in the city of Milwaukee and environs.

The Diener-Nelson Co., 188 Eighth Street, Milwaukee, distributor of the Haynes and Grant Six, has taken possession of its new quarters in the Hippodrome building, 612-623 Wells Street.

The Auto Service & Supply Co., 207 Fourth Street, Milwaukee, announces that Carl Aken, Jr., has been placed in charge of its storage battery service department. Mr. Aken has had several years of experience with storage batteries and formerly conducted the Aken Battery Co., Milwaukee, representing the Gould battery. The Auto Service & Supply Co. is distributor in a large territory of Vesta batteries and other products.

Trade Happenings

The J. H. Ryan Motor Truck Co., Madison, Wis., state agent of the Diamond T truck, has established a branch salesroom and service station at 495 Broadway, Milwaukee. The entire state territory will actually be handled from the new Milwaukee branch, and J. H. Ryan has moved from Madison to Milwaukee to take personal charge.

The Western Motor Supply Co., 408 Jefferson Street, Milwaukee, wholesaler, jobber and retailer of supplies and accessories and Quaker tires, has added a storage battery department, in charge of Charles Warner. The new department will make a feature of U. S. L. batteries and systems. Mr. Warner has specialized in electric storage battery work for more than 6 years.

Philadelphia Items—E. W. Burnshaw, Jr., recently in charge of the wholesale department of the Girard Automobile Co., 2314 Chestnut Street, distributor for Peerless cars and trucks, has been promoted to general manager of the company.

W. P. Herbert, Chandler dealer at Broad and Race Streets, has incorporated the business with the addition of W. G. Herbert and R. W. Cook. Mr. Herbert is president; Mr. Cook, vice-president and general manager, and W. G. Herbert, secretary and treasurer.

Mountain Trade — The Automobile Sales Corp., Denver, Studebaker and Franklin distributor for Colorado and Wyoming, has moved from 1509 Cheyenne Place to 1520 Broadway.

The C-B Auto Service Co., Denver, has opened a Moore distributing agency for Colorado at 1439 Cleveland Place.

The Maines-Hough Motor Co., Denver, Chevrolet, Monroe and Mitchell distributors for Colorado and Wyoming, with sales and service station at 439 Broadway, has given up the Mitchell and is handling the other two lines exclusively.

J. M. Scoville, Fort Morgan, Col., has secured the Chalmers agency for Morgan County.

The Denver Tire Service, Inc., Denver, United States tire distributor for Colorado and Wyoming, with salesroom and service station at 215-217 Sixteenth Street, is now managed by J. A. Payment, formerly manager of the Quick Service Tire Co., distributor of Quaker tires.

The George H. Estabrook Auto Co., Denver, Briscoe and Hollier distributor for Colorado and Wyoming, has secured the McGraw tire distributing agency for the same territory. The general salesroom is located at 1646 Broadway.

The Chamberlain-Woods Motor Sales Co., Denver, the new firm name of the Hupp Motor Sales Co., Hupmobile and Locomobile distributor for Colorado and Wyoming, has added the Dort distributing agency for the same territory.

F. P. Van Sickle, Denver, has opened a Colorado, Wyoming and Utah distributing agency for the Aurora demountable truck at 1608 Broadway.

Willys-Overland, Inc., Denver Branch, Denver, is the name of a factory sales and service branch just opened at Fifteenth Street and Cheyenne Place to handle the Rocky Mountain territory. The new concern will be managed by C. C. Eib, formerly general manager for J. W. Leavitt & Co., San Francisco, Overland and Willys-Knight distributor for the entire Pacific coast. The new branch will supply all of Colorado and part of Wyoming, Utah, Idaho and New Mexico.

H. G. Wimbush, Denver, formerly vice-president of the Motor Sales Co., a Ford time-payment concern, has secured the Mitchell distributing agency for Colorado and Wyoming and opened a salesroom in the new Fisk Building, Broadway and East Twelfth Avenue.

The Colorado Motor Car Co., Denver, Col., Saxon and Reo distributor for Colorado and Wyoming, has given up the Cole and Saxon and is arranging to move the Reo headquarters from 1520 Broadway into another location.

The J. S. Morrison Auto Co., Denver, Oakland distributor for Colorado and Wyoming, has taken on the Allen distributing agency for the same territory. The salesroom is at 1528 Broadway

The Mid-West Auto Sales Co., Denver, King and Wichita truck distributor for Colorado and Wyoming, has given up the King and secured the distributing agency for the same territory for the Paterson light six and the Ross eight, and the Colorado territory for the Twin Bed trailer.

The Quick Service Tire Co., Denver, local agency for Quaker tires, which was formerly managed by J. A. Payment, is now handled directly by the Boss Rubber Co., 1548 Broadway, which has added the Quaker to its Kelly-Springfield tire distribution for Colorado, Wyoming and New Mexico.

The AUTOMOBILE

Vol. XXXV
No. 6

NEW YORK, AUGUST 10, 1916

Ten cents a copy
Three dollars a year

Stewart

Vacuum System

4,000 a Day

That is the present production of Stewart Vacuum Tanks.

And only the surface has been scratched.

Dealers who make it a point to install Stewart Vacuum Tanks can do a very easy and profitable business.

"No car is better than its accessories"

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

$10

The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, AUGUST 10, 1916—CHICAGO No. 6

77,496 Cars Exported in Year

$97,464,381 Worth of American-Made Cars and Trucks Go Abroad

U. S. A. AUTOMOBILE EXPORTS
Fiscal Year 1916

	Vehicles
Europe	35,280
Canada	10,403
Australia	7,278
South America	6,725
Asia and Oceania	54,096
West Indies	46,058
Other countries	40,053
Mexico	434

LEADING COUNTRIES THAT IMPORTED U. S. A. CARS IN 1916 FISCAL YEAR

	Cars
United Kingdom	18,428
Canada	10,043
France	7,768
Australia	7,378
Oceania and Asia	5,496
Russia	5,177
West Indies and Bermudas	46,056
Argentine	4,444
Denmark	847
Chile	843
Venezuela	524
Mexico	434
Italy	387
Brazil	283
South America, remainder	631
Other countries	40,053

WASHINGTON, D. C., Aug. 8—The United States exported 77,496 automobiles and motor trucks during the 1916 fiscal year which ended June 30. These cars represent a total value of nearly $100,000,000, or, to be precise, $97,464,381. During the 1915 fiscal year 37,876 motor vehicles worth $60,254,635 were exported.

In spite of the war Europe continues to be the heavy consumer of U. S. A. automobiles, buying, all told, 35,280 during the year, or 2.7 per cent of the total output. Canada has been the second greatest customer, purchasing 10,403 machines, which is more than twice as many as she bought from us during the preceding year.

Australia as a continent takes third position in purchasing our cars, buying during the year 7378. So steadily has the Australian business developed during the past year that for the first time the government has given a separate classification to it. Heretofore Australian figures were included with those of Asia and Oceania.

(*Continued page* 247)

Reo Six Price $100 Lower

LANSING, MICH., Aug. 5—The Reo Motor Car Co., this city, has lowered the price of its six-cylinder car $100 and has added two inclosed bodies to its line for 1917. The six now sells for $1,150, and like the four, which still sells at $875, it is unchanged except for minor refinements. The new bodies are an inclosed type for the four with which it sells for $1,025 and a sedan body for the six, this car listing at $1,750.

The Reo Motor Truck Co. has reduced the price of its 1500-lb. model to $1,000, a decrease of $75 and is continuing its 2-tonner at $1,650, the same price as for 1916.

Ford 1-Ton Worm Drive Truck

200,000 Output Planned for Vehicle to Sell at About $500

DETROIT, MICH., Aug. 5—Some time during next fall the Ford 1-ton worm-drive truck is expected to be ready for delivery. Demonstrators are expected to in the hands of Ford distributors or agents within the next few months.

What the price will be at which the Ford Motor Co. will sell this truck, officials claim not to know themselves, as it has not yet been decided; they say. It was stated from other sources that the price will be around $500, possibly a bit lower than this, and that it is expected that 200,000 of these trucks will be made during the first year.

Gasoline Price Down 1 Cent

Lower Rates Prevail in Many Sections Due to Cheaper Crude

NEW YORK CITY, Aug. 7—Gasoline is 1 cent per gallon lower all over the country. Reports from such scattered points as Dallas, Tex.; Columbus, Ohio; Boston, Mass.; Cleveland, Ohio; and New York City, all bear out the reduction. The primary cause is the fall off in crude prices which have dropped 5 to 10 cents a barrel in the past week. Chicago and St. Louis report the only exceptions to the general reduction.

For the first time in several years Dallas, Tex., is enjoying 18 cent gasoline, prices having been all the way up to 22. Throughout the middle West, including Ohio, Indiana, and Illinois and in New York and neighboring States, the price of gasoline is 23 cents per gallon in place of 24 last week. In Boston prices are 1 cent higher, being 24, a reduction of 1 cent from the 25 charged for the past few months.

The Gulf Refining Co. made the reduction general and the Standard Oil Co. reduced only in New York, Brooklyn and Connecticut, the S. O. New Jersey price remaining 22 cents. The Texas Co. has not made reductions in New York, Brooklyn or Connecticut as yet though the New Jersey price has been reduced 1 cent to 22 cents. The Crew-Levick Co. has not changed its figure of 24 cents. Retail prices vary from 24 cents to 26 cents.

In Boston, the Standard Oil Co. yesterday reduced the wholesale price 1 cent to 24 cents, the retail price being 26 cents.

Chicago reports no change in price and no immediate prospect of a change.

The reduction is ascribed to the

(*Continued on page* 249)

533,921 Fords Built in 1 Year

225,708 More Made in 1916 than in 1915—Worth $235,000,000

FORD HISTORY IN FIGURES

Total output 13 years, 1,406,997 cars

Ford Motor Co., organized June 16, 1903.
Employed 311 men first year.
Capital stock in 1903, $100,000.
Capital stock in 1916, $2,000,000.
Number of men employed in 1916, 31,035.

Year	Cars Made and Sold	Increase or Decrease	Daily Average
1903-1904.	1,708	.....	5
1905.....	1,695	— 13	5
1906.....	1,599	— 96	5
1907.....	8,423	+ 6,824	28
1908.....	6,398	— 2,025	21
1909.....	10,607	+ 3,209	35
1910.....	18,664	+ 8,057	62
1911.....	34,466	+ 15,802	115
1912.....	68,544	+ 30,078	228
1913.....164,452		+ 95,908	545
1914.....248,307		+ 83,855	827
1915.....308,213		+ 59,906	1,027
1916.....533,921		+225,708	*1,816

Largest one-day output, 2,430 cars, Feb. 29, 1916.
Sales value of 1916 output, minimum, $235,000,000.
Sales value of 1903-1904 output, less than $2,500,000.
Expected output of 1917, minimum, 750,000 cars.
The Ford Motor Co., in June, 1915, announced that it will increase its capital stock to $100,000,000, but as the laws of the State of Michigan do not allow such a large capitalization and as the Ford company did not want to incorporate in another state, the present capital stock of the company is still $2,000,000.

*The average daily output is based upon 300 working days, except for 1916, where the actual number was furnished by the company as 296.

DETROIT, MICH., Aug. 7—Ford built 533,921 cars during the 12 months beginning Aug. 1, 1915, and ending July 31, 1916, the company's fiscal year. This is 225,708 more Fords than were made during the 1915 fiscal year, when 308,213 cars were completed.

There were 296 actual working days at the Ford plant during which the 1916 output was turned out, so that the number of cars made daily was 1,816 as compared with 1,027 in 1915 and 827 the previous year. Many a day during the past season more than 2000 cars were made, the record day being Feb. 29, when 2430 cars were completed and shipped.

Figured in dollars, the 1916 Ford output represents a minimum of $235,000,000. It is probably several millions higher, but this figure is conservative.

Including all models made since starting to make Fords the total number of cars built and sold by the Ford Motor Co., to July 31, 1916, was 1,406,997.

Up to a few years ago a large percentage of the Ford production came from the Detroit plant. In recent years the Detroit plant has been used especially in making the parts for the assembling of the cars and the assembling plants throughout the country were the actual builders of the cars. In other words, most of the Ford cars are now assembled in the assembling plants from the parts made here in Detroit. Within a year or two at the most not a single complete Ford car will be made here at the Highland Park works.

The principal reason why Ford is able to sell his cars at such low prices is because every year the production is placed upon a greater efficiency basis. There are many instances, where according to a Ford shop foreman, men increased their output 100 per cent within 2 years or less, on the same machine, simply by working on a more systematic basis.

There is no doubt even now, a year ahead, that for the season 1917 Ford prices will again be reduced in a surprising way. Officials will not speak of this, but the fact that the big plant is expected to be trebled within the next few months, that probably 15,000 to 20,000 men will be added to the working force here sometime this coming winter, that most all the machinery and tools for the plant additions have been ordered long ago and part already delivered, or at any rate stored, seems to make the suggestion of a Ford dealer that the car will soon be selling at $250 quite possible.

Canadian Ford Ships 32,646

FORD, ONT., Aug. 5—Nearly double the amount of Ford cars was shipped from the Ford Motor Co. of Canada in the fiscal year ending July 31 compared with the previous year. Total number shipped in the 1915-1916 year was 32,646, March being the greatest month with 4500 cars from the Ontario plant. The largest single day's output was on March 29, when 312 cars were shipped. It is estimated that the shipments for the next year will reach 60,000.

Durant Denies $700 Eight Report

NEW YORK CITY, Aug. 8—W. C. Durant, president of the Chevrolet Motor Co., has gone on record as denying the intention of the company to put out a $700 eight. The report was published widely in the press of the country and it was also stated that a big cut in price was to follow the Ford announcement. This has also been denied categorically.

It is well-known that the Chevrolet company has been developing an eight-cylinder car for some months, and no denial of this has been made by the company. It is well understood, however, by those who have followed the plans of the company closely that this will be priced at considerably above the figure given and very likely at from $1,100 to $1,200. The present prices of the Chevrolet cars are $490 for the little four and $750 for the larger one.

W. C. Sills, treasurer, states that the company had on hand Aug. 1 cash and securities in excess of $25,000,000.

French Adopt Uniform Carbureter

Army Fits American Trucks with Claudels—Soldier Drivers Waste Fuel

PARIS, Fr., July 12.—Dissatisfied with the gasoline consumption of many American trucks, the French army automobile authorities have decided to adopt a uniform type of French carbureter. The first batch of trucks to be changed comprise 700 Reos; these will be followed by all the Jefferies, then by Pierce-Arrows. For more than 6 months there have been complaints that gas consumption was too high. This was due, in many cases, as the American factory representatives in France were able to prove, to incorrect carbureter setting and poor driving. Nevertheless, the authorities were of the opinion that considerable economy could be effected in the amount of gas consumed by army trucks.

One French carbureter manufacturer offered to replace the whole of the carbureters on American trucks with his instruments and accept as payment half the price of gasoline saved. This offer was not accepted, but the authorities ordered careful records to be made of mileage and consumption for every truck and convoy in army service. These statistics have been compiled over a period of several months, and are the most elaborate of any got together by any truck users. The comparative diagrams show the gas consumption for a given period of all Pierce-Arrow, Packard, Velie, White, Jeffery, Kelly and Reo trucks. A feature of these diagrams is the wide divergence between trucks of a different make but a common load capacity. A more curious case is that for one of these makes the gas consumption of the 5-ton model is only a fraction higher than that of the 3-ton type. This is attributed to poorly proportioned gear ratios.

Claudel Wins Competition

When this data had been secured, the authorities held a competition among French carbureter manufacturers. Three firms took part, Claudel, Zenith and Solex. The winner was Claudel, who was given the initial order to replace the carbureters on the Reos. Statistics showed that the 3½-ton Reo was consuming 52 liters per 100 kilometers (4.52 miles to the gallon). With the Claudel and other European carbureters the figures given out are 30 to 32 liters per 100 kilometers (32 liters are equivalent to 7.36 miles per gallon). Results with the 3½-ton Sterling were practically the same, the consumption being dropped from 51-52

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I. A. L. Barred from U. S. Mails

I. A. L. Tire Co. Also Included In Charge of Using False Pretenses

WASHINGTON, D. C., Aug. 3—The International Automobile League, Inc., and the International Automobile League Tire Co., of Buffalo, N. Y., have been barred from the use of the mails by a fraud order issued to-day authorized by Postmaster-General Burleson. It is charged that A. C. Bidwell is engaged in obtaining money through the mails under false pretenses under these names. Bidwell was arrested in June by Federal authorities upon the complaint of Richard H. Lee, of Cleveland, chairman of the legislative committee of the American Automobile Assn., who charged that the league was obtaining money in exchange for services it was unable to render, automobile owners, garagemen, car and accessory dealers being the victims of this policy.

Agents of the league have been arrested on the charge of obtaining money under false pretenses in several sections of this country and also in Canada.

The hearings on this case before the solicitor for the Post Office Department began on March 25 and consumed in all 46 days. In his memorandum to the postmaster-general with reference to this case, the solicitor says:

"The International Automobile League is a corporation practically all of the stock of which is owned by one Alfred C. Bidwell, its president, by whom the corporation is absolutely controlled. Under his own name as president he signs letters, receives mail, and uses the post office establishment substantially to the same extent as he does under the name of the corporation. The league undertakes 'to furnish each member automobile tires and supplies, which it may be able to obtain, at dealers', jobbers', or manufacturers' prices, to maintain without expense to the member a home office, and to mail quotations from time to time.' Membership, so-called, costs $10 per year in advance where the member owns but one automobile, and $5 per year additional in advance for each automobile in excess of one owned.

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Flanagan Heads Pyrene Sales Dept.

NEW YORK CITY, Aug. 7—The Pyrene Mfg. Co. has appointed a 25-year-old man as sales manager. T. F. Flanagan has succeeded to the chair just left vacant by C. L. Allen, who is now the company's president. Four years ago Mr. Flanagan was business manager of a college paper. Following his graduation from Trinity College in Hartford, Conn., he entered the service of an advertising agency and later became advertising manager of the C. J. Tagliabue Mfg. Co. He remained there as sales manager until 14 months ago, when he entered the Pyrene company as assistant advertising manager.

Chase To Add 3-Tonner

SYRACUSE, N. Y., Aug. 5—The Chase Motor Truck Co. will shortly announce Model X, a 3-ton, worm-drive job to retail at $2,800, equipped with cab. This new model will round out a line of trucks of ¾, 1, 1½, 3 and 3½ ton capacities.

Hollier To Add a Six

CHELSEA, MICH., Aug. 8—The Lewis Spring & Axle Co., which has heretofore made only the Hollier 8, will build a six for the coming season in addition to the eight. It will sell at $1,085 with either a five-passenger touring or a four-passenger roadster body. It will have left drive, cantilever rear springs, floating axle, valve-in-head block motor, 3 by 1¼ in., 116-in. wheelbase, wood wheels and 33 by 4 in. non-skid tires.

Adrian Castings Plant Burned

ADRIAN, MICH., Aug. 3—The Adrian Steel Castings Co. was practically all destroyed by fire to-night, caused by spontaneous combustion. A new plant is to be erected at once.

Chalmers Assets Gain 50 Per Cent

DETROIT, MICH., Aug. 3—Chalmers assets have increased by 50 per cent in the last year. Preliminary statements made regarding business during the 1916 fiscal year which ended June 30 show a gain in total assets of $4,857,274, the total now being $13,051,538.

The surplus totaled $2,066,673.88 instead of $1,010,422 in 1915. Cash on hand and in banks showed a decrease totaling $564,746.64 instead of $1,173,135.

Among the assets, plant and equipment and buildings, machinery, etc., are given as $3,184,278.01, as compared with $2,215,813 last year. Investment in stocks shows a total of $409,740.53; investment in sales branches, $120,961.80.

Among the current liabilities, notes payable, merchandise accounts, deposits on dealers' contracts and accrued accounts, total $4,268,006.53. Liabilities to stockholders total $2,000,000 of issued preferred stock, less $542,200 held for cancellation. The common stock totals $5,000,000.

Close Dealers in Mo. Tractor Show

Small Farms Present Difficulties and Scatter Demonstrations—Farmers Pay Cash

By S. P. McMinn
Staff Correspondent

ST. LOUIS, Aug. 4—With fifty-four tractors plowing Missouri soil, the third of the series of eight National Tractor Demonstrations was formally opened here on Tuesday morning in much the same manner as those at Dallas and Hutchinson. Tractor manufacturers and dealers, however, are not as optimistic regarding results to be obtained as they were at the two previous demonstrations. In this respect, however, it is pertinent to point out that these great tractor shows are far different from automobile shows. Contracts seldom are signed on the spot and for this reason it must necessarily be some time before the real good that has been done can be checked up.

For example, the Moline Plow Co. has but recently closed up some fifteen dealers as a result of the Hutchinson demonstration last week. And every one of these was for from three to twenty-five machines. Again, the C. O. D. Tractor Co. has just closed with the Western Farm Tractor & Supply Co. for the entire state of Kansas. The Wallis Tractor Co. has signed up with Piffer Bros., Denver, to handle the state of Colorado as a distributor. This company took an initial order of 100 machines and will pay cash for them.

Cash Deals a Feature

This cash proposition, by the way, is rapidly becoming the feature of the demonstrations. The newer companies in the tractor field, those that center all their activities upon the productions of tractors and make no other farm implements, are invariably making contracts which call for cash on delivery. And even the old-line implement manufacturers are now coming around to this way of doing business. Some have been conducting business in this way during only the past year and others are taking the step now for the first time. They reason rightly that if the farmer is willing and anxious to pay cash for his automobile, and if the newer members of the tractor family can extract cash from the distributor and the ultimate owner, there is no reason why they, too, should not do so.

Missouri is not what may be termed a great agricultural state—that is, judging by Minnesota and Iowa and the Dakotas

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Victoria Street, Buenos Aires, on which are located the Overland agency and also the Bosch depot. This would make an ideal motor row for the Argentine capital. In the background can be seen part of the large Government building corresponding to the capitol in Washington, D. C.

This shows how many of the narrow streets in the older sections of Buenos Aires are being widened. The widening process is carried on generally on one side of the street. The large new building at the right is set back to the new street line with which all the houses on the block will eventually correspond

South America—III

Careful Planning and Good Business Methods Are Necessary in Entering the South American Market

By David Beecroft

IF you contemplate entering the South American automobile market you must go into it in a business way, with the determination to build up a business there whether it requires 5 years or 10 months. There is one big consideration you must carefully consider, namely, Are you prepared to stick? If you are not prepared to stick, then keep out of it, leave South America to others who are. Ability to stick is a prime essential of the automobile and accessory business in any of the South American countries.

Ability to stick presupposes that you are ready to spend a large amount of money in establishing your products in perhaps eight or ten of the best buying and distributing centers. Every U. S. A. merchant who has made a success of his South American business has done this. We have not been able to find a single exception. With every large U. S. A. firm now enjoying good business in Argentina, Brazil or the other countries, the business was primarily secured by a heavy original investment coupled with a determination to stick.

A dozen firms that have succeeded by such measures might be mentioned and they would include such household names as Remington, General Electric, Westinghouse, Ford, U. S. Steel, National Cash Register, Singer Sewing Machine, Standard Oil, Edison, International Harvester, Case, Fairbanks Morse, etc., etc. These all made heavy financial investments, these all sent their best men there to establish and look after the business, and to-day they are reaping the fruits of this wise discretion.

Every U. S. A. business man in Buenos Aires, in Rio de Janeiro, in Montevideo and other places is more or less disgusted with the tactics pursued by many of our firms when entering the South American market. Our firms have not gone with the apparent determination of establishing a permanent business, but rather with the hope of getting several original orders, making a good long profit out of them, and then casually picking up as much business as possible without building up a permanent organization to take control of the South American business.

Our U. S. A. citizens resident in these cities and managing large interests are all bitter in their denunciations of our business methods in relation to foreign trade. They are unanimous in declaring that it is much better for our firms not to try for the South American market at all, than to try in such a faint-hearted way. They all asked me to strongly urge any of our companies contemplating the South American field to keep away from it unless they are ready to enter on a permanent basis.

Every U. S. A. citizen resident in any of the above mentioned cities and in a score or more of other cities, and conducting the business of some U. S. A. house, unequivocably stated that his business is personally injured and the general reputation of U. S. A. goods injured by every one of our companies spasmodically dipping into the business, plucking off a few first-time orders and then leaving service and the supply of parts, etc. to care for themselves.

So much of this has been done that to-day our country has a reputation for such foreign trade tactics, and naturally many foreign business houses have not that confidence in our national trade character which they should have. It is true that U. S. A. firms with home reputations of high character, have not a foreign trade character in South America worth considering. It is all because they have not gone into the market with the thought of staying there, but rather entering it as a kind of experimental trade excursion. This our own people down there dislike heartily and this the South American equally dislikes.

Entering the South American field to stick should be carefully considered: There is no question of the possibilities of the field but there are a few potential factors that must be judiciously weighed and conditions must be shrewdly investi-

This illustration shows a new boulevard recently built in Santos, Brazil, and leads from the center of the city to the beach at a distance of 2 miles or more. On the beach is a 40-mile drive over hard sand where the going is practically as good as on the beach at Florida. Avenues of this nature are being built in many South American cities and suggest the hold that the automobile already has on the people. The next 10 years will see scores of boulevards of this nature built in practically every South American country

1—*This is a wide Belgian block business street in the suburbs of Buenos Aires. There are scores of streets of this width and well paved. They are ideal for motor car and motor truck use*
2—*Another wide Buenos Aires street paved with stone blocks and having double trolley lines in the middle*
3—*This street leads to a suburb of Buenos Aires in which one of the largest breweries is located. The street suggests possibilities of using motor trucks*
4—*Typical street of La Plata, Argentine, a seaport 65 miles from Buenos Aires and near which are located Armour & Swift packing plants. There are many cars and trucks in the city*
5—*A wide street in the outskirts of Buenos Aires and which is a part of the new highway from Buenos Aires to La Plata. The street is wide enough for eight automobiles abreast*
6—*Typical narrow street in the business section of Rosario, which is the second largest city in Argentine*

Typical modern, wide street in Buenos Aires which makes for ideal motor car and motor truck use. This picture must be compared with the one on the opposite page which shows the older form of narrow street in the city. Buenos Aires is making every fourth street wide like the one shown in this page in many sections of the city so that traffic conditions are being handled on a broader scale than in the majority of our North American cities. Buenos Aires has been building wider streets for 10 to 15 years and already much has been accomplished. This widening of streets is being pushed constantly and to-day you will see in a dozen different parts of the city examples of this work. The widened streets are generally well paved from curb to curb with Belgian blocks and the single row of ornamental iron poles in the center supporting the electric lights as well as the two trolley wires is good economy of street space and forms a natural division of the street, establishing passage for pedestrians

gated. If you go into this field you should go into it right and until you are ready to go into it right, we recommend that you remain out of it.

Going Into the Market Right

What does going into the market right mean?

FIRST:—You will have to establish a South American department in your own factory. Nearly every country in South America uses the Spanish language, excepting Brazil which is Portuguese and British Guiana which is English. You must then secure reliable Spanish typewriters, persons familiar with commercial Spanish. They must be more than mere typists, they must possess many essentials of business, they must have good common sense, as you must rely on them in many matters calling for good business judgment due to your not understanding Spanish. You cannot possibly conduct business in Argentina, Chile, Uruguay, Peru, Bolivia and other South American countries without such a home equipment. You must have a typewriter machine with a keyboard intended for the Spanish language.

If you do business in Brazil and you cannot afford to go into South America without going into the Brazilian market, then you must equip yourself similarly with regard to the Portuguese language. There is great commercial rivalry between Brazil and Argentina. They watch each other like Ancient Rome watched Ancient Carthage. When Brazil gives an order for a new warship, Argentina immediately places an order for as large a one. When Argentina adds to its army Brazil follows suit. With this relationship existing you can readily see that it will be exceedingly unwise business policy to write a letter in Spanish to a business house in Brazil or to send one in Portuguese to a business house in Argentina. You must fit up with both Spanish and Portuguese.

SECOND:—You must be prepared to go into the field with catalogs in Spanish for certain countries and Portuguese in Brazil. The same catalog will not do for both countries, but the same Spanish catalog that you use in Argentina will do for every other Spanish country in South America as well as islands in the West Indies and countries in Central America where Spanish is the prevailing language.

It is essential to have Spanish and Portuguese catalogs. You would not try to sell cars in the U. S. A., Canada or England without catalogs in English. Your dealers demand catalogs. The people in Argentina are just as human as we are, and catalogs are just as essential there as in the U. S. A. Many of our makers have not thought so and I have seen in Argentina and Brazil huge boxes filled with catalogs in English that were never used. The automobile salesman in Sao Paulo, Brazil or in Montevideo in Uruguay or at Buenos Aires had too good business sense to even think of distributing a catalog in English to prospects who do not know any more about English than we know about Chinese.

Get the business attitude of the Buenos Aires automobile dealer by a homely parallel: Conceive if possible that you are going to sell in the U. S. A. a new type of Chinese piano that some Chinese salesman has shown to you and explained to you by the few words of English he knows. Then this Chinese salesman leaves you a box of Chinese catalogs on this piano. You cannot read a word of the catalog yourself, but yet you are going to take them and mail them out to your prospects in New York or Chicago. Not one of these prospects ever spoke a word of Chinese but still you are going to mail them around. What asinine stupidity that would be.

But go a step further: That Chinese piano manufacturer has not an English stenographer in his office in Pekin and all the business letters you get are in Chinese. You do not understand them and you have to rely on the veracity of some translator. Then go a little further and keep in mind that you must pay for those Chinese pianos the day they leave the factory in Pekin or perhaps the day they are loaded on a boat to leave China. You may have your doubts as to whether they will ever reach you or not but that makes no difference. This parallel may savor of being extreme but it is hardly so when the business fundamentals underlying it are considered.

THIRD:—You must be prepared to go into the South American field with instruction books for your cars in Spanish and others in Portuguese. One automobile dealer in Sao Paulo, Brazil, told of having sold over 200 of a certain make of popular U. S. A. cars in the last 2 years and yet he had never received an instruction book in Portuguese. Think of

This illustration showing one of the narrow streets in the business section of Buenos Aires mut be compared with the illustration on the opposite page, showing the wide streets. These old-fashioned, narrow streets hamper traffic very seriously and with one row of vehicles along the curb there scarcely remains enough width for two motor cars to pass. There is not sufficient room for a wide motor truck to pass an automobile. On many of these narrow streets is a single street car line placed close to the curb on one side. There is only room for one vehicle at the side of a street car. It is nearly 15 years ago since the widening of these narrow streets was undertaken and already great progress has been made. By requiring all traffic on these narrow streets to travel in one direction it is possible to avoid traffic congestion and also have good speed; in fact you can make as good speed in a motor car on many of these one-way traffic streets as you can on the broader streets with traffic in both directions

it! There he was having sold over 200 cars to people who cannot speak a word of English and only understand Portuguese and yet they were expected to read in English all about this new automobile. It would be difficult enough for them to read the book in Portuguese for many of them are not very mechanical and require to be fed mechanics in homeopathic doses, but to add to the impossibility the heavy doses are given in English. Such a U. S. A. firm is succeeding in South America in spite of its own inexcusable bad business. Such a concern deserves no credit for what success it has already achieved and if such a concern expects to build up a substantial South American business it will only do so because of the great demand for our cars.

European Methods Approved

Everywhere in South America you hear of the good business policies of the European houses, particularly the Germans, who have the best reputation in South America for knowing how to develop trade. One dealer in Montevideo told me of how a large German house got into the Uruguay market. It built a medium-powered car and before the first cars arrived there reached Montevideo a case full of catalogs in Spanish and also a case filled with instruction books, posters, and general literature, all in Spanish. This literature was all corrected according to local customs in Uruguay so that every word used was the correct word.

But the German house had gone further and made the catalogs and instruction books much more elementary than those used in Germany or other countries. It had recognized the fact that the South American countries are not manufacturing countries, that their peoples are not so technical as are we in the United States, Canada and Europe, and that naturally a catalog or instruction book for South America must be much better illustrated than one used at home. Best of all this literature arrived before a single car was received, not months or years after 100 cars had been sold. Any U. S. A. maker going into the South American field can afford to take several pages out of the note books of German houses in building up South American business.

FOURTH:—You must be ready to give these South American countries the cars they want when they want them:

Selling.—In Argentina the selling season begins about November 15 and continues through December, January, February and to March 15. These are the big selling months. These are their summer months. Argentina being south of the Equator has seasons directly opposite to ours. When we are in summer they are in winter. They sit around and roast on Christmas day while we complain that the weather is too cold to go motoring.

Keep this selling season in mind and aim at having your your cars reach their destination in South America by November 1 or 15. The dealer must have them then.

In June I spent an entire forenoon with one of the largest dealers in Buenos Aires listening to him tell me about the impossibilities of doing business with one of our largest automobile makers. He had received only a few weeks before a big shipment of automobiles that were due to reach him last December. They arrived months after the selling season was over and now he has to keep those cars on hand until the next selling season opens in December. But then he will have 1916 models instead of 1917 ones. Fortunately the dealer in question is a very wealthy house and can afford to carry nearly 400 cars for several months, but the house will not be caught that way again and the U. S. A. factory has lost much prestige, because there are several dealers in many towns and cities of Argentina who have lost confidence in the company. Confidence is not an easy quality to restore.

There were twenty or more similar examples of this. The Buenos Aires representative of one of our oldest houses showed me the first 1916 model of his line which he got out of customs on June 15. He was promised it last October. Delay followed delay until the freight situation got tangled up and then the factory found it had to wait nearly 3 months to get steamer space. I visited several automobile dealers who did not get cars until the selling season was over and were carrying the 1916 cars over to the 1917 season.

You must work months ahead when developing South American business. It is not like at home where your dealer keeps after you and then you finally ship by express. It is practically 2 months from your factory to your dealer in Buenos Aires. Your first 1917 shipments should be leaving

This is a gasoline storage depot at Rosario, Argentine. The gasoline is carried in 5-gal. cans, two of these cans being crated. The gasoline is brought this way from U. S. A. and stored in long rows of these warehouses instead of huge storage tanks as in U. S. A. Argentine aims at having a supply of 5,000,000 gal. of gasoline and 5,000,000 gal. of kerosene in storage all the time.

This shows the first curbside gasoline depot in Buenos Aires. The equipment is a Bowser which was installed in May, 1916. The car being filled is a Jeffery four and standing to the right of the Bowser pump is George W. Gaidzik, South American representative of the Jeffery company. This curbside pump is proving a success, and it is probable that soon there will be hundreds of them in use.

your factory Sept. 1 providing you have shipping space arranged for and if shipping space is not provided you should be already on the job.

FIFTH:—Be prepared to give them the kind of cars they want at the time they want them.

Tread.—For Argentina they want cars with 60 or 62-in. treads for the camp or country. That is the tread of the huge farm carts that dominate the roads and it is just as essential to have the wide treads for the Argentine camp to-day as it was to have them in many of our Southern States 5 years ago. True we agreed to stop making wide tread cars because our U. S. A. roads are getting improved to that stage where we can get on with standard treads, but Argentina is not in that condition to-day, and if you are going into permanent business there you will have to build the wide tread.

Narrow Tread

It is true you can sell in Buenos Aires narrow tread cars but you cannot sell them in the camp. Better to keep out of Argentina business than to try to break in with the narrow tread. Ford and several others have found it good business to build the wide tread for Argentina and many other sections of South America and you will find it the same. In June some of our largest concerns agreed to build the wide tread for Argentina.

Steering.—Argentina rules of the road are opposite to those in the U. S. A. In Argentina you keep to the left, whereas we keep to the right. Argentines want the steering post on the right. They insist on that. Our best makers are giving them cars this way. Some of our makers are charging $8 extra for this and the Argentine dealers object to this. It is good business for him to pay the extra amount and get a car that will sell easily. A few of our companies shipped cars with steering wheels on the left and are in bad. In open country it does not make much difference whether the steering wheel is on the left or on the right but for city use it does, and where you have narrow city streets like many in Buenos Aires and in nearly all South American cities it is necessary to have the steering wheel on the right.

Left Steering for Brazil and Chile

In Brazil the opposite rules of the road apply, that is the same rules as are in vogue in the U. S. A. and so the steering wheel on the left is correct. The same is true in Chile.

Clearance.—Next comes clearance: Cars for the camp or country must have good clearance. They want 10 in. or preferably, more. They cannot get along well with much less. The camp roads have deep ruts, deeper than we are accustomed to here, and with low clearance you cannot get along at all. We saw one salesroom in Rosario stocked with a leading make of U. S. A. car of low clearance, and the owner was practically desperate. He had ordered higher clearance but the U. S. A. factory had not heeded the requirements. He had on his hands cars that he could not sell. He had lost several precious business months, and was not able to get larger wheels and tires. He was not going to place any further orders and was ready to give up the agency if he could only get out from under his present load. The dealer produced his order duplicates to prove that he had specified clearance and it was apparent that the factory had not given heed to this requirement. As a result the dealer had lost confidence in the U. S. A. factory and you could not blame him. That is one way in which you cannot build up a South American trade. If you cannot give the right clearance, then do not ship cars until you can.

Colors.—Give the dealer in Argentina or Brazil or Chile the color he wants and the color of car you agreed to supply him with. This is very rarely done. One of our largest automobile factories lost its agent in one of the biggest South American cities on July 1 simply because it shipped cars with colors different from those ordered. This dealer placed orders, let us say for one touring car in green, one in blue and three in red with black striping. The dealer had sold the cars with these colors and was duty bound to his prospects to give them such. When the cars arrived they were all painted black and not a single prospect would take them. The dealer had difficulty getting them painted the correct color. It cost him over $100 each and the company would not make any allowance to him. Naturally he was through with that factory and naturally that factory is receiving a black eye in that market. The dealer has already given up the agency. His opinion of the U. S. A. factories has not improved because of his experince.

You must be prepared to give the South American dealer the car he wants, the color he orders and at the time he wants it, as well as the type of body he orders.

Sent Closed Cars Instead

Bodies.—In Sao Paulo another glaring example of poor U. S. A. business methods came to my notice: One of the large implement dealers in this city of 500,000, located in the finest section of Brazil and in a section that compares with any area in all South America wanted the agency of a certain Detroit car. Through his New York exporting house

he asked for three or four touring cars to be shipped in order that he might test them to decide if he would take an agency for the State of Sao Paulo. When the cars arrived there was only one touring car, one other was a coupé, and two were sedans. This implement agent had been selling U. S. A. cars for nearly 4 years and had been selling only in the camp. There was no demand in the city. Picture his chagrin on receiving out of the four cars, three that were entirely unfitted for the country, and three cars that had been on his selling floor for months and which he had no chance of selling. In the country they want five- or seven-passenger touring cars. They are not interested in closed types.

You say why not sell the closed types in the city. There were many reasons making that practically impossible: First, in all South American cities they use chauffeurs and they will not have a chauffeur sitting in the same compartment with them. Caste is different in South America than in the U. S. A. and while in New York or Chicago a family will have the driver in a sedan or coupé they will rebel at such in South America. A woman in Buenos Aires or Rio could not be induced to drive in a sedan with the chauffeur.

Shipped Wrong Body

In Buenos Aires another similar example of the U. S. A. foolishness was seen. In the top floor of a large salesroom was shown a beautiful three-passenger coupé that had been shipped in place of a town car. The dealer could not get any one interested in it, and after having it in storage for nearly 3 years was having the body removed so as to fit a delivery wagon body to it. The body had been a total loss and the company he was dealing with was willing to wipe off the body cost as a penalty for its error.

Again: We could site examples by the score of similar inexcusable acts on the part of our automobile makers and exporters, but only one more will be cited, in the hope that it will analyze the situation sufficiently fully: A Sao Paulo dealer ordered a touring car of a particular shade of blue. It arrived in due time but the body finish was ruined because the packing paper was sticking into the varnish. Apparently the body had not been sufficiently dried. It was crated too green. The dealer had paid $60 extra for the special color and had waited several weeks for it, only to have it arrive in a spoiled condition. He had it repainted in Sao Paulo at a cost of $110 and as the Detroit company had not agreed to rebate the $60 for its error when I was in Sao Paulo, the dealer was not in a loving attitude at having to pay $170 for a special color. Keep in mind that Brazil, Argentine and all southern South American dealers are nearly 2 months from your factory, by the freight route, and their orders should receive the very carefulest consideration. It is different if you make an error on a Chicago or New York order, where the dealer can care for the job with little loss of time, but not so in South America.

Give 3 Months' Credit

SIXTH:—Be prepared to give 3 months' credit on goods sold to South American dealers. This applies to practically all dealers. There is scarcely any reason now why you should not do this. With the National City Bank of New York with branches in Rio de Janeiro, Santos and Sao Paulo, Brazil; with its branch in Montevideo, Uruguay; and with its branch in Buenos Aires, and agents in other parts of Argentina; and with prospects of it opening branches in other countries, there is no just reason why you cannot get all of the credit information on any prospective dealer you may want to sign a contract with. This bank has had in operation for a long time a very competent credit department in all of its branches and is ready to give any and all information that our makers require. So far as credits go you are now on a par with European houses.

Feature of Novel Steel Wheel Is Simplicity

ALMOST the simplest of all steel wheels is a recently patented device of British origin, of which a sample has just been imported. It has the advantages of lightness and extreme cheapness, while it can accommodate any form of demountable rim. It may be described briefly as a disk wheel in which the disks are largely cut away, and the illustrations make clear the construction.

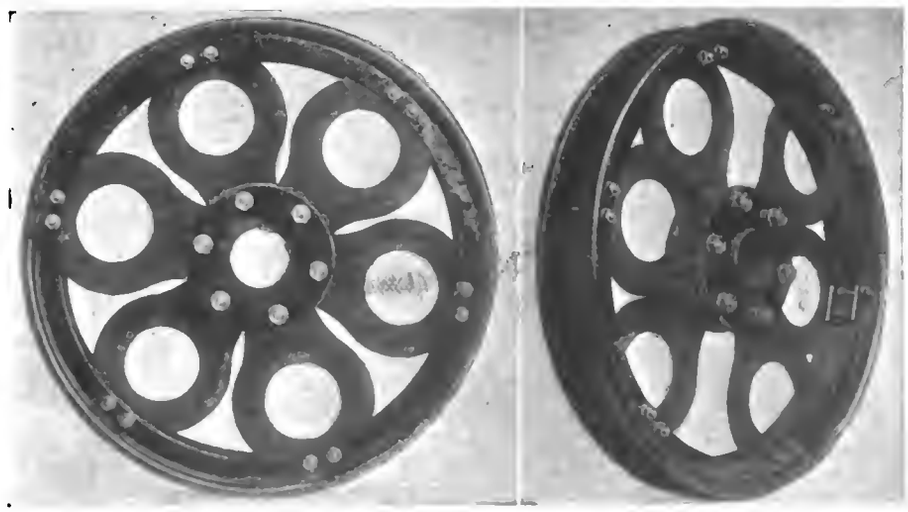
Stamped Side Plates

The side plates are stamped from sheet steel and bolted to the hub and to little brackets riveted within the felloe, and the removal of a dozen nuts reduces the wheel to its elements. Except upon the hub, there is practically no machining, as the bolt holes in the felloe and in the side plates are punched in the press. Neither hub nor felloe band is any more complicated than for a wood wheel, and it is stated that the side plates can be stamped, and the wheel assembled, for less money than a wood wheel can be built.

In appearance the wheel is distinctive, and it has a look of lightness in contrast to the massiveness which is characteristic of the full disk wheel. Its lateral strength is not comparable with that of a wire wheel, of course, but it should be at least as great as that of a good wood wheel. The inventor also points out that if the wheel should be buckled by some exceptional skid, it is only necessary to take it apart in order to hammer the side plates flat again.

To Market the Wheel

The wheel is called the Blakoe Double Trefoil, and the American rights are at present in the hands of G. W. Morrison, 1170 Broadway, New York City, who hopes to be able to conclude arrangements with interests in this country which will enable him to put the wheel into regular manufacture on a commercial scale at an early date.



Blakoe double trefoil wheel, which is built up of two steel stampings, and is very light and simple

Willys-Knight Now Carries Seven

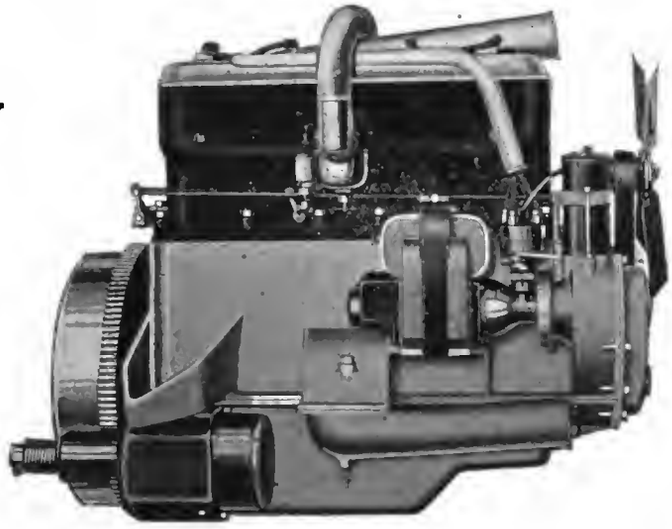
Body Lines Better — Improved Cantilever Springs — New Axle and Gearset Unit—Prices Higher

THAT the new Willys-Knight four is the handsomest and most comfortable car ever turned out of the Willys-Overland factory in Toledo, Ohio, is beyond all question. It is a seven-passenger car with all the most modern lines and fittings; it has an improved system of cantilever spring suspension; it has a completely new rear axle and a new gearset in combination with the axle. Naturally, with all these improvements the price has been increased to $1,285 for the touring car, in addition to which there are two closed types at $1,950. Of these, one is a seven-passenger touring sedan of the Springfield pattern, with a permanent top and glass windows which remove completely, and the other is a seven-passenger limousine.

On all three models great care is taken with the finish, which is to be maintained at a quality in keeping with the fine lines of the bodies. It is becoming almost platitudinous to describe a 1917 car as having a custom-built aspect, but this is really the best way to sum up the external points of the new Willys-Knight.

Battery Ignition Used

As to the chassis, the wheelbase is now 121 in., but the changes in detail, considerable though they are, do not appear at a glance. The engine, 4⅛ by 4½ in., is the same as the 1916 series, except for the ignition which is the Connecticut battery system instead of the magneto. The electrical equipment is all Auto-Lite except the actual distributer; the generator, which is very little larger than the magneto, is mounted on the engine right and chain-driven direct from the crankshaft. With it the ignition unit is combined and the coil is mounted in a clip on top of the chain case, this making the wiring of minimum length. To drive the generator the chain pinion has an internally toothed ring outside the case, and the generator shaft a pinion with a corresponding number of teeth which fits inside the ring. This gives the small amount of universal action required to allow for minute differences in alignment and also allows the generator and igniter to be removed by merely detaching the wires and undoing a single screw holding the clip which retains the generator on its platform.

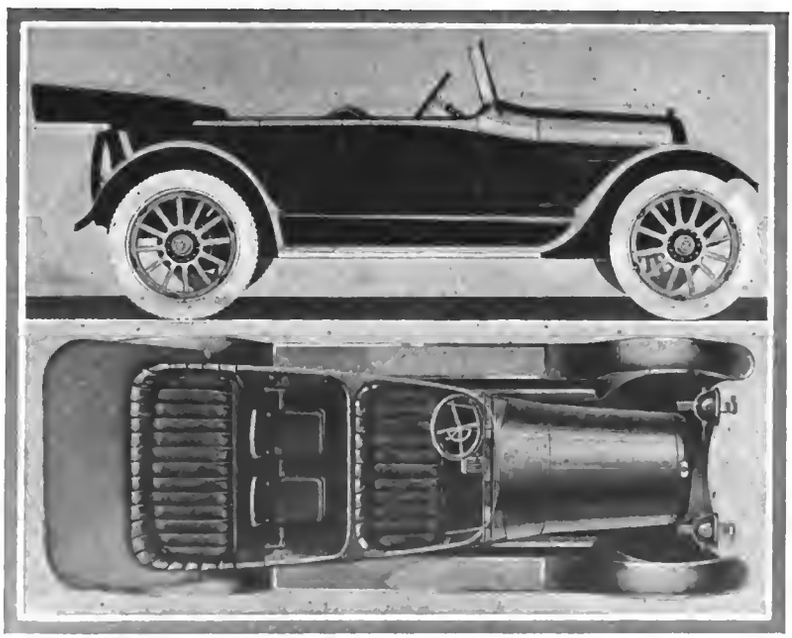


Intake side of four-cylinder 4⅛ by 4½ in. engine used in the Willys-Knight, showing high mounting of carbureter and also the position of the electrical units

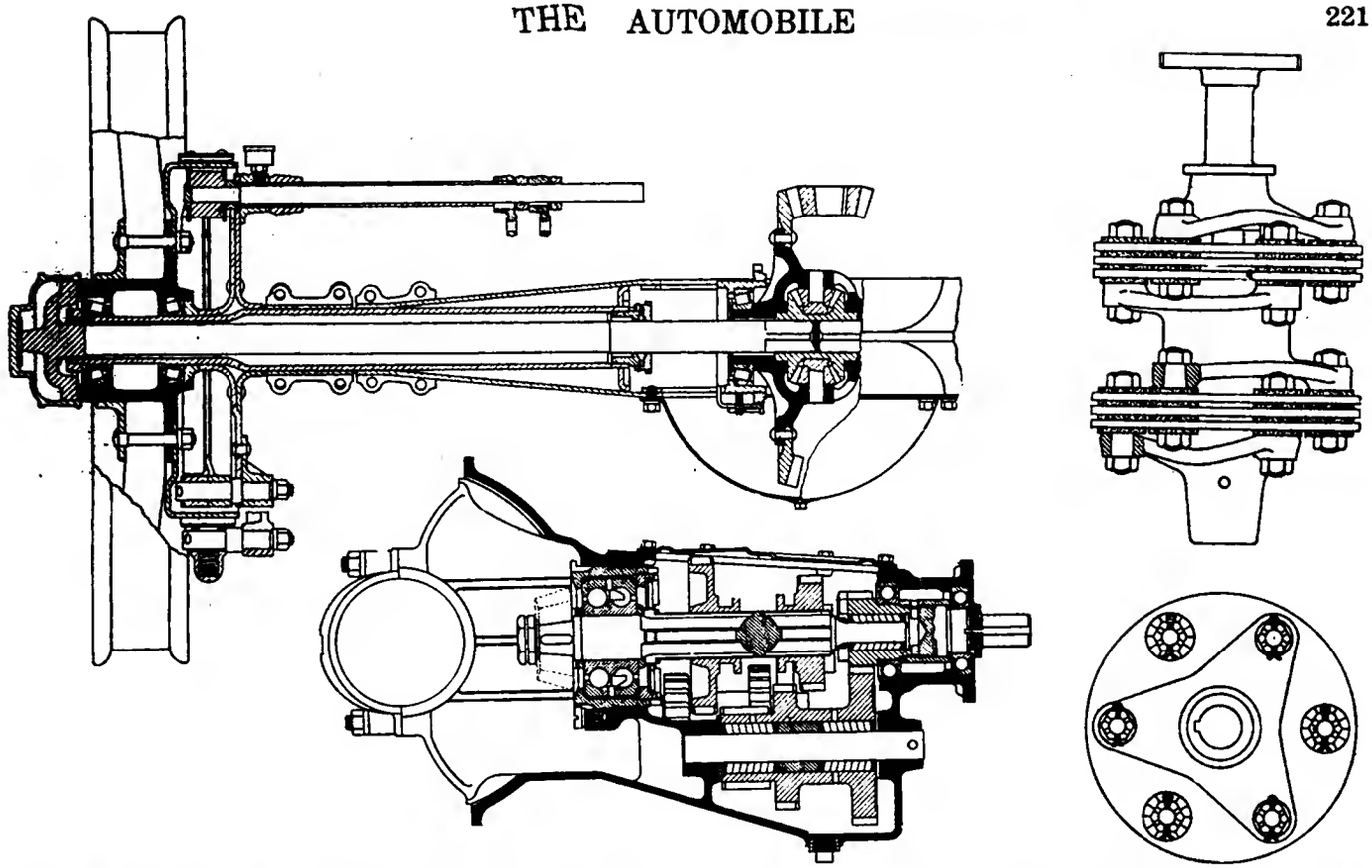
The starting motor has a Bendix pinion which draws forward, toward the body of the motor, to engage, so that there is a minimum of overhang when the starter is operating. The motor lies just beneath the right rear supporting arm of the engine where it does not interfere with the accessibility of any other part. Completing the electrical system, the battery is housed beneath the floor in the driver's compartment, on the right, and is accessible through a detachable panel in the guard strip which joins the running board to the frame.

One of the features of the engine is the system of lubrication. The earlier Knight engines were all splash lubricated, but the Willys-Knight has a pressure feed to each main bearing on the crankshaft, whence drilled holes carry the oil to the connecting-rod ends. Thence the overflow is whirled out by the cranks, so reaching the sleeves which are grooved to conduct an adequate supply to every part of the working surfaces. The oil pump, a plunger pattern, is located in the base of the crankcase, and the supply delivered to the bearings is controlled by a throttle working in conjunction with the carbureter throttle, so that the engine receives oil in proportion to the work demanded at the moment. One noticeable result of this control is that the engine is not prone to smoke.

Experience with the 12,000 cars made in the past year shows that this engine has the quality common to all Knight motors of insusceptibility to carbon. First, carbon does not form so fast as in an L-head engine and, second, when it does form it has much less effect on the running. Up to a point carbon is actually beneficial to a Knight engine, putting a sheen on the sleeves and port edges. The exact reason why this should be so has not yet been stated, but probably the absence of trouble due to presence of



Willys-Knight seven-passenger touring car which sells for $1,285. Note the attractive body lines and comfortable seats



Above are illustrated the new axle and gearset unit of the Willys-Knight showing the banjo-shaped steel stamping now used, the differential being carried on brackets projecting from the back of the gear-box. At the right is illustrated the new universal joint which consists of two sets of leather disks, each set comprising three disks

carbon is because of the almost spherical shape of the combustion space, and the absence of any roughness. In a Knight engine every part of the combustion chamber is machined, and there are no angles or pockets to house the deposits which could get red hot and cause pre-ignition.

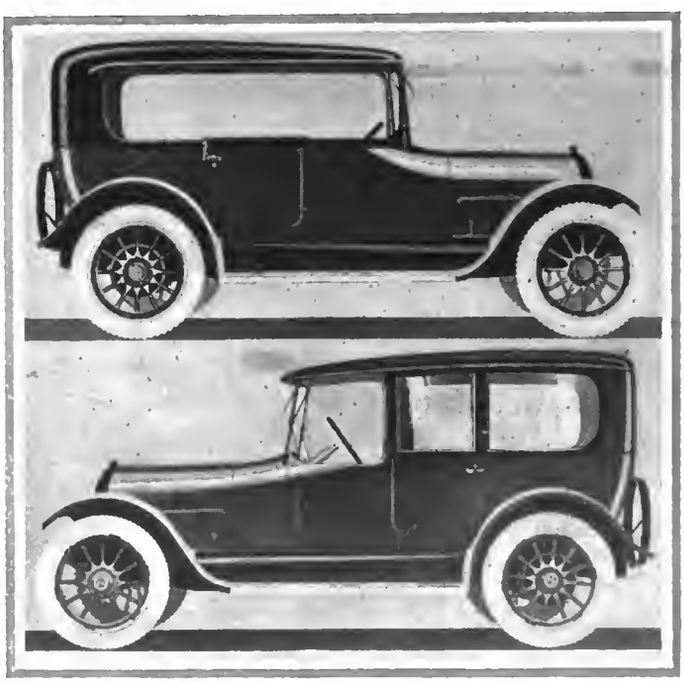
Thermo-Syphon Cooling Continued

Thermo-syphon cooling, used for the 1916 series, is retained. There is a passage through the crankcase which makes the inlet to the cylinders from the radiator, as seen in the illustration of the right side of the engine. From the top of the cylinders a large aluminum header returns the hot water to the radiator, the water path being almost ideal for straightness and freedom from twists.

Carburetion is by a horizontal Tillotson instrument bolting to the cylinders and drawing hot air from a muff on the exhaust pipe. The gasoline tank is at the rear with fuel supply by Stewart vacuum feed.

The transmission system follows the same general lines, that is, the gearset is in a unit with the rear axle and a stout torque tube incloses the propeller shaft. This torque tube is hung on pivots at the front, thus taking both the driving torque reactive stresses. Though, at first glance, the gearset appears much the same as previously, it is actually a complete new design, having the countershaft beneath the mainshaft instead of beside it. This change makes the box narrower and so stiffer. Three speeds are used and the arrangement of the bearings is rather out of the ordinary. The tail end bearing on the mainshaft takes the bevel pinion thrust, so a large double-row, New Departure ball bearing is used. At the front end of the mainshaft is a substantial single-row ball race. The spigot bearing is a Hyatt roller. The countershaft is fixed in the case, the whole set of countershaft gears being assembled into a unit which is bored out larger than the fixed shaft, the space between being filled completely with Hyatt rollers from end to end.

Another notable change is in the rear axle construction. Formerly the axle had a cast center case with tubes bolted to it, but now there is a steel stamping of the so-called "banjo" form, the differential being carried on brackets projecting from the back of the gearbox. At the back of the axle a simple cover plate completes the inclosure of the differential so that inspection is possible with the removal of only a few nuts. The road wheels are mounted outside tubular sleeves which are fixed in the ends of the banjo stamping, so the



Above is the Willys-Knight touring sedan, with permanent top and removable glass windows, and below is the limousine. Both models sell for $1,950

new axle is full-floating. Throughout it Timken bearings are used.

For the brakes there is the conventional layout of external and internal on the same drums, but attention should be given to the very substantial shoes used for the internal portion, giving a rigidity to the working surfaces which results in a very smooth, though powerful, action.

Leather Universal Joint

Still another transmission change is in the universal joint which is now made up of six leather disks in two sets of three disks. This gives perfect universality without any metallic moving parts, there are no surfaces to wear and nothing that can ever make a noise. The life of the leather is said to be entirely satisfactory and it is worth noting that real leather is used, not a composition. Actually it is much the same sort of leather as is commonly employed for facing cone clutches. The flexibility of this universal is quite remarkable; it feels, when moved by hand, as free as any metal joint and more free than some of them.

The cantilever rear springs are 48 in. long and 2½ in. wide, and applying the test of driving across a railroad at 20 m.p.h. proved their ability to absorb shock. At this speed the rear seat passengers can just feel the crossing, but are not shaken off the seat, and the front seat occupants feel nothing. In handling the most noticeable feature is the ease of gear shifting, due to the soft acting cone clutch and the strong clutch brake which quickly brings the cone to rest. Still, with a high gear ratio of 4.6 to 1 which is the standard, there is little need for the shift lever, as the engine operates smoothly down to 5 m.p.h. and even below this speed. Another point which is noticed when driving the car for the first time is that there is no apparent increase in vibration at high speed. At 20 m.p.h. there is a slight tremor which can be felt in the front seat but not in the rear one. At 40 m.p.h. this tremor is, if anything, less noticeable, while the engine is, of course, just as quiet at 50 as at 20. The pulling at slow speed is markedly good, and the acceleration smooth and easy.

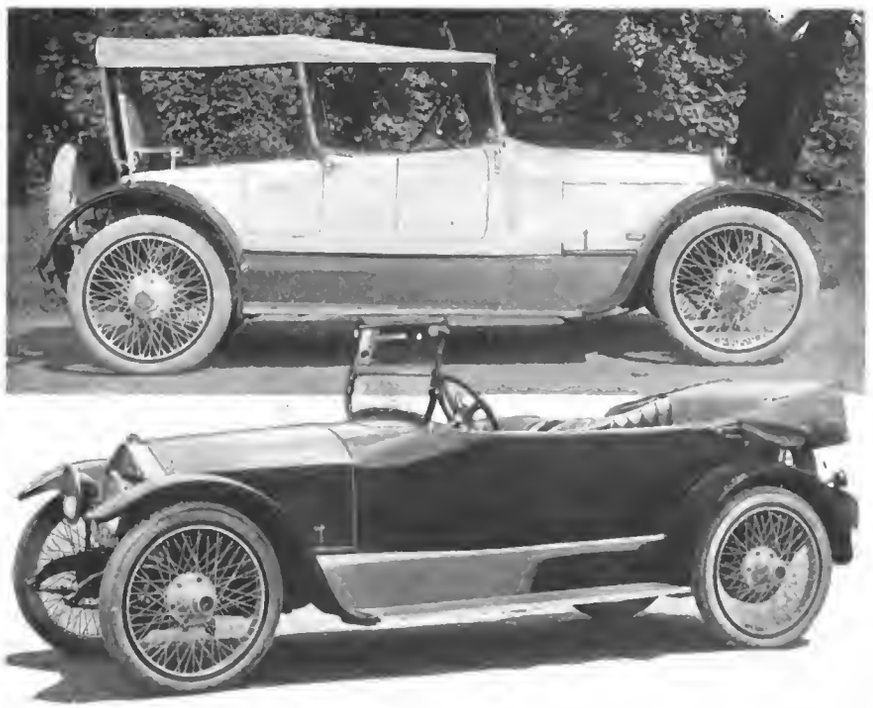
Bodies Strong and Well Furnished

Coming back again to the bodywork, this is much more rugged in construction and great pains have been taken to strengthen all points where weakness might lead to squeak or rattle production. The engine being so quiet the need for soundless bodywork is greater than ever, and this can only be obtained by solidity of frame and careful fitting of doors, etc. The upholstery is deep and very soft, both the cushions and the back padding being the kind that the body sinks into. Whichever way one leans there is a springy "give" conforming to the attitude taken. For the cowlboard and for the back of the front seat into which the folding seats disappear a grained finish is employed, so cunningly devised that the closest examination does not disclose the fact that the material is really steel. The carpet used in the tonneau is of heavy material in keeping with the leather of the upholstery.

Radiator Shell Changed Slightly

A small change which has not been mentioned is in the radiator shell. While still distinctively Willys, this now has a bulge at the front of the top tank, slightly overhanging the core and rounding out the lines of the front end. All the usual accessories are neatly arranged in the cowlboard, the magnetic speedometer, electrical gages and oil pressure gage, while a little glove cupboard occupies a part of the board not needed for anything else. Included in the equipment are a Boyce Moto-Meter and a gasoline gage. All the finish is dark rich blue, upholstery, body and hood all matching. The road wheels are gray and black is used for the fenders; fittings are of nickel or polished aluminum. For tires, the size is 34 by 4½ in., the touring car having plain treads on the front wheels with non-skid on the rear, while the closed cars have non-skid all around. There is a spare demountable rim included in the equipment.

Custom-Built Bodies on Roamer Chassis



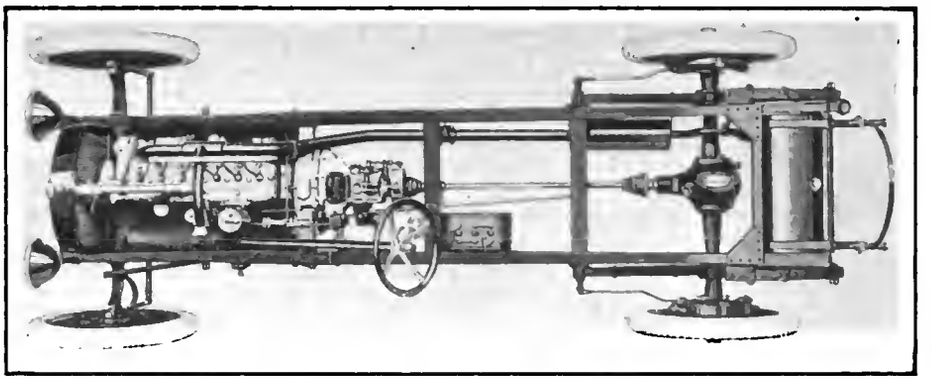
These illustrations serve to give an idea of the custom-built bodies which are applied to the Roamer chassis. A feature of these cars is their low-hung appearance

ROAMER cars are being produced in a number of designs of pleasing variety in carrying out the company's policy of using custom-made bodies. The illustration herewith shows two types of body, the upper being a special four-passenger roadster job, selling at $1,900 and the lower the regular club touring model listed at $1,800. Mechanically, these cars are all mounted on a stock chassis of 124-in. wheelbase. They have the 3⅛ by 5 Rutenber engine fitted with Bosch magneto ignition and Bijur lighting and starting. Other special parts and fittings are the Hess axle, Grant-Lees gearset and Houk wire wheels. The cars are offered in a great variety of finish, and as a matter of fact, each purchaser has his choice of color.

Harry J. Everall, Inc., who is now handling the car in New York City, has placed an order for 150 of the Roamer chassis and for twenty-five special closed bodies for the New York trade. In Boston, arrangements have been made with Alfred Morse, agent for the Rolls Royce and Lancia companies, to handle the Roamer and in Philadelphia, the Oliver agency, handling the Mercer cars, will take on the Roamer.

New Jeffery Six Is 3 In. Lower

Rear Axle Re-Designed and Springs Underslung—Crankshaft Balance Better—Unit Power Plant 3½ By 4⅝—Body Comfort a Feature



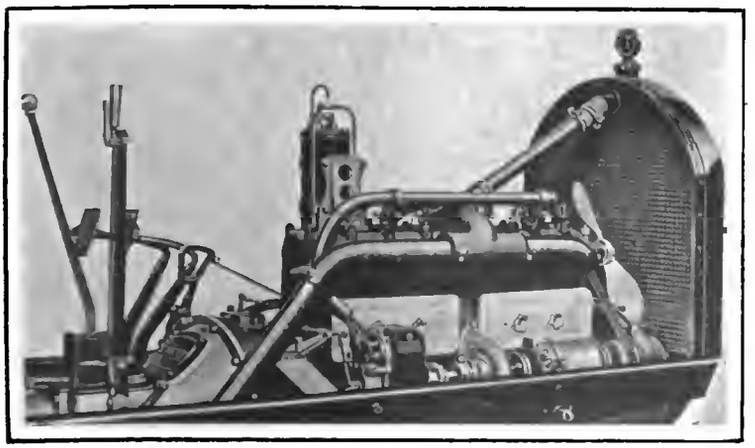
Jeffery six chassis, showing mounting of unit power plant, battery and fuel tank. Note clean design

IN addition to the Roll Edge four which was announced 2 months ago, the Thomas B. Jeffery Co. of Kenosha, Wis., has brought out a six-cylinder model for 1917 under the series number of 761.

Probably the outstanding feature of the new Jeffery six which will retail at $1,365, or $85 lower than the previous six, is its low body and general comfort in seating arrangement. This low effect has been accomplished by redesigning the rear axle so that the springs are now underslung. In this car the line of vision is 7½ in. lower than it was in the previous six. In addition to this improvement a more perfectly balanced crankshaft is used, resulting in a smoother acting engine so that the two details of body comfort and more quiet engine action have combined to give a much better performing car.

Floor Is 3 In. Lower

Summing up the body improvements, the floor of the new six is 3 in. lower than that of the 1916 model. The running board is now 15 in. from the ground and to add to the low, long appearance, the windshield has been given a pitch of 16 deg. and is now 20 in. high. Nowhere on the body is there a flat surface, every piece of metal being of double curvature. The upholstery is better and the dimensions of the seats are more liberal. For instance, the rear tonneau seat is 48 in. wide and 18 in. deep and the distance from the front of the back to the back of the front seat is 32 in. The auxiliary seats have also been made more comfortable and passengers occupying these are allowed 9 in. of knee-room. The seats themselves are 14 in. deep and there is 8½ in. knee-room between the passengers in the rear seat and the auxiliary seats.



Exhaust side of the new Jeffery six engine, showing its low mounting. Note hot air connection for carbureter, drive of electric units and two-bladed aeroplane type fan

3½ by 4⅝ Unit Power Plant

The unit power plant has its six 3½ by 4⅝-in. L-head cylinders cast in a single block with the upper half of the crankcase integral. This is an iron casting and to it is connected the pressed steel pan which forms the lower half of the crankcase. The valves are carried on the right side.

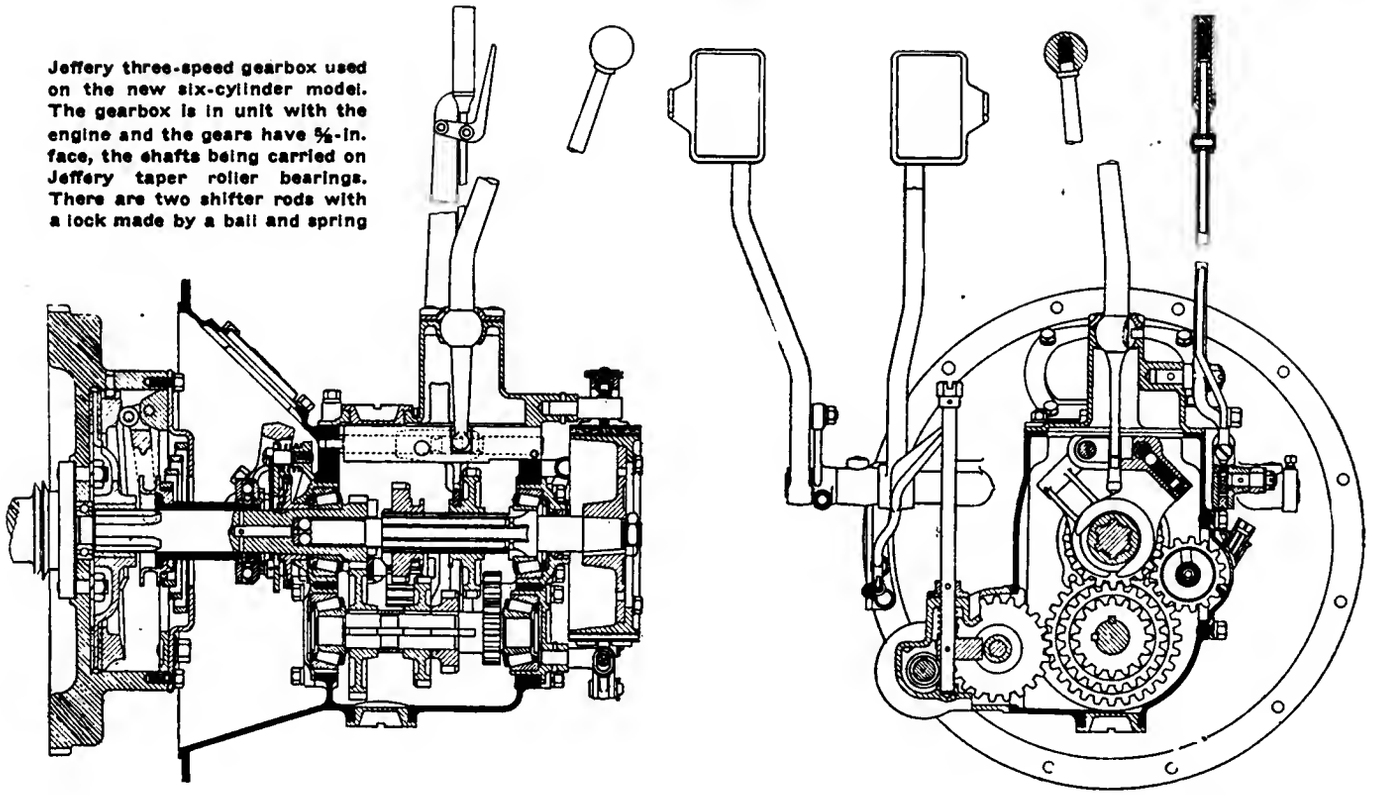
In line with present practice the reciprocating weights of the Jeffery engine have been kept very low. The entire weight of the piston with rings and pins is 1 lb., 7¼ oz. The pistons are of aluminum alloy and weigh but 1 lb. The length of the piston is 3⅞ in. and these are fitted with piston pins having a diameter of 1 5/16 in. The rings are three in number and are of the eccentric type and made from gray iron.

Drop forge alloy steel connecting-rods are used, having a length of 9½ in. The weights of these rods are 3 lb. 2¾ oz. and at the lower ends the caps are fastened by two chrome nickel steel bolts, at the upper end the piston pin bearing is carried in a phosphor bronze bushing, located in the connecting-rod. The lower end bearings are of die cast babbitt and have a length of 2 in. The diameter of the crankshaft, which is a forging of 0.35 to 0.45 carbon is 2¼ in. and this is laid out to be inherently balanced. It is carried on three main bearings, the dimensions being as follows: Front, 2¼ by 2 3/16 in.; center, 2¼ by 2½ and rear 2¼ by 3¼.

A one-piece drop forging makes up the camshaft from which the entire valve drive is taken. Mushroom type followers are used and the camshaft is carried on four bearings. All of these are of liberal size, the shaft diameter being 1 5/16 in. The length of the front three camshaft bearings is 2 1/16 in. and the rear 1 in. The diameters are 1⅛ in. for the center pair, 2 11/16 for the front and 2¼ for the rear.

Conventional valve timing is used with the inlet opening at 8 deg. after top center and closing 40 deg. after bottom center. The exhaust opens 40 deg. before bottom center and closes 8 deg. after top center. In other words, there is a zero lap, since the intake opening and exhaust closure are coincident. Morse silent chain is used to drive the camshaft, the chain being 1¼ in. in width and operating on drop forged sprockets with adjustable centers.

Lubrication is by combined pressure and splash with oil forced to all the main and camshaft bearings and



Jeffery three-speed gearbox used on the new six-cylinder model. The gearbox is in unit with the engine and the gears have 5/8-in. face, the shafts being carried on Jeffery taper roller bearings. There are two shifter rods with a lock made by a ball and spring

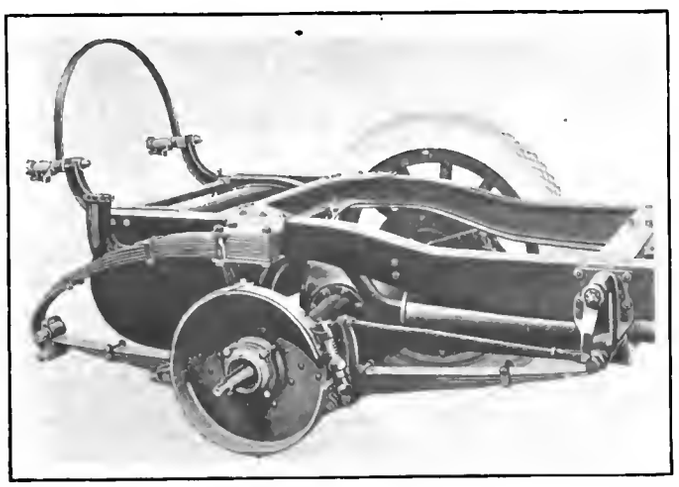
also to the driving chain. In addition, oil is fed to splash troughs into which the connecting-rods dip, taking care of the connecting-rod bearings, piston and piston pins.

Gasoline feed is from the Stewart vacuum system to a Rayfield Model M-3 carbureter. This is a 1¼ in. instrument fitted with a hot air tube. In the intake manifold special care has been taken to give a free passage to the gases and in fact this has been carried right through to the valves which have an overall diameter of 1¾ in. with an inside seat diameter of 1 9/16 in. and a lift of 5/16 in. These are the ordinary 45 deg. poppet valves and the material from which they are made is tungsten steel on the exhaust side and nickel steel on the inlet.

Two-Unit Starting and Lighting

Electrically, the car is Bijur for lighting and starting and Splitdorf for ignition. The Dixie magneto is used in combination with A. C. spark plugs located in the cylinder head midway between the valves and the cylinder bore. The starting and lighting system is in two units with a 20-lb. Bijur motor capable of turning over the engine at 160 r.p.m. and a generator mounted on the pump shaft. The battery is a U. S. L. 6-volt type of 80 amp.-hr. capacity weighing 48 lb. This is a lead plate battery. The lamp equipment is by Edmonds & Jones, operating at 6 volts with 18-candlepower headlamps. Throughout the entire lamp equipment the Ediswan base is used with single contact.

From the engine, the drive is taken through a Borg & Beck three-plate clutch to a Jeffery three-speed gearbox. There are one steel disk and two asbestos friction plates in the clutch, which is located in the flywheel. The gearbox is in a unit with the engine and is arranged to provide ratios in the box of 14.61; 8.2 and 4.5 to 1 of the rear wheels. The width of the gear face is ⅝ in. and the shafts are carried on Jeffery taper roller bearings. There are two shifter rods with a lock made by ball and spring. The drive shaft has six splines and the shaft center distance is 3½ in.



Rear construction of the new Jeffery six, showing mounting of underslung three-quarter elliptic springs for Hotchkiss drive, and also brake, fuel tank and spare tire carrier

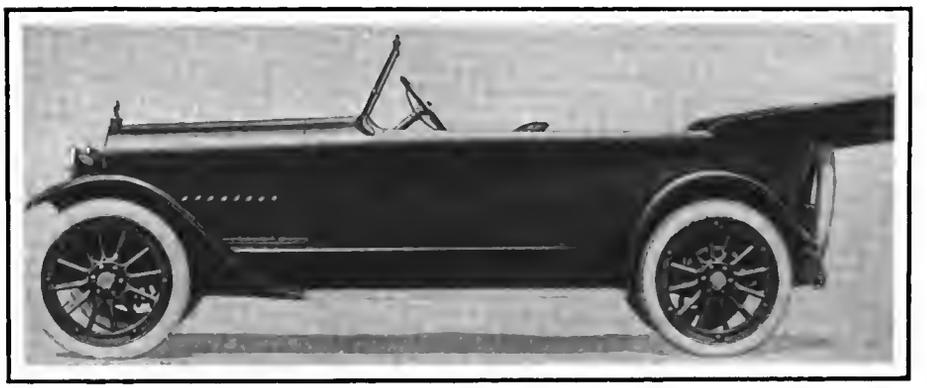
Jeffery Semi-Floating Axle

A Jeffery semi-floating rear axle is used in which the ratio is 4½ to 1 as regular equipment, although 4 2/14 to 1 and 4 10/11 to 1 can be furnished. This arrangement is secured by a fifty-four-tooth bevel gear with eleven, twelve, and thirteen-tooth pinions respectively. The gear teeth are spirally cut and have a 5 pitch. The differential is a bevel gear design and throughout taper roller bearings are used. In making up the axle housing a malleable iron center is used with alloy steel tubular ends. Both the drive and torque are taken through the springs by the Hotchkiss drive.

The spring equipment is manufactured by the Detroit Steel Products Co. The rear spring is three-quarter elliptic, underslung and is 53 in. long with eight leaves in the lower part and seven in the upper. The width of the spring is 2 in. the front springs are 38 in. long with eight leaves and 2 in. wide. The front axle is a Jeffery drop forged I-section with 9½ in. clearance, it is fitted with a Gemmer steering gear of worm and wheel type.

In the frame construction the side members are of the usual channel shape made with a single drop and the depth of the channel is 5 in. with 2 21/32 in. flanges. The frame

is provided with four cross bars with the side rails extended at the rear to provide a support for the gasoline tank and spare tire. The width of the front end of the frame over the front axle is 30 in. and over the rear axle it is 31¼ in.



New Jeffery six touring car which sells for $1,365, including full equipment. This car has a 125-in. wheelbase and uses 34 by 4-in. tires

Wire Wheels Extra

Artillery type wheels are used with twelve spokes front and rear. The spoke width is 1⅛ in. The wheels are made from hickory on the standard equipment, although Houk wire wheels will be fitted at additional cost. The rims are Stanweld of the straight side detachable type and designed to fit any straight side tire. The tire equipment on the standard cars is Goodyear with plain tread and front and the All-Weather non-skids in the rear. The tire size is 34 by 4 in.

On the six-cylinder car there are three bodies, the seven-passenger touring selling for $1,365, seven-passenger sedan at $1,530 and roadster at $1,335. Full equipment is included at these prices and all are mounted on the same wheelbase of 125 in. The equipment includes one-person top, Jiffy curtains, rain vision sloping windshield, rope straps, foot rest, extra rim, complete set of tools, Boyce Moto-Meter, Stewart power-driven tire pump and electrically lighted instrument board with speedometer, ammeter, oil gage, ignition switches and carbureter adjusting device.

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An Electric Truck with Trolley Battery

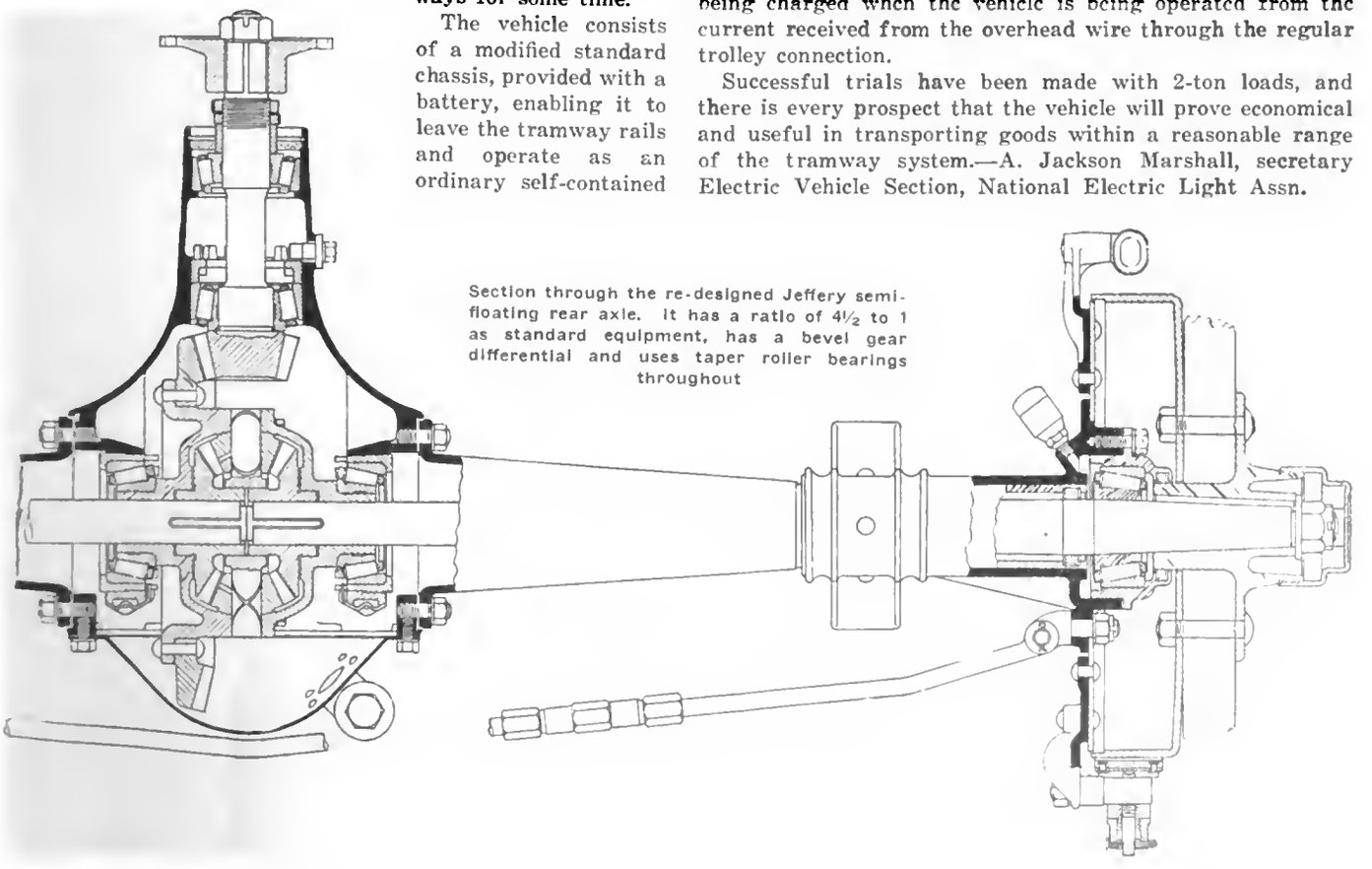
AN electric commercial vehicle which operates from an overhead trolley when traveling on tracks and on a trolley battery when on the road has been successfully used in Bradford, England, by the Bradford City Tramways for some time.

The vehicle consists of a modified standard chassis, provided with a battery, enabling it to leave the tramway rails and operate as an ordinary self-contained vehicle when the occasion demands, which is often the case in conveying material to a point beyond which the current is not available from the overhead trolley wire. The vehicle in question, in addition to being self-contained for special work, is also equipped with standard electric street-car equipment, including a trolley through which the current may be obtained, contact with the rails being made by means of a cast-iron block to the steering gear, and automatically steering the vehicle. The motors are of 20 hp., operating normally at 500 volts on the usual series-parallel system of control.

When the vehicle leaves the tramway route, the rail contractor is lifted, the trolley pole pulled down and a switch moved to bring the batteries into action. Owing to their lower voltage the speed of the free running provided by the batteries is slightly lower than the normal trolley speed, but the vehicle remains able to surmount any gradients.

The connections are arranged so that the batteries can be charged while running on the tramway routes. The normal range of the vehicle on one charge of the battery is about 10 miles, which, of course, may be extended by the batteries being charged when the vehicle is being operated from the current received from the overhead wire through the regular trolley connection.

Successful trials have been made with 2-ton loads, and there is every prospect that the vehicle will prove economical and useful in transporting goods within a reasonable range of the tramway system.—A. Jackson Marshall, secretary Electric Vehicle Section, National Electric Light Assn.



Section through the re-designed Jeffery semi-floating rear axle. It has a ratio of 4½ to 1 as standard equipment, has a bevel gear differential and uses taper roller bearings throughout

French Army School Trains Drivers

Some of the school cars returning from a practical road test for the drivers

Course Combines Theoretical and Practical Repair Shop and Road Work

By W. F. Bradley

Special Representative of THE AUTOMOBILE in France

PARIS, July 12—An army truck driver for convoy formations can be trained in 15 days. A capable touring car driver cannot be produced in less than 6 to 8 weeks. This is the experience of the French army authorities in the training of thousands of men who have not had previous automobile experience.

From their various regimental depots the men are sent in batches to a big automobile school which did not exist a few months ago. Everything has had to be created since the outbreak of war: officers and instructors, sheds for the men to live in, kitchens to cook their food, shops to repair the trucks, and a uniform program of instruction calculated to produce the best drivers in the shortest possible time.

The methods adopted for the training of a touring car driver are entirely different from those applied to the production of a truck driver. The latter is rarely, if ever, called upon to work entirely unaided. The touring car driver, on the other hand, must always be independent of outside help, and be sufficiently expert to get his car home no matter what conditions may be met with en route. Speed is a difficulty. While any ordinary man, without previous experience of motoring, can be trained to drive a truck, a certain proportion of recruits above 30 years of age are naturally incapable of becoming the drivers of mile-a-minute cars.

Theory and Practice Combined

The method adopted at the leading French army touring car school is a judicious combination of theory and practice. The pupils are divided into classes, of which there are about a dozen, each one in charge of an instructor. At the entrance to the avenue about thirty men are gathered round a sectioned automobile chassis. It is a Darracq of simple construction from which the radiator has been removed and the front of the timing gear housing taken away. A part of the waterjacket and cylinder walls has been cut out of No. 1 and No. 2 cylinders, to expose the two pistons. A color scheme has been adopted as an aid to comprehension. Thus the water pump, the inlet and outlet water pipes, and the exposed portion of the waterjacket space are painted a uniform color. The accelerator, the gasoline feed pipe and the carbureter are another color. The brake pedal, rods, shoes and drums have all been daubed from the common pot, and so on throughout the entire chassis, thus making it easy for the novice to trace the connections from one part of the machine to another. In this class elementary instruction is given to men who have for the most part entered the school without any notions of automobile construction and operation.

Learning to Shift Gears

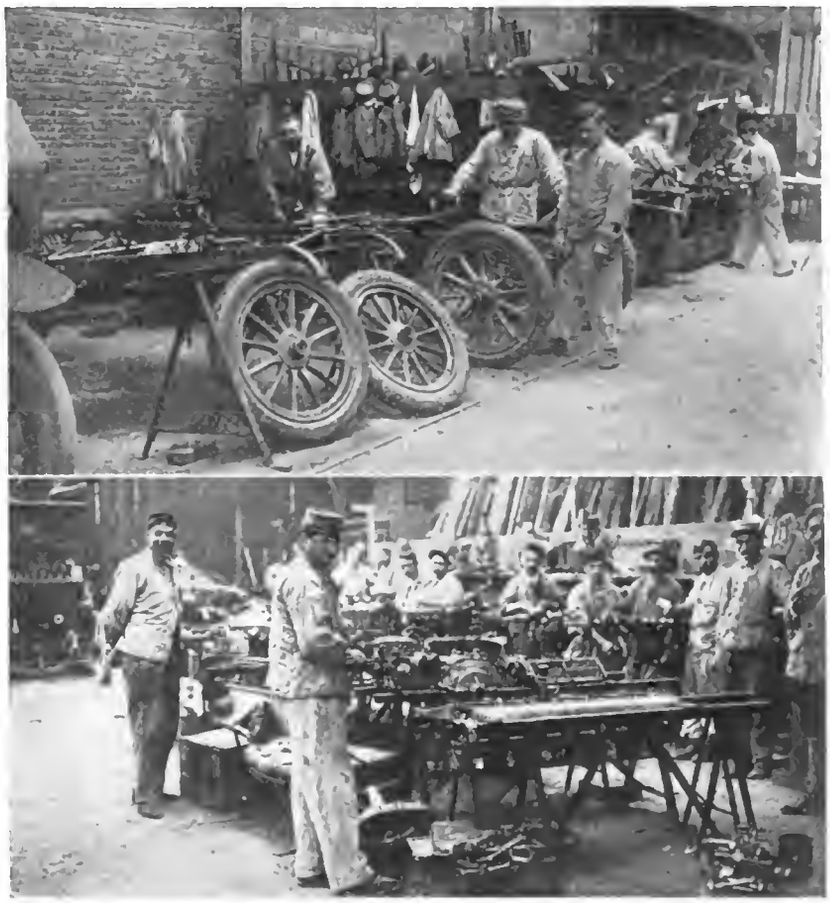
In the center of the next group is a touring car with its rear axle jacked up and its front wheels locked. Here the men are learning both to crank the engine and to change gears, the latter operation being one of the most difficult the instructors have to inculcate. The gearbox cover is removed

A few of the many touring cars awaiting repairs at the shops

and for the first attempt the pupil is allowed to watch the revolving gears. As soon as he has realized that the object of the change speed lever is to put into engagement sets of gears of different diameters, it is insisted that he make all changes with his eyes on the road ahead.

Following the gear-changing classes there are two others dealing with pneumatic tires. It is a fact that a large proportion of the pupils are not aware that a pneumatic tire comprises an outer casing and an inner air tube. This is explained to them, and also the manner of mounting and demounting tires and inflating them to the correct pressure.

These three classes, dealing with elementary automobile construction, gear changing and tire manipulation, are obligatory on all pupils whether they are going to be drilled into expert motorists or by reason of their mediocrity are destined to be transferred to the separate truck school. Other and more advanced classes deal with the theory and construction of carbureters; still another handles the problems of ignition by high-tension magneto, battery ignition evidently being ignored in this school. In another class gearbox design and gear ratios are dealt with, and still further along the interest is centered around rear axles.



Above—A crew of three mechanics engaged on touring car repairs. Below—A scene in the touring car repair shops

Indoors and Outdoors Each Day

The working day is divided into two groups: the men who have been in the open-air classes in the morning spend the afternoon on the road, while those who began the day with driving are given theoretical instruction in the afternoon. This method of alternating theory and practice is found to be most conducive to rapid progress. Four men and an instructor are put aboard each car, the school machines comprising practically every known French make, together with a sprinkling of foreigners. The men do not adhere to any one car during their period of instruction, but change practically every day, so that from the outset they become habituated to different types of control.

During the elementary stages of their instruction the cars are confined to a 5 or 6 mile circuit comprising dead level roads with plenty of by-lanes. Straight ahead driving is not encouraged, the man being constantly called upon to turn, reverse, stop, start, and go through the train of gears. Each man takes his turn at the wheel while the three others listen to the criticisms and advice of the instructor.

After some skill has been acquired in the handling of the steering wheel and the levers the men go out in convoys over give-and-take roads mostly of a hilly nature, the entire convoy being in charge of an officer. As they near the end of their course the men are put on faster cars and every day each man gets about 30 miles actual driving on a machine capable of 60 m.p.h.

No driver is considered competent until he has spent two weeks in the repair shops, forming a team with a couple of skilled mechanics. Night driving tests have also to be successfully passed, these, of course, being undertaken without any lights on the cars and over unknown and unlit roads.

A Practical Test

The army touring car driver must be capable of all kinds of running repairs, and of getting his car going again after a breakdown, in the shortest possible time. As a test in this connection, the driver goes on the road in company with an underofficer, and during the trip his car is disabled. On the skill shown by the man in getting his car back to running condition will depend the number of points given him in the examination. Most of these men, when sent to the front, will have to carry officers, or may be intrusted with important messages to be delivered to units in the field.

Every week a certain number of men leave the school for a central automobile depot from which they are allotted to the armies in the field requiring their presence. Generally on entering the school their military equipment is incomplete, but on leaving that institution they are uniformly dressed in the light blue uniform of the active army; with a steel helmet, a red badge with the letter A on the right arm—signifying "automobile"—a kit bag over one shoulder and a rifle over the other, they go forth to active service. For a large proportion of them there is no novelty in going to the front, for these newly formed drivers are old soldiers who have been wounded and rendered incapable of further service with the fighting forces. It is a general rule that men shall not be admitted into the army automobile service if they are physically fitted for the firing line.

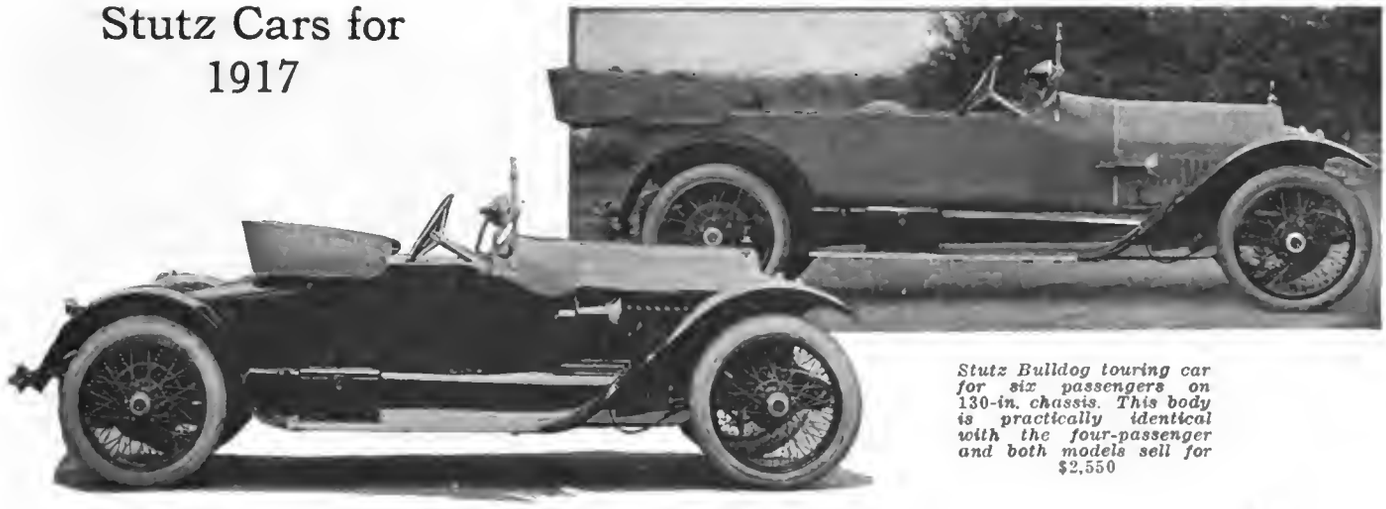
Repairing Pneumatic-Tired Cars

In connection with this school there is a huge repair department for all kinds of pneumatic-tired automobiles used in the various services behind the lines. No trucks, or any kind of vehicle running on solid rubber tires, are handled in this section, and although generally known as a touring car repair depot, a more correct designation would be pneumatic tired automobile repair department, for ambulances and light vans form a sprinkling among the touring machines.

There is more variety in this repair shop than in any automobile establishment in any part of the world. In addition to a score of modern types of well known French makes, the

(*Continued on page* 238)

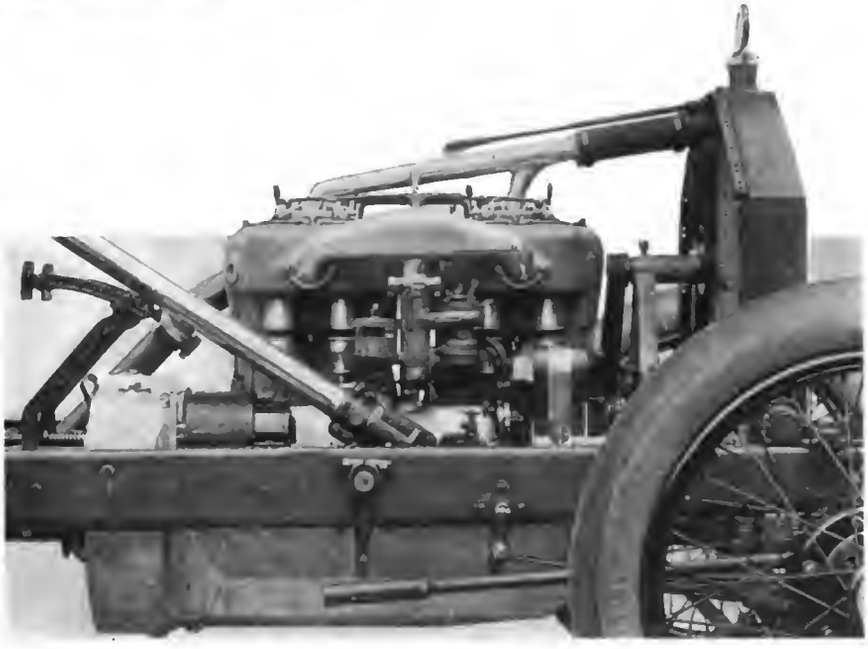
Stutz Cars for 1917



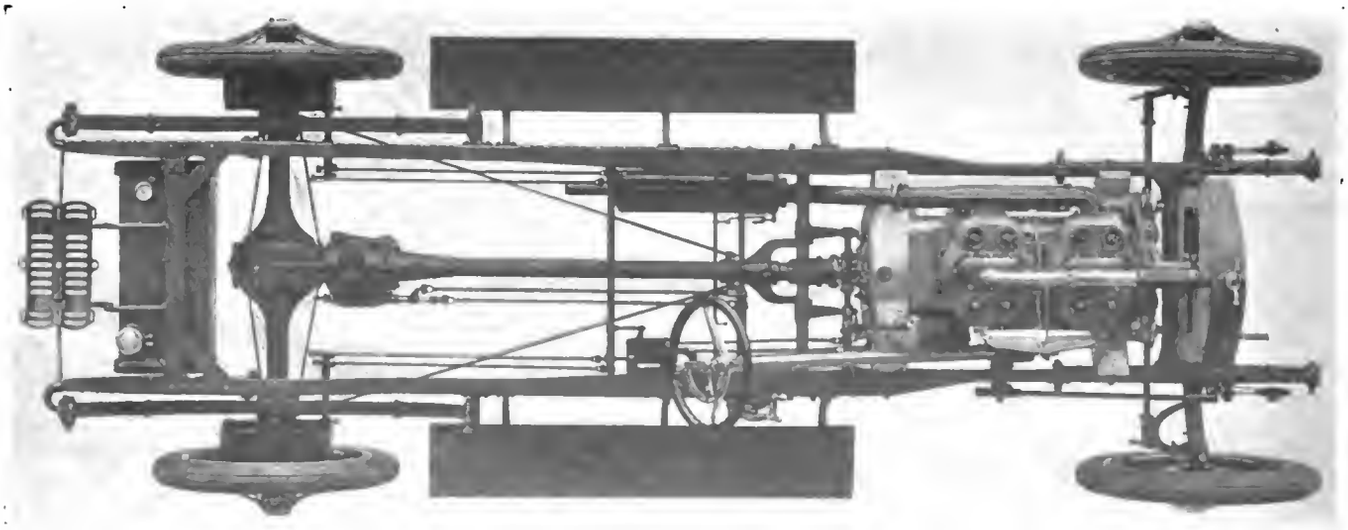
Stutz Bulldog touring car for six passengers on 130-in. chassis. This body is practically identical with the four-passenger and both models sell for $2,550

New Stutz roadster with rear deck and tank carried on the rear of the frame. Carrying space is provided beneath the seat and under the deck

Rear of roadster, showing spare wheel on deck. This view also gives an idea of the smooth, rounded fenders and the gasoline tank mounting



Intake side of Stutz engine for 1917. The carbureter is the only important change, being designed to take care of the low-grade fuels now so largely in use. Note new arrangement for preheating gas. Hot water jacketing is also used to take care of heavy fuel



Stutz touring chassis, showing that, in spite of the high-powered engine, simplicity has not been forgotten. Note, for example, the manner in which the frame ends are curved over to form the rear spring supports. The engine has four 4¾ x 5½-in. T-head cylinders with a formula horsepower of 36.10. Note the three-speed gearbox mounted on the rear axle and the spare tire carrier. The rear springs are 6 in. longer than in the previous model

Easier Riding New Stutz Feature

Longer Wheelbase and Springs—New Roadster Body—Improved Carbureter Layout To Suit Heavy Gasoline

THERE are few changes evident in the new Stutz chassis. A water-heated intake manifold and a hot air supply to enable the heavier grades of gasoline to be used are new features. Next is a change in the wheelbase, which is now 130 in. on all models, and an increase in rear spring length.

Three Models in 1917 Line

The range of models now includes the four and six-passenger Bulldog specials and the new roadster. The Bulldog models have a little more room in the bodies, and the roadster is entirely new in body equipment.

The price of $2,550 for the Bulldog is the same as on the previous model, while the new roadster price, which is $2,275, is an increase over the previous model justified by a longer wheelbase and a great number of refinements.

The only change in the power plant is in the location of the carbureter and manifold and the new facilities for heating the gases. The new manifold has a waterjacket of unusual capacity, which is connected over the top of the engine by a short pipe directly to the water-exit pipe which leads to the radiator. Not satisfied with this method of heating alone, the Stutz designers have installed a flexible hot-air tube from a stove on the exhaust manifold which leads between the two cylinder blocks to the air intake in the carbureter. This construction not only permits the entrance of heated air into the mixing chambers of the Stromberg, but also eliminates the chance of condensation of the gases by their passing through a hot manifold before entering the motor.

The new carbureter location is several inches higher than that of the previous models, making the instrument very accessible. The frame has been increased in size. The side bar is now 5 in. deep, with a 3½-in. width in the center gusset plates which are integral with the side bar. The rear of the frame is now extended to form a spring hanger by the use of U-shaped forgings instead of the goosenecks previously used.

Straight Line Drive

An alteration in the chassis design which not only makes a much easier riding car but permits a straight-line drive through the double universal joints is the increase in length of the rear springs from 50 to 56 in. and so changing the design that when the car is loaded these springs lie perfectly flat. This, together with the Hartford racing type shock absorbers, which are used as regular equipment on all models, and the characteristic Stutz feature of unusually low center of gravity in the body and seating of passengers, makes the new car by far the most comfortable riding proposition which the factory has yet produced.

In speaking of the new Stutz bodies, of course the brand-new roadster is the most interesting because of its newness. The body is placed on the standard 130-in. wheelbase, whereas all previous Stutz roadsters were on a 120-in. wheelbase. In the place of the combination oil and gas tank and traveling trunk evident on the old roadster, the new car has a modified turtle-back rear with a depression, circular in form, for carrying an extra wire wheel and tire. The wire-wheel carrier provides a very substantial support; in fact, the wheel is fitted onto lugs much as it is when it is in place on the axle. With the addition of a special padlocking device for safety, the spare wheel is placed so firmly that there is no chance of its vibrating.

There is a carrying space in the rear of this body, directly in front of the spare wheel space and behind the seat, which is large enough to hold two or three suitcases. Entrance to the compartment is gained through a large door on the top, which is locked by a key on both sides.

Body Is 4 In. Longer

The body length of the touring car has been increased 4 in. and the width 1 in. The increase is all taken up in the rear compartment, so that ample leg room is provided both for the passengers in the auxiliary seats and in the rear seats. The bodies of the four-passenger and the six-passenger are identical, except that in the latter folding auxiliary seats are substituted for the cowl cabinet and Thermos bottles, which in the four-passenger are carried as regular equipment.

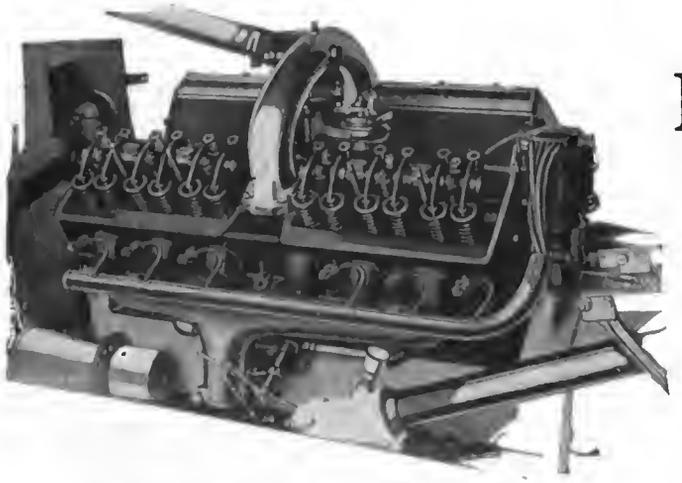
The engine is a four-cylinder, pair-cast, T-head design, 4¾ by 5½ in., with three bearing crankshaft and camshafts. The leather-faced cone clutch and the characteristic Stutz rear axle gearset which have been used by this company since its inception are unchanged. As in previous models, the camshafts operate roller-type pushrods and the valves, which are tungsten steel, 2¼ in. in the clear, have the mechanism inclosed by individual housings. The camshaft is by helical gearing. Lubrication is by force feed through a hollow crankshaft, carburetion by a Stromberg, and ignition by Bosch double-distributer magneto, with a Remy system taking care of starting and lighting.

In the gearshift, however, there is an alteration in that the shifting lever positions are reversed to what they were on previous models. With the former construction the high-gear position was on the inside and toward the driver. This position was slightly inconvenient, inasmuch as the lever was in the way of the driver's leg. The change has been made, as stated above, by reversing the shifting positions so that now the lever when in high is against the body and out of the way. A padlock for locking the shifting lever in neutral has been added.

Pedals Are Adjustable

The pedals may be adjusted to suit the driver's requirements, there being a variation length of 2½ in. There is an inclosed propeller shaft, the torque tube surrounding it being attached to a face plate back of the clutch.

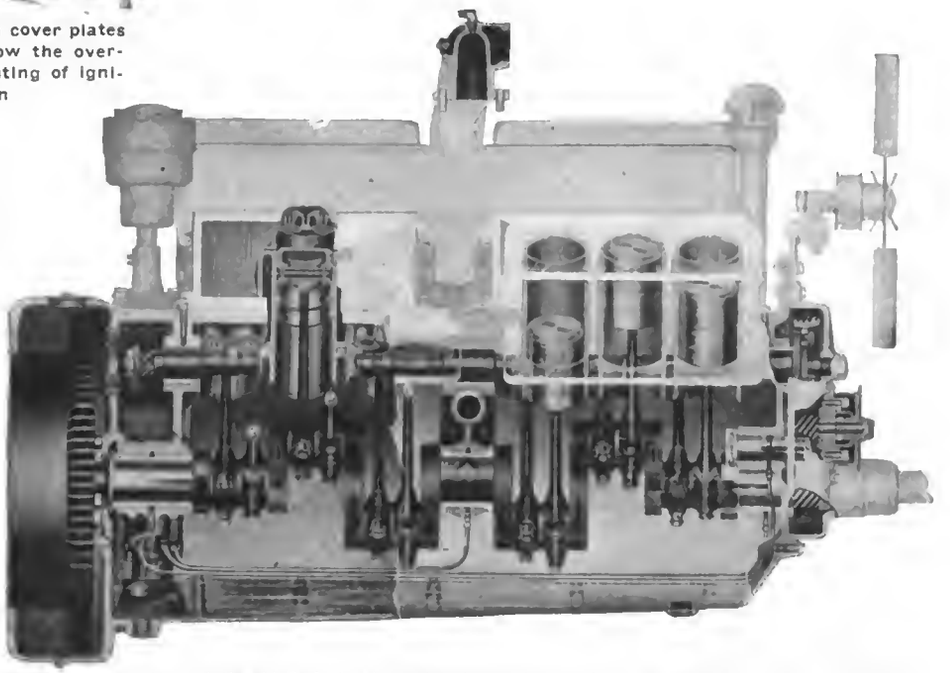
Upholstering on all new models is either brilliant-finished, long-grain, hand-buffed black leather or dark brown Spanish hand-buffed leather. The fenders are now slightly crowned, which adds to the appearance of the assembly. Battleship-gray and Mercedes-red are the new standard colors. Stutz has departed from the use of wood wheels altogether and will furnish Houk wire wheels in one size, 34 by 4½, one extra wheel going as regular equipment without additional cost. In tires, an option of either Goodrich Silvertown cord or Goodyear cord is offered. Accessories include a Boyce Moto-Meter, windshield spotlight and double-bulb lamps, with the small bulb out of focus to comply with dimmer ordinances.



H-A-L twelve-cylinder engine, with cover plates removed from the left block to show the overhead-valve mechanism. Note mounting of ignition distributer and horn

H-A-L Twelve Now In Production

Overhead-Valve Engine 2⅞ by 5 In.—135-In. Wheelbase, Straight Taper Frame and Body Lines with Rounded Top Edge



Phantom view of the H-A-L twelve, showing side by side connecting-rod mounting for which the cylinder blocks are offset 1½ in. The oil lead connections, camshaft and distributer drive are also illustrated

EMBODYING a 2⅞ by 5-in. twelve-cylinder unit power plant, a three-speed gearbox and floating rear axle, the H-A-L car sells for $2,100 as either touring car or roadster. Although the car was announced some time ago, the H. A. Lozier Co., Cleveland, Ohio, has only recently begun production and the complete details of the cars are now available.

Body fashion designers have approved the straight taper from radiator to rear of car, with no break at the hood; they have said that the cowl effect at the back of the front seat is good form and also made it clear that the top edge of the body must be rounded over. The H-A-L exhibits all of these fashionable curves, and as its wheelbase is 135 in., there is ample room for carrying out the smooth, sloping lines. At the present time two body types are offered, these being the seven-passenger touring car and the roadster.

The H-A-L has an overhead-valve twelve-cylinder engine with a bore of 2⅞ in. by a stroke of 5 in., the drive being taken through a disk clutch, three-speed gearset and open driveshaft fitted with two universals. The final drive is a Timken floating axle, and the rear suspension is by semi-elliptic springs. The frame is a straight tapered affair reinforced by four large cross members, and the tires are 34 by 4½.

The Engine in Detail

The engine develops, according to formula rating, 39.6 hp., but this is merely a nominal figure, for it is claimed that the engine will deliver 70 hp. at 2000 r.p.m., and that the maximum is well over 90 hp. The dimensions give a displacement of 389.6 cu. in.

In its general arrangement, the power plant is of the type in which the cylinders are cast in two blocks of six. Practically the only thing between the blocks is the carbureter, which is a commendable construction. The overhead valves are inclosed by cover plates, four in number, each housing the valve mechanism for three cylinders.

On the right side are the starting motor, the generator and the water pump. Thus only one extra driving gear is required besides the timing gears. The fan is driven by a pulley on the front of the generator and water pump shaft, and at the rear of the crankcase just back of the cylinder blocks is the vertically-mounted ignition distributer. This is driven from the rear end of the camshaft by a helical gear. The position of these units leaves ample room for the exhaust manifold for the right block.

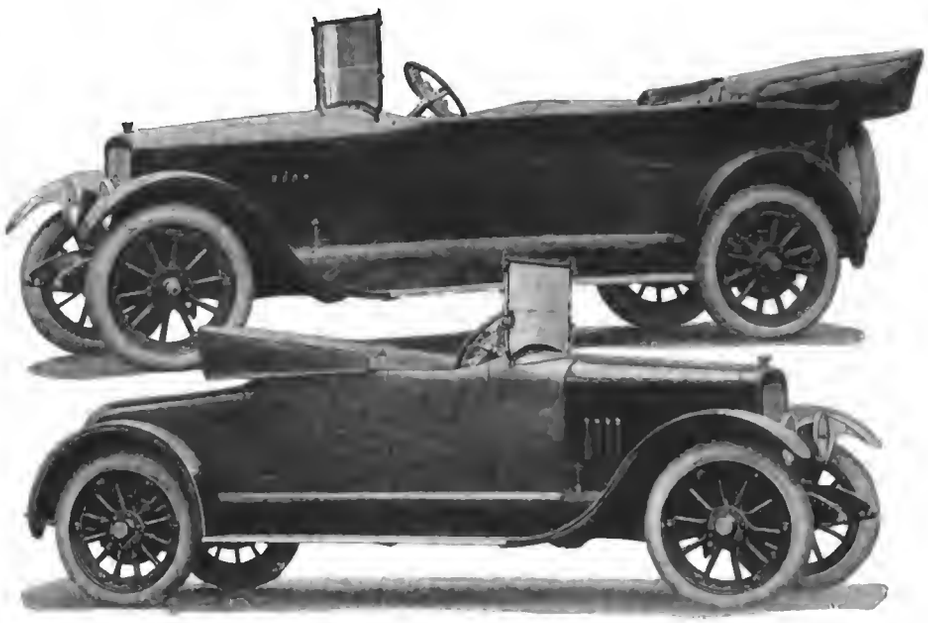
Cylinder Blocks Offset

The cylinder blocks are arranged with a 1½ in. offset from one another with side-by-side rods. The three-bearing shaft has a diameter of 2⅛ in., which when it is considered that the bore is only 2⅞ in., appears to be an exceptionally large shaft for a motor of this size. The camshaft is mounted also on three bearings, and is positioned directly above the crankshaft, so that it actuates all of the valves directly. Due to the fact that the cylinders are offset, it is possible for each tappet to have its own individual cam, which construction simplifies the lower valve construction and allows for synchronized valve timing, since it is not necessary to consider more than one valve in the shaping of each cam. Pistons are quite long and have chamfered heads which should assist in keeping the oil down out of the combustion chambers, since there is a tendency of the lubricant to ride by the piston head instead of being scraped into the combustion chamber as might be the case if the upper edge of the head were not of this beveled form. In addition to

the top rings there is one ring near the bottom which acts as a wiper. The pistons are cast iron.

Pressure Oiling System

An elaborate oiling system has been provided for the engine with the oil pump in the crankcase forcing a constant supply through individual pipes to each of the three main bearings and also to the camshaft bearing. The connecting-rods are oiled from the main bearings through holes drilled in the webs of the crankshaft. There is sufficient oil thrown off from the sides of the connecting-rod lower ends to lubricate the cylinder walls, this oil being virtually a vapor, due to the rapid revolving of the crankshaft. A special lead runs to the timing gears and the oil breather and filler pipe is mounted at the front of the motor, directly ahead of the left cylinder block, being brought up high enough so that filling is very convenient and spilling oil minimized.



H-A-L touring car and roadster which are mounted on the same chassis with 135-in. wheelbase with twelve-cylinder power plant. Both models sell for $2,100

This engine is arranged so that the water outlet connection is combined with the intake manifold, which bridges the gap between the cylinders and from which the carbureter is suspended. Thus the heated water from the cylinders passes around the inner pipe which carries the fuel to the cylinders and good vaporization of the gas results. As before stated, the water pump is mounted on the right side back of the generator. Besides introducing the water into the immediate block of cylinders, the pump also sends a supply across through the crankcase to the more remote block and the design is such that each set of cylinders gets equal cooling water. The belt-driven fan is mounted on a bracket attached to the crankcase and there is a simple adjustment for the belt tension.

Electrical System Arrangement

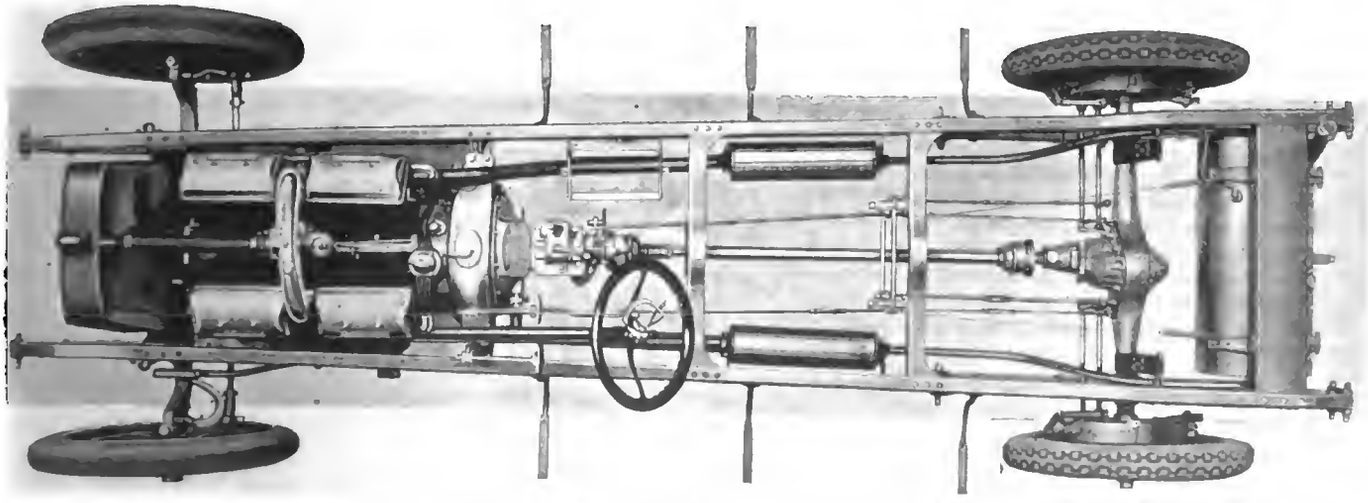
Electrical units for starting and lighting are Westinghouse and these, together with the Remy distributer, utilize a 100-amp.-hr. Gould storage battery, carried on the right side of the chassis and reached through the floorboard of the front compartment. The location of the distributer is such that the ignition wires running from the spark plugs are quite short ,and as the plugs are mounted on the outside of the cylinder block, wiring manifolds are fitted which prevent the wires falling down on the exhaust pipes below them. The starting motor drives through gear connection with teeth cut in the flywheel rim in the usual way.

Compactly attached to the rear of the crankcase are the multiple disk clutch and three-speed gearsets, the bell housing of which completely incloses the flywheel and clutch mechanism, as well as carrying the brake and clutch pedal shafts.

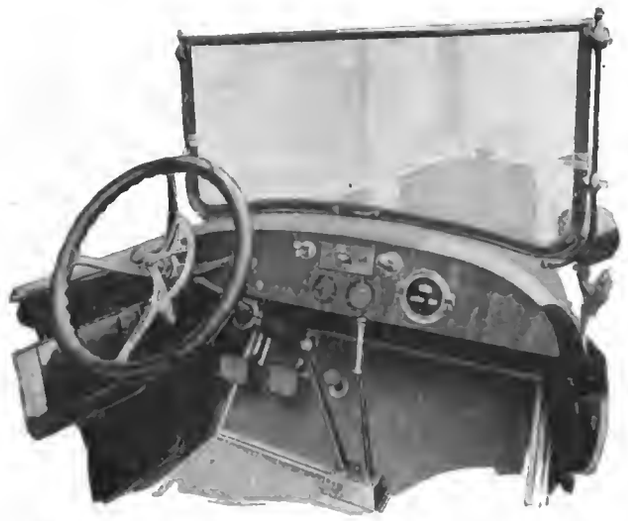
The clutch is a dry disk type made up of one steel disk and two of Raybestos, all three being 12 in. in diameter and having a face width of 1¾ in. Gears and shafts in the gearset are made of nickel steel and mounted on S. K. F. annular ball bearings. On the left side of the gearcase is mounted a single cylinder tire pump which is driven by one of the countershaft gears meshing with the pump gear. To throw the pump into driving engagement, there is a key located in the floor in front of the driver's seat. Then just back of the gearbox on the driveshaft is mounted the speedometer driving gear, meshing with the flexible speedometer shaft gear which is bracketed to the back side of the gearcase.

Floating Rear Axle

The drive is through a propeller shaft of nickel steel tubing, having a 2 in. outside diameter and a wall thickness of ¼ in. The rear axle unit is a Timken floating construction,



H-A-L twelve chassis, showing neat layout of power plant, double exhaust lines, straight taper frame and mounting of fuel tank at rear. Note combined water outlet and intake manifold bridging the V between the cylinder blocks



Driver's compartment of the H-A-L, showing control members and symmetrical arrangement of instruments on the cowl board

fitted with spiral bevel driving gears and all carried on Timken roller bearings. The axle housing is a steel pressing with axle tubes in unit with the differential case. A large plate at the rear gives complete access to the differential gears and driving gears for adjustment or repair. The axle affords a ratio of 4 5/11 to 1.

Long, flat rear springs of semi-elliptic form are fitted, these being underslung from the axle and taking a flat position under load. They consist of ten plates, 2½ in. wide and are 57 in. long. The tapered frame narrows at the front in order to give a small turning radius, and a firm body support throughout the entire body length as well.

At the rear is mounted a 23-gal. gasoline tank, suspended by steel straps from the rear cross member. Fuel is fed to the carbureter by the Stewart vacuum tank arrangement.

In connection with the outward appearance of the car, mention should be made of the distinctive type of radiator used, which is moderately high and narrow and which blends well with the general sloping lines of the car. There are auxiliary tonneau seats which fold into the back of the front seat, and another attractive feature is the symmetrical grouping of the instruments on the board.

Gray & Davis Electric System for Fords

GRAY & DAVIS, Boston, Mass., have just brought out a double unit starting and lighting system for Ford cars to sell for $75. Electrically the characteristics do not vary from previous Gray & Davis practice. The system consists of a motor and a generator which are electrically separate, but which are inclosed in the same housing, lighting and starting switches and a complete outfit of wiring and sprockets, etc., to make a complete installation.

Simplicity is the keynote of the new apparatus and it is designed particularly to appeal to the average Ford owner who desires to fit his car with full electrical equipment. It is intended for use on even the latest Fords, for, although these have electric light, there is no battery and the headlights are not available unless the engine is running. With this system the layout includes a full battery and charging apparatus.

A shunt-wound dynamo is used and this is connected to the crankshaft by means of a sprocket and silent chain. The chain width has been made particularly large for long life and also for silence. The regulator is a magnetic type and includes the automatic cut-out.

Located above the dynamo is the starting motor. This is a straight series-wound machine which is featured by a Bendix gear meshing with the dynamo sprocket wheel to crank the engine. The series-wound motor, in conjunction with the Bendix arrangement, gives a very simple mounting, especially in that the driving units do the work for both the starting motor and the generator as shown very clearly in the illustration herewith.

The fittings and materials have also been given close attention. The framework, for example, is forged from alloy steel and the end or bearing brackets are electrically welded to the frame. An enameled steel box is used to carry the 6-volt battery and there should be no clumsy wiring on the car, as the wires and cables are all cut to proper length and furnished with the outfit. The supporting clips and terminals are also provided.

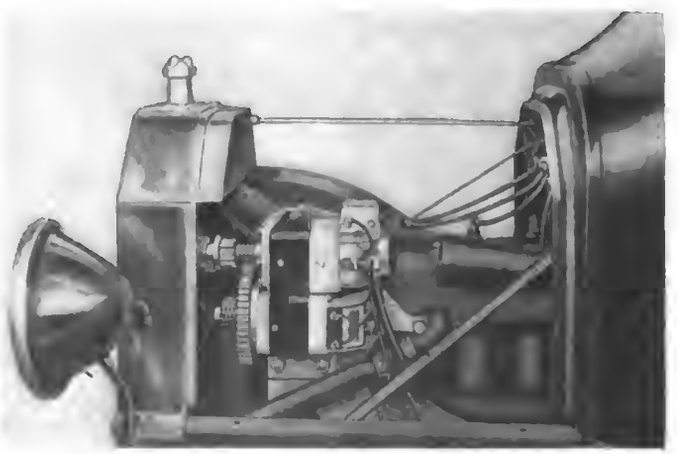
In making the installation the only part removed from the engine is the pulley on the crankshaft which is replaced by the sprocket. Even the starting crank can remain in position if desired. The framework bolts in place and is simple to mount, although when in place, the entire assembly is very rigid and well able to sustain the torque reactions in turning over the Ford motor.

The wiring layout is conventional, the battery floating on the line and thus acting as a pressure regulator, keeping the flow steady in spite of the rate of speed. The generator is capable of carrying the full lamp load at comparatively low motor speeds and is arranged to cut in at a car speed of close to 10 m.p.h. This is the speed at which the units on larger cars operate and it is found that for the average driver, the battery will be kept fully charged if more than a normal amount of night driving is not indulged in.

Carrying Spare Bulbs

THAT so few automobile manufacturers provide proper means for stowing away the necessary spare bulbs for the headlamps and tail lamp is rather remarkable. There are now a good many cars in which there is a fuse assembly back of a panel in the cowl board, giving access to all the fuses when unlocked and opened. Surely the spare bulbs could more often be carried behind a similar panel, each fitting in a dummy lamp holder, as in the Franklin car.

Inside the panel it would be a good idea to have a printed notice, stating the type and make of bulb for which the lamps are adjusted and the sort of filament which suits the reflectors. Such a precaution would prevent the use of unsuitable bulbs which is a common cause of glare and of poor driving light.



Latest Gray & Davis Ford starter, showing super-imposed starting motor

Advantages of Caterpillar Tractors

Special Work Can Be Done by This Type Which Wheeled Machines Cannot Accomplish—Type Worthy of Development—Automobile Engineering Experience Would Effect Vast Improvements

Part II

PREVIOUS reference has been made to the width of round wheels in some of the earlier steam engines built for work on peaty ground, and in the early days the driving wheels were made as wide as 12 ft. on either side of the engine. The standard width of caterpillar track is 24 in. and the wide track is 30 in. for the 75-hp. machine, but as the length of the track is 67 in. on each side of the machine, it will be seen that the specific load is 7 lb. per square inch of projected area with a 24 in. wide track. The weight of the machine being 23,500 lb.

Useful in Great Cold

That the caterpillar is not confined in its operation to temperate countries but is able to work under conditions of extreme cold is shown by the work accomplished in Alaska at a temperature of 40 deg. below zero Fahrenheit where timber has to be hauled for a distance of 9 miles and is used for fuel. The wood is hauled by team from where it is cut to the river and then loaded on sleds, from 5 to 8 in number, and hauled down the frozen Tanana, which is a branch of the River Yukon. Thirty cords of wood are hauled at one time in this way at a profit of about $5 per cord, the operating cost being $60 per day. Some of the peculiarities of the local conditions may be summarized as follows:

The extreme cold makes the snow dry and yielding so that the steel runners do not readily slide over it. It is therefore impossible to start the train with the full load after it has once stopped, and in order to get over this difficulty, the following method is adopted:

The caterpillar is first backed into the train of sleds and each one jolted back far enough to leave slack in the chains between all of them. The caterpillar is then started forward with a jolt and each sled in turn started with another jolt. In spite of this severe usage, the caterpillar has been at work satisfactorily for four years and is likely to continue some time longer. The only breakages up to the time of writing have been a few valve brackets and one large cast iron bevel gear. The intense cold renders the cast iron brittle.

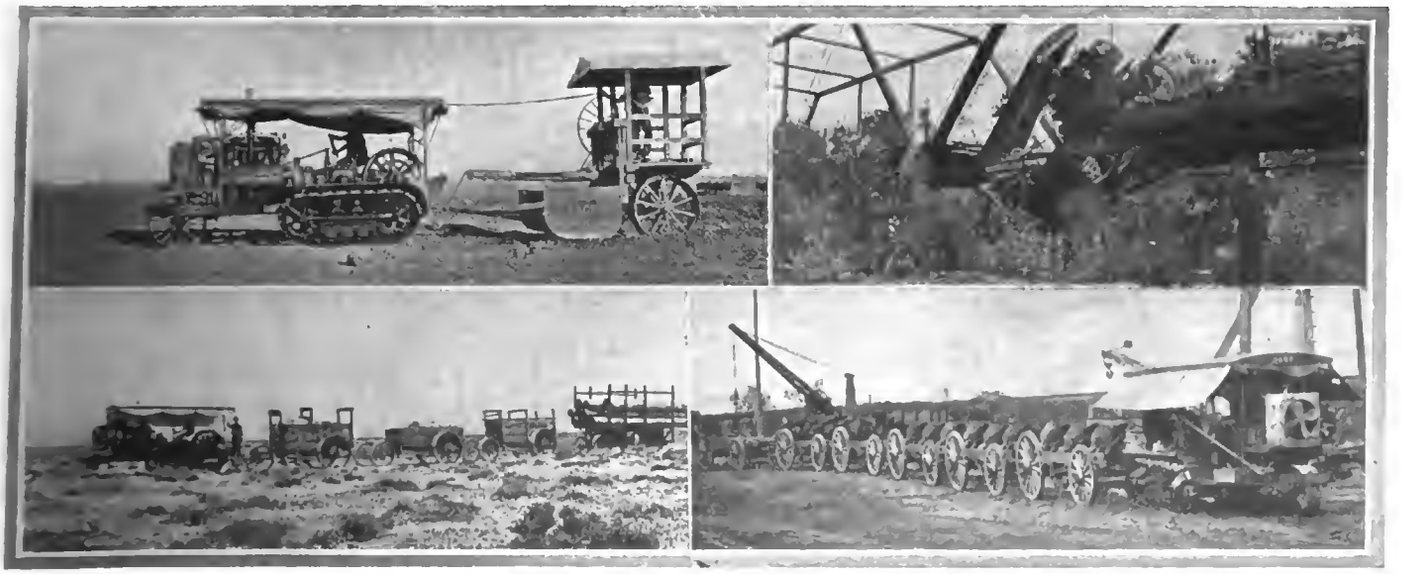
In order to adapt the machine to the climatic conditions a crude form of radiator made of half inch pipe was substituted for the standard radiator and the fan was eliminated. Extra adhesion is obtained by welding a large chain around each shoe.

The fuel used in the engine is distillate at temperatures down to 25 deg. below zero, but when the temperature drops below this, gasoline is used, as well as for priming the engine before starting. It is stated that no trouble is experienced in starting the machine from cold in any weather.

Can Haul Lumber

An example of the caterpillar working under difficult conditions of another type may be mentioned from the logging industry. From a report on the performance of a 60-hp. caterpillar covering 3 years' work hauling shingle bolts, making four and sometimes five round trips a day on a 2-mile haul, we obtain some idea as to the arduous character of the work involved.

These shingle bolts are hauled by the caterpillar over a skid road made up of cross ties and planking, with a row of logs down the center. The sleds on which the bolts are loaded, straddle across the center row of logs, which prevent the sleds slipping sideways on the greased ties. The par-



Upper left—Caterpillar tractor hauling a land leveler. Right—Precipitated 13 ft. into a river by the breaking of a weak bridge, this caterpillar went home under its own power. Lower left—Caterpillar in desert freight work. Right—Outfit owned by a gold-mining concern, another example of the caterpillar's hauling abilities

ticular machine engaged in this operation differs slightly from the one used in Alaska, by reason of its being provided with two front wheels, to enable it to straddle the center logs. Three sleds are pulled at once, each one hauling 4 cords of shingle bolts weighing 3500 lb. to the cord. The 2 mile road is on an uphill gradient, part of which is 12 per cent, and the load is never less than 20 tons. Work of this nature can be performed by the caterpillar more effectually than by any other type of hauling machine, as the irregularity of a wooden or corduroy road in no way affects the operation of the machine.

References have already been made to the work of the caterpillar in leveling land, and a land leveler being operated for this purpose is shown on page 229. In much of the Western country it is necessary to pull the stumps of trees before the leveler can be got to work, and as an example of what the caterpillar can do, the following may be cited:

Pulling Old Stumps

In a certain district the trees had been cut, many of them being as much as 8 ft. diameter, but the stumps were left in the ground and sugar cane was planted with the aid of pick-axes in the field thus partially cleared. The ground was quite soft and the surface uneven, so that it was just a question as to whether a tractor could be used for pulling and hauling these stumps. A period of eight years had elapsed between the time of the trees being cut and the time of the attempt to pull the stumps by caterpillar power, but this was eventually tried and a ¾-in. diameter steel wire rope was attached to the trees in turn, as it was found that chains which had been previously tried snapped in two. The uprooting was done by a steady pull, and owing to the roots being even at that time firmly fixed in the ground, 1½ to 2 cu. yd. of earth came away with each stump. A good day's work for two men with the caterpillar was twenty-five stumps.

In addition to leveling open country, the grading of roads forms an important occupation for the caterpillar, and in competition with traction engines we will take an example where a mile stretch of land between two irrigating ditches about 45 ft. apart was chosen. Seven tractors, in addition to one caterpillar, took part, and the first machine was occupied for more than half a day grading 150 yd. Another machine graded 150 yd. in 3½ hr., and again the fifth machine required 4 hr. and 20 min. Some of these tractors wasted a considerable amount of time in turning, which operation required from 7 to 12 min. in some instances.

When the caterpillar came along, it completed its work in 2 hr. and 5 min., and then went straight ahead and graded another 350 yd. in 1 hr. and 42 min. Not satisfied with this performance, the caterpillar representative picked out a stretch of gumbo land that was admitted to be the worst in the country, and it finished half a mile in 2 hr. and 12 min. During this exhibition the consumption of fuel was 11 gal., of track oil 1 gal., of lubricating oil 1 pint, and no perceptible water.

The caterpillar will stand some rough usage, as illustrated on page 229, depicting what occurred when a very weak bridge collapsed, precipitating the machine a distance of 14 ft. into a river. The bridge in question had been condemned for some time, but the driver of the caterpillar was of the opinion that the large distribution of weight which is afforded by the caterpillar tracks would be a sufficient safeguard against an accident of this kind happening. He was, however, mistaken, but the caterpillar did not suffer any damage as a result of this fall. The front end of the caterpillar was gently lowered to the ground and the engine re-started and run home under its own power, no parts being broken except a casting on the steering gear.

Future Is Promising

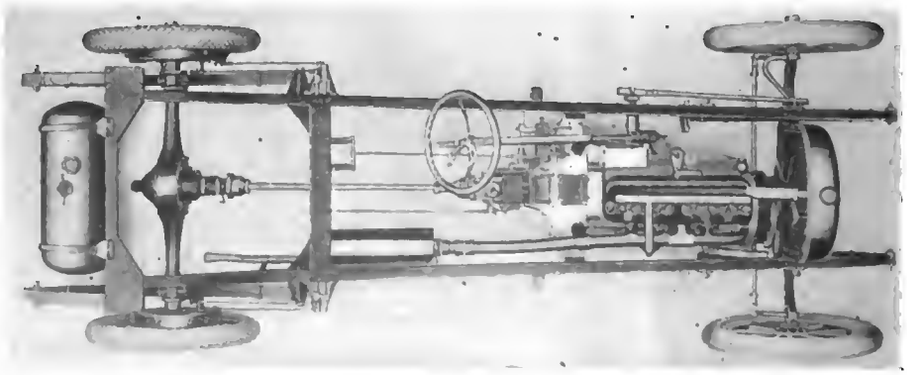
Some time ago an American farm power journal published an article and graph showing the percentage of slipping of round wheels on a tractor engaged in plowing, and the data was based on the performance of a 20,000-lb. tractor operating in an average field with standard cleats on its wheels. This curve showed that the slip when hauling four plows was 2 per cent, which increased to 5 per cent when seven plows were hauled. With an increase of loading up to ten plows, the slip was 20 per cent, and with twelve plows 38 per cent. There are, of course, certain conditions of ground surface when the tracks of a caterpillar will also slip, but these are not frequently met with. When the surface is hard and unyielding, such as closely fitting boards, stone setts or cobbles, the caterpillar tracks will sometimes slip rather than allow the load to pull up the engine, and in freighting on this type of road some care has to be exercised by the driver in the event of one track operating on a different type of surface from the other track, as there is a tendency under these conditions for the caterpillar to slew round.

Working on a hard surface is one of the most severe tests of the caterpillar, by reason of the vibration which is set up in the machine and particularly in the track. Under no circumstances, therefore, when reliability and endurance is aimed at, should a caterpillar be run at more than 2 m.p.h. At such a speed its economy is at maximum and the rate of fuel consumption of a 75 hp. machine will be about 2¼ gal. per mile.

Some Troubles With Track

Actual practice has shown that on hard roads there is a very considerable difficulty in keeping the bolts in the track tight, and these not only stretch and shake their nuts loose but they appear to jar themselves down onto the metal surface of the track plates and a general looseness results. Another difficulty which develops in the track is the breaking of track bolts under heavy vibration, but this is not insurmountable, and resolves itself into a matter of material and design. The above difficulties do not manifest themselves under the conditions of working for which the caterpillar was originally intended, namely working on soft ground.

In conclusion, although the caterpillar is in its infancy as a mechanical appliance, regarded in the light of other methods of haulage and locomotion, its performance over a large variety of heavy duties has proved so remarkable that great hope can be held out for its future development. It has amply proved that it can carry out successfully difficult duties which cannot be attempted by any other type of machine, but it suffers from lack of that detailed development and advanced design of which it is worthy.



Chassis of the Velie small six, showing clean layout and the taper frame construction

Velie Improves Appearance

New Body Styles of Handsome Proportions—Chassis Practically Unchanged—Range Includes Small and Large Sizes

THE Velie has always been a car of distinctive character, and a car built with somewhat more than usual regard for the little things which make for satisfaction. The new models just announced by the Velie Motor Vehicle Co., Moline, Ill., are no exception in this respect, rather they are even better in detail quite apart from the new bodies which are really distinctive. The touring cars now have the top edges of the doors and side panels well rolled inward, instead of finishing with a square edge, the lines are straighter and the whole exterior smoother. Also it should be remarked that these bodies are of rugged construction. The doors shut with the feeling of solidity always noticeable on a custom built job, the seats are deep with good depth of padding at the backs and the proportions are such that an easy sitting position is obtainable either in the front or rear compartment. For the driver there is distinctly more room than usual and the pedals have a wide range of adjustment to suit any stature.

One of the most striking of the new models is a four-passenger roadster which has a long deck back of the rear seat. The deck is carried along the sides of the rear seat, which is a little narrower than the full width of the body, so that the seat sides stand up something like the combing around the seating of a motor boat. As the deck slopes from front to rear the effect is quite distinctive, catching the eye immediately.

Another body style which the Velie company expect will be in strong demand is a French model of town car, and there are several other styles as well.

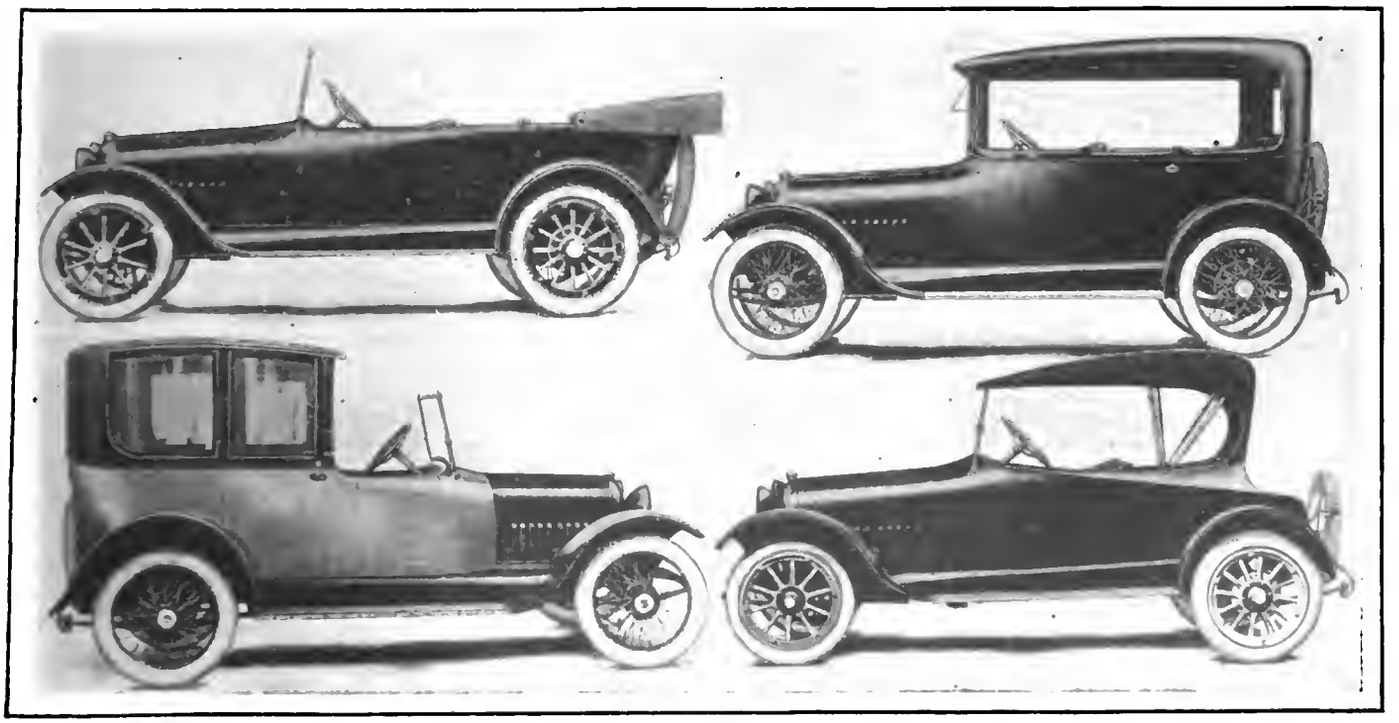
As for last year, there will be two chassis, both sixes; the smaller being made in the largest numbers. Both have Continental six-cylinder engines, the smaller 3¼ by 4¼ in. and the larger 3½ by 5¼ in. An innovation for Velie is the use of Timken axles front and rear. Both power plants are the unit type, the smaller car having a three speed transmission and the larger four speeds with the high gear indirect. Dry disk clutches are used for both cars.

Velie was one of the first to adopt the taper frame with the side rails perfectly straight from end to end, and this is being used for both 1917 cars, three-quarter rear springs and Hotchkiss drive being two other features which are likewise unchanged. Lighting and starting is cared for by a Remy outfit, the generator having the ignition distributor combined with it. A feature of this system is its small size and weight, and the Velie engineers have arranged the generator so that it is very accessible.

Wide Choice of Bodies

Tabulating the different body types offered is the easiest way of emphasizing their variety. On the large six there is only one style, this being a seven-passenger touring body. The wheelbase of this model is 124 in. and tires 35 by 4½ in. On the smaller chassis which is 115 in. wheelbase and has 32 by 4 in. tires, non-skid on rear, the bodies available are as follows:

Touring, five passenger	$1,085
Roadster, two passenger	1,065
Roadster, four passenger	1,085
Coupe, four passenger	1,750
Town car	2,200
Touring sedan	1,685
Cabriolet, two passenger	1,485



Upper left—Large "Biltwell" Velie six with seven-passenger body. Below—The French type town car on the smaller chassis. Upper right—Convertible touring sedan with detachable windows on the small chassis. Below—The new four-passenger roadster

Getting Correct Front Spring Action

Possible Methods of Mounting Automobile Front Springs Which Will Eliminate Front Wheel Wabble and Interference with Steering Caused by Road Shock

By H. H. Dyke

IN a letter in Forum some months ago certain disadvantages of the standard type of front spring construction were pointed out and it was shown how these disadvantageous features arise from causing the front semi-elliptic spring to turn on a fixed pivot at its forward end, *ahead* of the front axle, and connecting the steering link to its steering gear arm some distance *behind* the front axle, bringing these two pivoting points on opposite sides of the axle so that they tend to move in divergent and conflicting arcuate paths.

What is needed to cure these defects is to get the centers on which the steering link and the front axle (with the steering knuckle arm secured to it) turn, close together, instead of as far away from one another as possible, and then there will no longer be the divergence between the paths in which these parts tend to turn and which give rise to "drunken" movements of the front wheels, wear on the front tires, steering gear wear, turning of the steering wheel in the driver's hands, and numerous other things which are wrong and could be avoided.

Reversing the Connections

A simple change leading in the right direction is illustrated in Figs. 1 and 2, in which the connections at the ends of the front spring are simply reversed from the ordinary practice, Fig. 1 showing a push shackle, and Fig. 2 the more desirable pull shackle. The only change required here is to move the fixed pivot away from the front end of the frame and spring, to the rear point of attachment between the front spring and the frame, and to move the shackled pivot to the forward end of the front spring and frame, merely reversing the ordinary practice. Here the centers C' of arc C and D' of arc D are close together and the circular paths C and D traversed respectively by the axle with its steering knuckle arm, and by the front end of the steering link, are practically coincident and the parts move practically together instead of pulling against one another. By making the shackle of a strong U-form any tendency to side sway can be easily prevented. There is no trouble in this day of Hotchkiss drives in making the spring strong enough, and the fact that with this construction the spring pushes the front axle instead of pulling it, makes the mounting of the axle of increased resiliency and, with a well built spring, is a positive advantage because of the added resiliency. There can be no doubt that such suspension can be used successfully, for the form of Fig. 1 is in use every day on Fifth Avenue, New York, in the Daimler buses.

Not the Ideal Arrangement

The arrangement of Figs. 1 and 2, while much better than the present practice, is not all that can be desired, because both the steering arm pivot D' and the spring pivot C' cannot always be brought into direct line with one another transversely of the car so as to get the same radius for each, and because an element so disregarded, namely the bending of the spring itself and the change in length due to the bending, varies to some extent the radial or circular movement in the case of the axle and its knuckle arm, whereas the steering link is, of course, inflexible and of unvarying length and turns on a true arc.

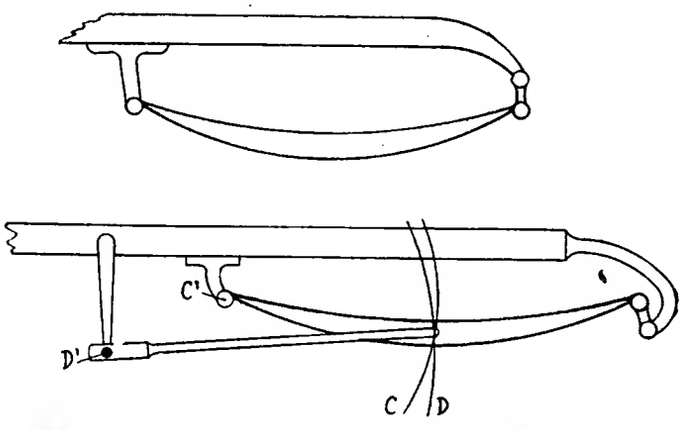
These various details, however, are of minor importance as compared with the one really important consideration, namely that the centers of rotation are both on the same—the rear—side of the front axle, and the natural paths are substantially the same and the conflicts between them and the various defects resulting therefrom are greatly reduced, so much so in fact, that it is apparent beyond question that the substitution of the Daimler front spring suspension for the present standard type would be a big step in advance in motor car design and one very much worth while.

Minor Variations Easily Overcome

Such minor variations as do occur between the paths of the steering link front end and the steering knuckle arm with the Daimler type may be completely done away with.

Whenever the springs are used as the sole means of securing the front axle to the frame, however, the actual movement of the axle and the path it traverses relative to the frame is quite complicated, involving rotation on a spring pivot or pivots and also changes in length of the spring due to its bending and unbending. It is only by floating the front axle on its springs and making use of radius rods, or of a radius yoke, for controlling its movement that it can be made to move in practically a true arc. When such radius apparatus—a radius yoke is preferable to rods—is pivoted to the frame or to some part rigidly connected to the frame, such as the engine base, with its pivotal support at the same distance back in the frame as the steering arm of the steering gear, the front axle and the forward end of the steering link move in practically identical arcs and there is substantially no discrepancy or conflict between them.

Such a radius yoke construction with the axle floated on semi-elliptic springs is illustrated with push shackles in Fig. 3, and with the preferable pull shackles in Fig. 4. Fig. 5 is



Above—Fig. 1—Push type front spring shackle connection
Below—Fig. 2—The more desirable pull shackle which is easily obtained

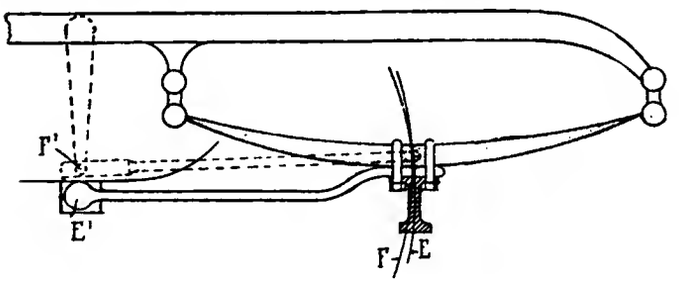
a bottom plan view showing how the radius yoke is secured to the axle. In this form the ordinary semi-elliptic springs are used, the only differences from present standard construction being that the springs and axle are made to float freely by the addition of an extra shackle at the forward end, and then the floating action is controlled by a radius yoke fixed to the axle in any convenient way, having a universal mounting at the rear end in a socket.

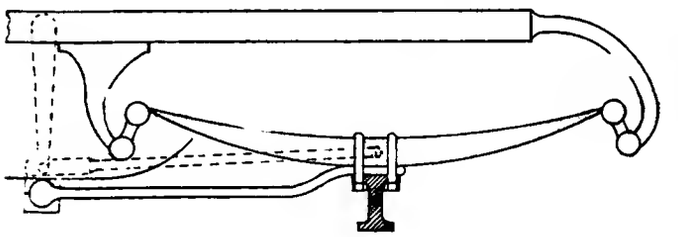
It will be quite apparent how the axle movement and the movement of the steering link front end are substantially identical with this type of construction, the center *E'* from which the axle turns on path *E* being at the same distance back in the frame as the center *F'* from which the steering link front end turns on the practically identical path *F*.

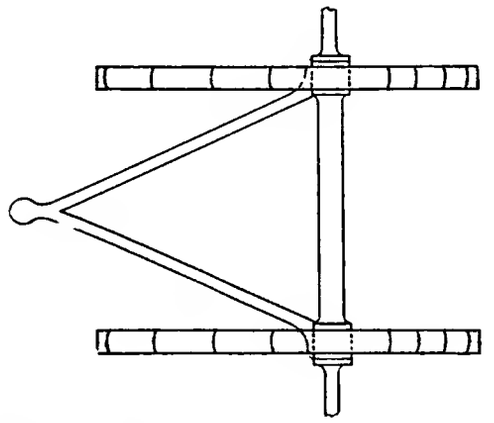
By placing the centers *E'* and *F'* together in this way, every one of the objectionable features of the present standard type of front spring construction is done away with, there is no wabble of the front wheels accompanying the spring action, and the steering wheel is not moved no matter how violently the front wheels and axle may play up and down. Their movement never gets to the steering wheel and is not felt there in the slightest degree.

Appearance Little Changed

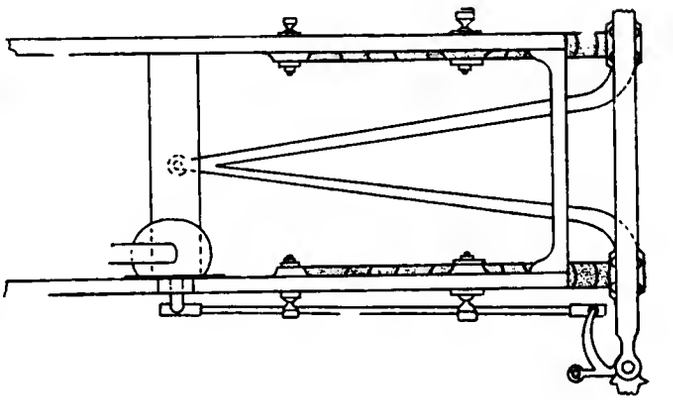
The departure in appearance from present standard construction is inconsiderable. The present projecting horns are retained and the ordinary observer would never note the addition of the extra front shackle and the torsion yoke beneath the machine.

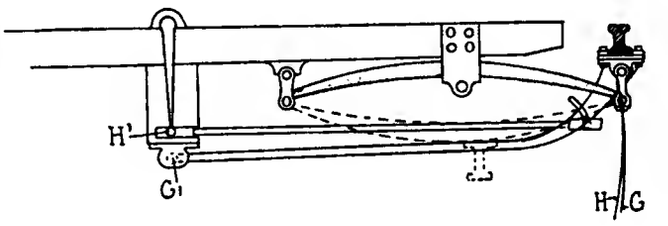


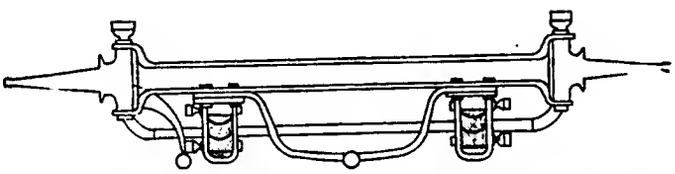




Upper—Fig. 3—Radius yoke construction with the axis floated on semi-elliptic springs, using push shackles. Middle—Fig. 4—With the more satisfactory pull shackles. Lower—Fig. 5—Bottom plan view, showing how the radius yoke is fastened to the axle







Upper—Fig. 6. Middle—Fig. 7. Lower—Fig. 8—These illustrations show a form of front spring suspension using full length semi-elliptic cantilever springs, the front axle being floated from their forward ends and its movement being controlled by a radius yoke

This construction may be properly criticized, however, in at least one particular. It does not afford an opportunity for reducing the height of the car body and frame. In this respect it is like the ordinary standard construction now in use which, as is well known, determines the frame and body height and prevents its considerable reduction.

Figs. 6, 7 and 8 show a form of front end suspension in which full length semi-elliptic cantilever springs are used, the front axle being floated from their forward ends by pull shackles and a radius yoke used to control the movement of the axle.

The front axle, with this type of mounting, pivots on the center *G'* where the radius yoke is mounted with a universal joint. This may be on the engine base or on a cross member of the frame, as is most convenient. It may readily be placed the same distance back on the chassis as the steering connection *H'*, and when this is done the circles *G* and *H* are practically identical and there is no interference whatever between steering action and spring play. The bending of the spring and its change in length, due to bending, does not affect the axle movement in any way, for the axle is floated from the spring on the pull shackles. It will be readily apparent how, with this construction, the wheelbase may be increased without lengthening the frame by merely moving the spring attaching connections forward, and how the body may be lowered as much as is desired by proportioning the spring connection and links to get almost any desired height. Straight line drive is readily possible, if wanted. The dotted lines in Fig. 7 show, for comparison, the added height which results from the use of the present conventional type of construction.

On the debit side of this structure must be placed the fact

that it adds a few pounds in weight and may cost a trifle more than the present type of construction. Where these things are determining, as in the cheaper cars, the Daimler construction may be made use of as it involves no necessary increase of weight or cost, the position of fixed pivot and shackled pivot merely being reversed from those now in use. In appearance its aspect may be considered unpleasing because it is different from that to which the public is accustomed, but the public readily gets used to things which are different if they are really better.

On the credit side of the construction shown in Figs. 6, 7 and 8, however, there are so many items of real importance that any small disadvantages are dwarfed into insignificance. Among such advantageous features of this construction are the following:

The construction is mechanically right; it gives the spring cushioning effect which a spring suspension must give, it prevents side sway and the axle movement is in perfect accord with the movement of the steering connections with no interference whatever between them. The wear on front tires caused by pivotal movement is done away with, the wear on the steering gear is minimized and, even with a reversible steering gear, the front axle may move freely up and down without turning the steering wheel at all. The wheelbase may be lengthened at will without extending the frame. The advantages of an underslung frame are obtained without the disadvantages which go with such construction. The body height may be decreased without cutting down the road clearance. Straight line drive is made possible, and a simple, straight, strong form of front axle may be used. Cars equipped with this type of front spring suspension cannot fail to make a strong appeal to the discriminating car owner-driver, because the floating axle and torsion rod give great driving ease and comfort, the most violent front wheel and axle movement taking place freely without being transmitted to the steering wheel at all.

It is safe to say that the ultimate car of the future, to which we all are looking forward, while it may not have any of the types of front spring suspension which have been referred to in this series, it will, at least, *not* have the obvious defect of a front axle pivoted to turn from a pivot in front of it and a steering link pivoted away behind it.

French Army School Trains Drivers

(*Continued from page* 227)

mechanics must be capable of handling such widely contrasting designs as a Ford and a Lanchester; a 1902 superimposed valve Metallurgique and a 1915 Packard; a Bugatti with cylinders like a liqueur glass, and a Mercedes with a capacity of a couple of liters in each cylinder.

Little Specialization Possible

All this repair organization has had to be got together hurriedly since the war, a task the difficulty of which will be understood by any person who has had to deal with automobile repairs on a big scale. Although the number of vehicles permanently in hand runs into hundreds, it is not possible to specialize to any great extent. Every car received for repair is examined, tested if necessary, and then reported on. It is then turned over to a group of three mechanics, who carry out all the repairs indicated on the docket, but are instructed to report if, in their opinion, any defective part has been overlooked. Attempts to specialize by forming engine, gearbox and rear axle teams have been found to be impracticable owing to the varying nature of the work and the variety of cars handled. Fluctuations are so great that some of the teams would be overworked while others had nothing to do. Making a single team responsible for the entire car limits and defines responsibility, rendering it possible for the officers to come back on the culprit if complaints are received after a car has returned to service. Naturally there are special sections for the repair of radiators, for acetylene welding, and for the various kinds of machine work. Generally, owing to the necessity of waiting for spares or parts being machined, each group of mechanics will have three or four machines in hand at once.

Defects Revealed in Repair Shop

It is interesting to note that very few of the officers are men who have graduated in the automobile factories. For various reasons which it is not desirable to amplify here, the professional automobile engineers have been returned to their respective factories and are doing good work there. The repair depot engineer officers are skilled men drawn from various branches of mechanical engineering and come to the automobile without any prejudices or pre-conceived ideas in favor of this or that make.

It is not an easy matter to tabularize the defects revealed in this repair work. Every vehicle is found to have some weak point when put on war service or placed in the hands of an unsympathetic driver; but what may be the weak point of one is probably the strong point of another car. Speaking generally, universal joints give a considerable amount of trouble; there is also a lot of repair work on gearsets; owing to unskilled handling motors still call for much attention, because of defective lubrication systems or inability of the drivers to give the necessary attention. Rear axles are not a very prolific source of trouble. Even here, however, there are considerable variations. As an instance, Renault and one other high-class make were performing similar service of an arduous nature. The Renault, which is a one-piece forging axle housing developed no trouble in this organ, while the other make, with a built-up axle housing had against it several fractured housings.

The officers in charge of the repair work are not on the whole partisans of forced feed lubrication for war conditions. Their experience is that foreign matter is not kept out of the oil, and under a pressure system this matter is forced into the bearings with destructive effects. The system which, in their opinion, kept the motor in the best condition is the circulating constant-level splash adopted by Panhard-Levassor. Under this system the oil is fed to the front trough and overflows to those behind it, the supply of oil being proportionate to the throttle opening.

Old Touring Cars Useless

During the visit to this formation it was realized that there is not much practical patriotism in the donation of old touring cars to the army for Red Cross Service. On several occasions well-intentioned English people have gathered together all kinds of touring cars which, after being stripped of their original bodies, have received an ambulance body and been sent for service with the French troops. Many of these gifts were old chassis, only fit, with considerable coddling, for service at home. Among them were noted chain-driven Napiers, which must have been built not later than 1902. The inevitable result was that such vehicles were wrecks by the time they had completed the journey from the coast to the front, and had to be returned to a repair depot, where the officers hesitated to waste good labor on them. A few of the numerous cars of this sort are shown on page 226.

The FORVM

USE OF AUTOMOBILE POWER PLANTS FOR RAILWAY COACHES IS PRACTICABLE WHEN LOADS ARE LIGHT—INACCURACY PERMISSIBLE IN CRANKSHAFTS

Railway Trucks Coming

By H. C. Tully

WHILE the railroads have been spending their time and their money on motive power that will drag all the tons the couplers can hold, the automobile world has developed machines that the railroads can now use. Hundreds of runs are made with so small a load that they should be handled by smaller motive power such as would be contained in a railway motor truck.

Any automobile engineer can turn out a power truck for a passenger coach that will be the same success as an automobile design they may work out for a season's hundred thousand cars production. There is no doubt but what such a truck will do the work; as it need not have a single experimental part.

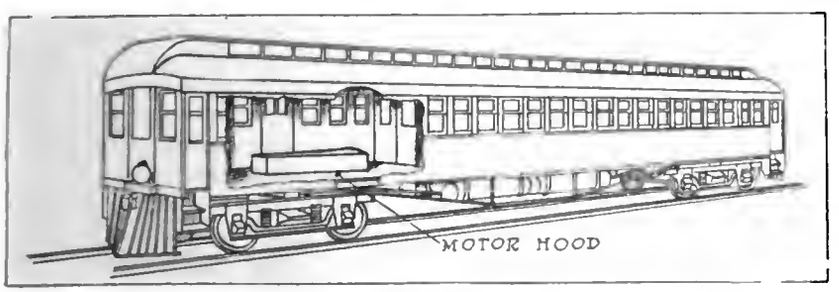
The car body can be made structurally strong enough to satisfy any master car builder by leaving in the body bolster and replacing the cut center sills by a steel diaphragm that will let the car floor clear the engine on any curve as shown by the line drawing herewith.

The control of the mechanism on the truck from either end of the car body can be electrical (absolute and not experimental) by the use of Westinghouse electro-pneumatic brake valves and the Cutler-Hammer magnetic gear shift—the magnets wound for the 32-volt "axle-light" car circuit. There is 90 lb. of air pressure on a rail car, which could be used to release the clutch. The designer is allowed free rein to obtain strength, as a few pounds more does not matter with a railway car.

Chance for Parts Makers

The possible railroad market for an automobile parts maker's product is much larger than a sales manager may think; there are only 277 railway motor cars now in service on 121 different steam roads in America, and there are 997 roads altogether. As additional customers for such cars there are also 1335 street railroads.

While the railway motor truck is a way for steam roads to handle a lot of business with two or three trainmen instead of five, as is now the case, the electric lines need in their rolling stock such trucks, too, for emergency use. The gas engine can drive a car through the gearbox anywhere any other motive power can, and when central station or transmission lines are out the motor truck will be on the job.



Illustrating application of automobile power plant to railway car for runs with light load

Permissible Crankshaft Inaccuracy

By A. Ludlow Clayden

THE crankshaft of a four-cylinder engine, theoretically has all four crankpins in the same plane, and a six-cylinder crankshaft has the pins so set that each lies in a plane making 120 deg. with the plane in which the next pin lies. Actually, of course, there is always some inaccuracy in manufacture, both as to angular relationship between the crankpins and as to the throw of the cranks. An engine with a nominal 5-in. stroke, for example, may have a minutely different stroke in each cylinder, varying from 5 in. plus some fraction to 5 in. minus a corresponding amount. There is not, however much difficulty in getting the crank throws accurate within very small limits, nor is it hard to machine a four-cylinder crank so that the four crankpins are all in the same plane within a very small amount indeed. The six-cylinder crank is not so easy though, because the cranks are twisted to the required 120 deg. while hot. Naturally this is not a very accurate process, so there are two alternatives in machining. One is to machine for accuracy without regard for the fact that some pins will be thus displaced a little in their relationship to the webs, and the other is to machine each pin so that it is, individually, true to its adjacent webs even if this makes the angular relationship between one pin and another somewhat inaccurate.

The point has been raised by a correspondent of THE AUTOMOBILE who is building six-cylinder engines and desires to know just how much inaccuracy in angular relationship ought to be permitted. To make a perfectly accurate crank calls for the removal and waste of a good deal of stock. Naturally if this can be reduced by allowing an angular variation it makes a better production scheme. So the question resolves itself into a decision as to how much variation can be permitted without affecting the operation of the engine.

Of course, *any* variation has a detrimental effect upon the balance of the reciprocating parts, but another point which needs consideration is the effect upon the timing. Near the dead point 3 or 4 deg. of crankshaft movement makes very little difference to the position of the piston, but at a point nearer midway of the stroke, such as the ignition point at maximum advance, 4 deg. may make quite a substantial difference. The opinions of manufacturers of six-cylinder engines would be very interesting.

The History of the Pneumatic Tire—14

Cemented Tire Cheap and Widely Used—The Tillinghast Basic Patent on Process for Making Single-Tube Type—Palmer's Thread Construction—Measuring Rebound of Tires

The History of the American Automobile Industry—41

By David Beecroft

AS mentioned last week, the cemented tire was cheapest and most widely used in 1892 and 1893. This type of tire had its casing split for a short distance on the base to permit inserting a tube having closed ends.

Clincher Type Popular

The G. & J. clincher type came next in favor and was recognized as a superior article but limited to the better class of goods. The Dunlop wired edge never attained a very high degree of favor in spite of its admittedly best qualities because of the methods used or not used in its introduction. This experience should be a hint to American makers who have goods to introduce in foreign countries.

The Tillinghast Patent

While the double-tube tire was striking the many attempts to secure a place in favor, the hose pipe, or single-tube tire, continued on its almost unnoticed way. A patent issued to Pardon W. Tillinghast, covering a process of making the single-tube tire, was found to be basic and eventually practically dominated the tire industry. The later years of the century, when the bicycle business slumped and makers turned their attention to the motor vehicle, found the single-tube tire on a large majority of the bicycles, with a sprinkling of cemented double tubes and G. & J.'s, with an occasional Dunlop.

Palmer's Thread Construction

While the vigorous development of tire designs was going on in the early '90's, students of the subject were busy investigating constructions. The Palmer thread tire has already been mentioned, in which the threads were placed parallel to each other and with one layer over the other, so that the respective threads of one layer crossed those of the other. The Lozier company brought out a tire in which the threads of the fabric ran directly across the circumferential length of the tire. To hold these threads together, lengthwise threads were used along each side of the casing, which was objectionable because it stiffened the casing where it should be free to bend and thus caused the tire to break more quickly, besides interfering with its smooth action. This construction was later modified by leaving out most of the side threads and using only enough longitudinal threads along the quarters to prevent the threads from being separated so far as to tear the rubber. The action of this tire when it encountered a pebble was to swallow it perfectly and without increasing the longitudinal strain on any other portion of the tread than that which was directly in contact with the ground or obstacle. This theory seemed to be correct, but unless the separation of the threads was limited by some means, the rubber would be stretched, easily punctured, and finally, badly torn.

Other Thread Types

Recognizing this fact, Charles E. Duryea and some others introduced fabrics which were meshed like fine fish net and which were stretched around the short diameter of the tire so that their threads were placed almost directly across the circumferential length and quite close together. They were therefore free to stretch in a circumferential direction up to the limit imposed by the mesh, which limit was presumed to be within the ability of the rubber, and because of the mesh a puncture could not extend by tearing, because the fabric strength prevented this. Several patents were issued to Duryea, showing this construction, but, because of the added expense and the cost of getting them on the market, the rubber company to which they were assigned failed to push them.

It has already been mentioned that bicycle racing men quickly found a difference between tires and tire fabrics in the matter of ease and speed, but were not clear as to what was the cause of this difference. To remedy this lack, Duryea, in 1892, constructed a very simple device for making a card of the number of bounces a tire would make when its wheel was dropped from a given height. A similar machine was made by the Victor Co. in 1893, and two cards from it were published in 1894, while in June of the same year a lengthy article by Duryea, with sixteen cards, appeared in *Bearings*. The Duryea machine was quite simple, embodying the use of a long axle hinged to the wall, so that the wheel could be lifted easily while a pencil and card served to register each bound. This device will be described in greater detail in the next installment of this series.

The Rostrum

Jack Bracket As Standard Axle Fitting

EDITOR THE AUTOMOBILE:—It would give me great pleasure if you would grant me a space in THE AUTOMOBILE in which to express my views on the Shortcomings of the Conventional Lifting Jack. As a practical man I have had the experience with most every make of car, and I find that the majority of American-made cars, or rather the designers of the rear axles in American-made cars, have overlooked this minor but very important detail of providing a place on the rear axle for a jack.

Some Axles Present No Problem

Where some of our manufacturers have been successful in overcoming this much needed feature, not due to providing a place for the jack but due to the clean-cut or simple construction of the rear axle, one would be able to place a jack anywhere between the differential housing and the brake drum, whereas, on the other hand, a rear axle constructed with truss rods underneath and no provisions for a jack makes it next to impossible to place same under this type of rear axle.

A Practical Suggestion

In THE AUTOMOBILE for July 27 the sketch, Fig. 1, I must say, is a very neat and practical idea and could be carried out very nicely by many rear axle manufacturers if they so desired, and in that case it would be possible to place a jack under such an extension of that type with ease for a tire change, providing the tire cross section does not exceed 3½ to 4 in., as one must bear in mind that when a tire is flat it is considerably wider. But on the other hand, if a car is equipped with a tire having a cross section of from 5 to 6 in. and a jack base of approximately 5 in., the placing of the jack under the place provided in Fig. 1 would be impossible, and in this case last mentioned it would be necessary to have the special bracket as in Fig. 1 extended toward the differential housing at least 3 in. to allow a change of this kind to be made. Therefore, in adding a bracket to the rear axle it would be necessary to give it due consideration to allow for those cars where the rear wheels are equipped with oversized tires.

As I have experienced just such difficulties on both foreign and American-made cars and would greatly appreciate for all concerned if an addition of such an absolute necessity could be made a standard equipment on at least all American cars.

As for the sketch, Fig. 2, I fear one would meet with many complications, as it would necessitate every automobile owner to carry a different type of jack head to suit the different kinds of rear axle construction in his car, and many other difficulties would be experienced which, I am sure, need no explanation. Also it would not be a standard equipment. This probably is the main reason for this particular type having not been adopted either in this country or Europe.

Orchard Lake, Mich. C. H. BUCKMAN.

Circuits of Remy System on Madison

Editor THE AUTOMOBILE:—Kindly publish a circuit diagram of the Remy electric system used on the Madison.

Brooklyn, N. Y. J. N.

—Circuit diagram of the Remy electric system used on the Madison cars appears in Fig. 1.

Adjusting Model H Schebler Carbureter

Editor THE AUTOMOBILE:—Kindly publish an explanation of the method of putting model H, latest type, Schebler cyclecar carbureter in full adjustment for maximum fuel economy under normal running conditions and for speed work. How should this be altered for a change in atmospheric or weather conditions? What is the small butterfly valve in the lower end of the air intake used for?

2—On page 466 of THE AUTOMOBILE for Feb. 19, 1914, a special cyclecar drive belt is described and the maker, Duckwell Co., given. Kindly give me the address of this firm or any other making a similar belt.

Glen Ridge, N. J. P. S. W.

—The only difference between the cyclecar Schebler carbureter H and the regular type is in the air valve, as the cyclecar type has the device for locking the air valve when cranking the car. The method of adjusting is as follows: Referring to Fig. 2 for low speed adjustment see that the letter air valve *A* seats lightly but firmly, then turn the knurled button *I* to the right until the needle point *E* sets in the spraying nozzle, or in other words, as far as it will

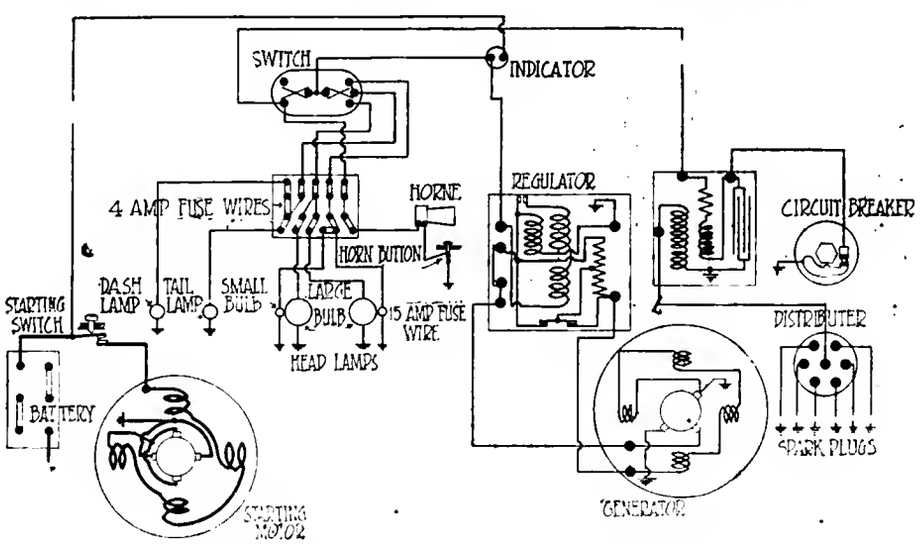


Fig. 1—Circuit diagram of Remy electric system on the Madison car

go without jamming. Then turn the button *I* to the left about two turns and open low speed adjusting screw *L* about three turns. Then open the throttle about half way and start the motor. After the motor starts close the throttle and turn the needle valve adjusting screw *I* to the right or left until the motor runs smoothly without missing. If with this low speed adjustment the motor runs too fast turn the low speed adjusting screw *L* to the right.

The carbureter is now ready for the high speed adjustment and the throttle and spark should be opened wide. The adjustment is now made by the pointer *Z* which as it moves from 1 toward 3 on the dial lowers the cam, thereby raising the needle and increasing the gasoline supply. Moving the indicator from 3 toward 1 raises the cam and cuts down the gasoline. When the indicator is at the right point the engine will run without missing or backfiring. If when the lever *Z* is turned to 3 the mixture is still too lean, causing the motor to backfire, the tension on the air valve should be increased by turning the adjusting screw 12 to the left.

For starting a wire should be attached to the shaft 12 which pulls out and locks the air valve *A* by compressing the spring behind the air valve. The shutter *C* in the air bend should also be connected with a wire thus allowing both primary and high speed air to be choked at the same time. This insures a rich mixture for starting.

2—The company that you refer to is the Duckwell Belting & Hose Co., 201 North West Street, Indianapolis, Ind.

Levett Pistons Made in New York

Editor THE AUTOMOBILE:—Who builds the Miller car and who makes the Levett pistons?

2—Will a six-cylinder motor firing 1, 2, 3, 6, 5, 4 develop as much power at 1500 r.p.m. as one firing in the conventional order?

West Milford, W. Va. B. BROS.

—THE AUTOMOBILE has no record of the Miller car. The Levett pistons are made by the Walker M. Levett Co., 417 East Twenty-third Street, New York City.

2—No. The unbalanced forces in a motor firing in this way would greatly reduce the power output.

Wants Higher Power and Speed

Editor THE AUTOMOBILE:—Can you advise me where I can secure a second-hand 300 cu. in., sixteen valve, high-speed engine?

2—Would it be advisable to install longer connecting-rods to raise the compression on a 4½ in. by 5 in. engine, after installing alloy pistons and rods, also larger camshaft, and manifold and carbureter, would increasing the compression increase the power and speed, if so to what extent, and how many pounds compression would you advise?

3—Would there be any disadvantage in raising compression; would the pick up be any better?

4—What type rear axles are used in racing cars, floating, semi-floating or three-quarter floating, and why is the type used in preference to others?

5—What kind of steel is used to make the live axles in racing cars, and where can it be secured?

6—How do you line up a semi-floating rear axle so as to obtain the least friction?

Gaffney, S. C. W. R. T.

—THE AUTOMOBILE has no record of any of these for sale.

2—This would depend altogether on the design of the engine. On some it would be impossible due to the shape of the cylinder top and the lack of clearance between the rod and the bottom of the cylinder. It is impossible to state the number of pounds per inch increase in compression due to lengthening the rod unless you advise the exact volume of the compression space. Knowing this it is quite easy to calculate mathematically the compression increase. The formula for this

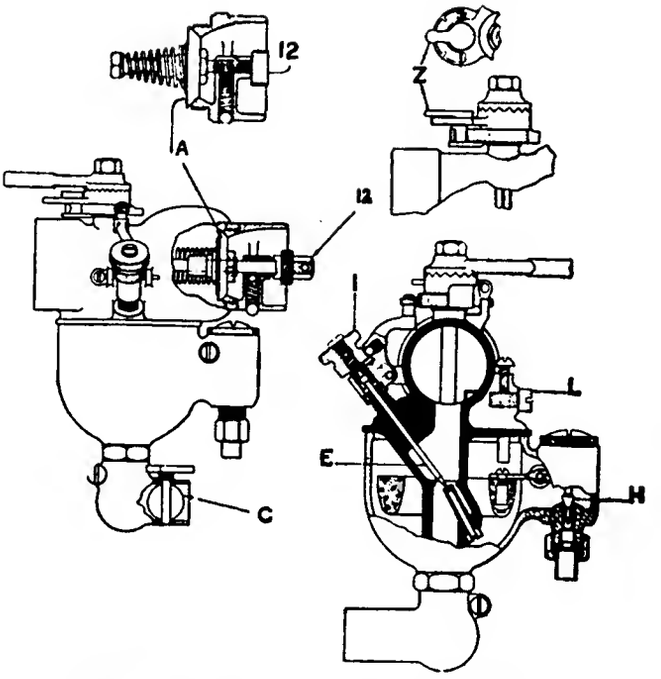


Fig. 2—Schebler model H carbureter, showing adjustments

is $P V^{1.4} = P_1 V_1^{1.4}$. Where P is the compression at present, V is the present volume of the combustion chamber, P_1 the compression at the volume V_1.

3—For high speed work there would be an advantage in raising the compression. Whether or not the performance would be better depends altogether on the design of the motor and what you are getting now.

4—A majority of the racing cars use floating axles.

5—Chrome nickel steel is used for the axles in racing cars. At the present time it is difficult to state where one or two shafts alone could be secured as most of the larger companies are tied up on their regular production orders. You should be able to secure shafts, however, from almost any of the axle companies.

6—The alignment is simply a matter of bearing location and this is taken care of in manufacturing.

Heavier Wedges Will Secure Rims

Editor THE AUTOMOBILE:—Will you kindly advise me if there is any straight side rim that I can put on wheels now equipped with Baker detachable rims that are heavy enough so that they will hold their shape and not squeak? I have always had this trouble with these rims and am of the opinion that they are too lightly built. Any suggestions you might make would be very much appreciated.

I do not want to go to the expense of taking the wheels to New York and having them rebuilt and refitted for another make of rim if there is a detachable rim such as I want that can be substituted without these changes.

Amityville, N. Y. H. H. T.

—It would probably be impossible to fit rims of another make without rebuilding the wheels. At all events, it would be a risky experiment. You can, however, remove the looseness from your present rims by installing wedges that are larger and thicker than the original ones. If the rim and the felloe band are in good condition this will bring the rims tight on the wheels.

Standard Automobile Gage Is 56 In.

Editor THE AUTOMOBILE:—What is the standard gage of an automobile?

West Kortright, N. Y. F. H. O.

—The standard gage of an automobile is 56 in.

ACCESSORIES

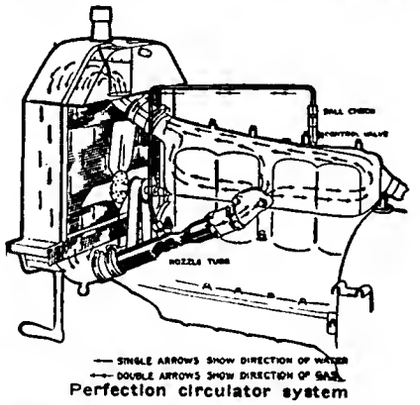
Evapco Auxiliary Air Valve

THE Evapco device is designed to reduce fuel consumption and carbon in the engine and at the same time to give better and more complete combustion with consequent increased power by supplying additional air to the intake manifold. It consists of a metal casing inclosing an automatic valve and screwed into the intake manifold. At low speeds the valve is held closed so that the normal mixture is supplied to the engine which would not operate well when turning over slowly if the mixture were too thin. As the speed increases the valve opens and admits air in proportion to the speed. No adjustment is required and the valve fits any make of car. It is installed by tapping a ⅜-in. hole in the manifold and screwing in the valve. The device sells for $5, prepaid. —Evapco Mfg. Co., 427 Grand River Avenue, Detroit, Mich.

Evapco auxiliary air valve, which automatically feeds additional air to the intake manifold in proportion to the engine speed

Hull Self-Service Pump

This is a curb pump designed to handle the sale of gasoline automatically without any attention whatever on the part of the garageman except to keep it filled and to change the vending mechanism as the price of gasoline varies. The advantage of this pump is that it enables the motorist to purchase 25 cents, 50 cents or $1 worth of gasoline by simply dropping in coins to this amount. The mechanism is so devised that when the tank is empty the coin slots are automatically closed.—Hull Pump & Tank Co., Owensboro, Ky.



Perfection circulator system

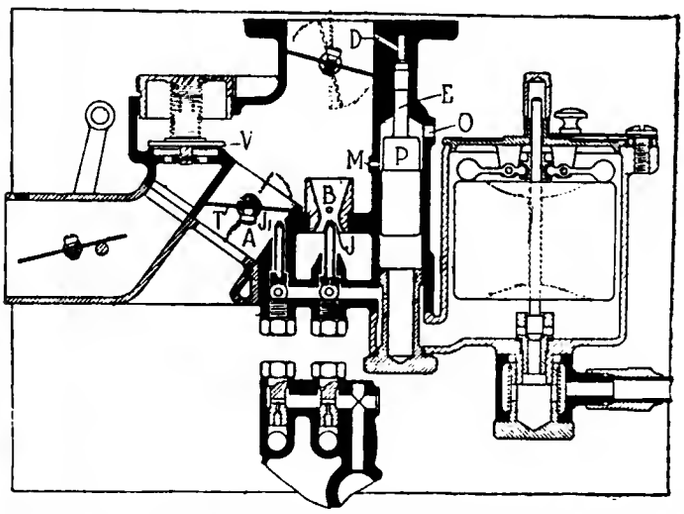
Perfection Water Circulator

The Perfection circulator is an air-operated ejector, designed to utilize a small portion of the exhaust gas from the engine to operate a device which will give uniform temperature to the motor regardless of the conditions under which it is operated. As will be seen by the illustration, the attachment consists of a specially designed nozzle tube connected with the exhaust manifold through piping which is carried over the motor. The gas is carried into the lower connection between the radiator and the engine. The water at this point is forced forward by the exhaust gas moving in the direction imparted by the jet, which is toward the engine. The water will be forced forward and through the cylinder jackets with a velocity which corresponds to the amount of exhaust gas pressure, and consequently the amount of engine labor. It is claimed that, with this device installed on a motor, in winter or in cold districts the motor can be maintained at the same temperature of high efficiency as in summer by simply removing the fan belt, any tendency to overheat or boil being immediately offset by the increased rate of circulation incident to the generation of heat in the cylinder. The equipment as illustrated sells for $7.50.—Motor Cooling System Co., Munsey Building, Baltimore, Md.

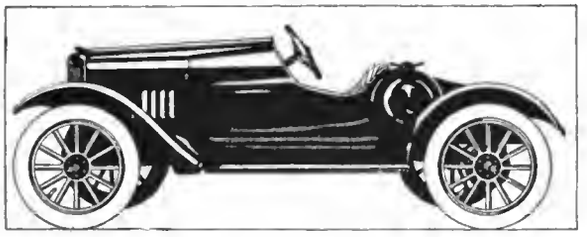
Hull self-service gasoline curb pump

Ball & Ball Carbureter

This is a two-stage carbureter, hot air being used in the primary stage of vaporization and cold air in the secondary stage. Referring to the sectional illustration, at the left there is a hot-air passage with a choke valve; the primary venturi appears at *B; J* is its gasoline jet, and *V* is a spring-loaded idling valve in a fixed air opening. These parts constitute the primary system. In the secondary system *A* is a cold air passage, *T* a butterfly valve and *J* a gasoline jet discharging into the cold air passage. This system is brought into operation by opening the butterfly *T*. A connection between the butterfly *T*, and the throttle, not shown, throws the butterfly wide open when the throttle is not quite wide open; at all other times the butterfly is held closed by a spring. The cylindrical chamber at the right of the mixing chamber has an extension *E* of reduced diameter connecting it with the intake manifold through a passage *D*. A restricted opening connects the float chamber with the cylindrical chamber so that the gasoline level is the same in both. A loosely-fitting plunger *P* in the cylindrical chamber has an upward extension into the small part of the chamber. *O* is a small air opening and *M* is a passage from the cylindrical chamber to the mixing chamber. Air constantly passes through this when the carbureter is in operation. In the working of the carbureter, when the throttle is closed,



Ball & Ball two-stage carbureter, using hot air in primary stage of vaporization and cold air in second



Remo racing-type body for Ford cars

suction on piston *E* causes plunger *P* to rise, closing the passage *D;* the space below the plunger is filled with gasoline. Opening the throttle breaks the partial vacuum and releases the plunger, which falls and forces the gasoline under it to rise and flow through passage *M* into the mixing chamber, forming a rich mixture for a quick pick-up. Under ordinary running conditions only the first or primary system operates; when the throttle is fully opened and maximum power is required the secondary system, with its extra fuel jet, is brought into play.—Penberthy Injector Co., Detroit, Mich.

Remo Ford Racing Bodies

Four styles of bodies are made for Ford cars, and in addition radiator, bucket seats and tanks are sold. The leader is the Model S, which is an attractive design patterned after modern racing cars. It has a high rounded radiator, sloping hood and cowl carried back to inclose the bucket seats. Tank and tires are carried at the rear. Special curved fenders, splash guard and extra long running board, linoleum covered and metal bound, are furnished. The Model C is a three-passenger clover-leaf, with one-piece windshield and fenders, like Model S. The Model R is an extremely light racing design, consisting of bucket seats, gasoline and oil tank, and framework for mounting these units. The Model T is a more elaborate design, with V-radiator, sloping hood and cowl, bucket seats, two tanks, fenders and top.—Auto Remodeling Co., 1501 Michigan Avenue, Chicago, Ill.

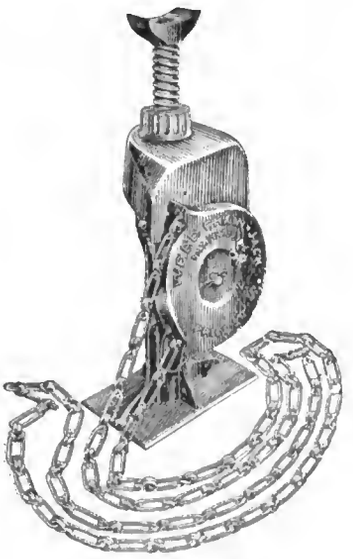
Fold-Up Door for Garages

This door folds up overhead and overcomes the inconveniences of swinging doors in garages where space is limited. It operates with chain and hoist, and can be raised by a child. Choice of wood or metal is allowed. A small hinged door in the panel of the lower section permits of passage without opening the large door. The upper section is built with wire glass panels.—St. Louis Fire Door Co., St. Louis, Mo.

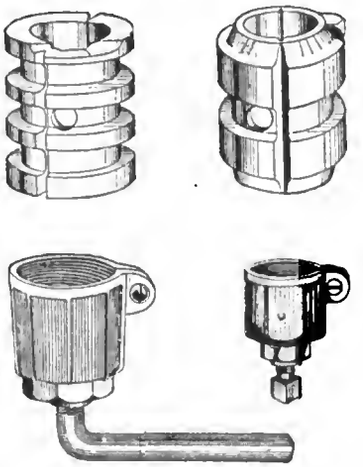
Weed Jack and Tire Lock

The jack is raised and lowered by operating an endless chain. Pulling the chain rotates a sprocket which drives a gear which raises or lowers the lifting member. The chain is non-kinkable and

American tire-lock chain to prevent theft of spares



Weed jack, which is raised and lowered by operating an endless chain driving a gear through a sprocket



C. & E. specialties for Fords. Upper—Camshaft bearings. Lower—Wheel pullers

is easy on the hands, it is said. The particular advantage is that the car may be raised or lowered without crawling under the car or even bending the back; it gives maximum convenience. The 8- and 10-in. sizes are provided with an auxiliary step which may be swung into place, adding 2 in. to the height. The gears are machine-cut, and thrust roller bearings are used. Specifications are:

Size. (Lowered)	Rise, Inches	Capacity, Tons	Price
8	4½	1	$5
10	5⅝	1	5
12	7	1	5
12 truck	7½	5	10

Chains for locking tires are made of flat links which give a strap-like action, permitting them to be drawn closely around the shoes and running board or through the wheel and spring or frame. They are readily attached, and when not in use take up small space in the tool box. They are furnished with wrought-steel japanned cast padlock, Yale & Towne cast bronze padlock or a keyless lock. Prices, per dozen. Galvanized chain, 36 in., with japanned lock, $7.80; Yale lock, $22.60; keyless lock, $22.60; without lock, $4.60. Bright chain, 36 in., with japanned lock, $9; Yale lock, $23.80; keyless lock, $23.80; without lock, $5.80. Bright chain, 36 in., covered with oil-tanned leather, japanned lock, $12.70; Yale lock, $27.50; keyless lock, $27.50. Forty-two- and forty-eight-inch sizes at additional prices.—American Chain Co., Bridgeport, Conn.

C. & E. Specialties for Fords

These muffler cut-out sets for Fords consist of a cut-out valve which clamps over the exhaust pipe, pedal, spring and pulley. They have 1⅜- and 2-in openings, the prices ranging from $460 to $560 per thousand.

A wheel puller for Ford cars consists of a threaded cap with a screw in the center. The cap is split at one side so that it may be clamped tightly about the hub, and then a screw is turned. The price with set screw is $300 per thousand, and with lever instead of set screw, $340. Camshaft bearings for Ford cars are made from high-grade smooth gray iron; price, $100 per thousand.—C. & E. Mfg. Co., Marshalltown, Iowa.

Fold-up door for garages, which is out of the way when open

The Automobile

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Our Foreign Trade

GOVERNMENT figures on automobile exports for the fiscal year ending June 30, 1916, suggests the necessity of our manufacturers watching very closely the movement of foreign trade. These figures bring three sections of the world into particular prominence—Australia, South America and the West Indies. The increase in exports to these three parts of the world has been so great that it is imperative that we give increased attention to the problems of exports. We have not a good reputation in any one of the three countries in so far as our business methods are concerned. We have well-nigh a world-wide reputation for being deplorably poor exporters, which is particularly true when doing business with countries using other than the English language.

Our business in South America and the West Indies is attaining that stature that demands shrewd handling. The figures show that we have made heavy gains. With South America our business has increased more than sixfold in a year. War conditions have aided us very materially, and we must be correct in placing the credit for the growth. With us it is essential to be fortifying ourselves to-day to hold the business to-morrow. If we get along without a well-organized foreign department to-day, when we have no competition in South America and Australia, that is no proof that we can hold our own to-morrow when up against the keenest competition of Europe in these fields. We welcome these great increases in foreign trade, but Providence only helps those who helps themselves; and as an industry we are not playing fair to ourselves if we are letting to-day pass without building deeply and permanently for our foreign trade of to-morrow.

South American Trade

NOBODY will question the possibilities of South American business in automobiles, trucks and tractors, as well as varied lines of accessories. The field is there, and although present conditions are not the most propitious the future is sufficiently great to warrant a considerable present investment with little if any immediate returns.

The South American field must be sanely weighed. A few of the major considerations must be carried in mind: The total population is hardly one-half that of U. S. A., and in some of the states, like Brazil, Bolivia and Peru, there is a large percentage of colored population that cannot be counted as an average potential buying factor.

Gasoline a Temporary Factor

At present the price of gasoline is so high as to make many business men refuse to consider buying motor trucks or farm tractors. Gasoline will not always be a serious factor, and it can be dismissed as offering only temporary troubles. If gasoline eventually is too expensive there is no reason why alcohol cannot be used, as nearly all South American countries can produce it in great quantities.

To-day there is the problem of unimproved roads, which can be dismissed as temporary, as in all parts of South America the motor car will bring about improved roads, as it has done in U. S. A.

We must face the question of high ocean freight, and the further fact that as a nation we have few ships, and for our South American trade we have largely to depend on the ships of our business rivals. To-day we are paying higher freight rates from our shores than Europe is. In some cases our rates are nearly three times as high. Should Europe desire, she can, after the war, give preferential shipping rates that will handicap us seriously, and perhaps go far to offset the advantages we have gained by rapid production. Europe is not going to assist us in taking away her trade, and we must look ahead a few years, when the war is over, and see how our shipping facilities will measure up. You cannot do business in South America if your freight rates are twice as high as those from Europe.

One thing that is bound to aid us very materially is the greater investment of U. S. A. capital in those countries. Trade is sure to follow heavy investments. The trade control of England and Germany attest to this. Our capital is going into South America very rapidly within the last two years, and already increased trade is showing itself, and we should rationally prepare to take care of it on as good a business basis as we take care of our domestic trade.

Represents Packard in S. A.

Cardway Will Establish Agencies—Cold Damages Crops in Argentine

DETROIT, MICH., Aug. 5—The Packard Motor Car Co. is sending Fred Cardway to South America for an extended tour to place new agencies. He will leave in September and will visit all the important centers throughout the continent. Mr. Cardway will make his headquarters at Rio de Janeiro, Brazil.

Frosts Injure Argentine Crops

BUENOS AIRES, July 7—Recent reports show that Argentina has been experiencing more cold weather in the last 3 weeks than it has for several years. So great has been the cold in the sugar section around Tucuman in the northern part of the country that there will be a great shortage in the sugar crop of next year. The young sugar cane has been burned by the repeated frosts and many new plantations have been killed by a succession of heavy frosts. Some predict that the crop of 1917-18 will be nearly a complete failure.

No part of Argentina seems to have escaped the severe cold, and although snowfalls are unknown in the country, there was a considerable fall in one section on June 26 and 27. The cold and frosts have necessitated many of the large farmers feeding their cattle which is most unusual in the winter season in Argentina.

The country is suffering from a lack of coal, and in the city of Rosario some of the outlying trolley services have been discontinued due to this cause. Nearly all of the coal comes from U. S. A. and the present shortage is due to lack of ships.

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Baker Cole Eastern Sales Manager

INDIANAPOLIS, IND., Aug. 7—E. H. Baker has been appointed central eastern sales manager for the Cole Motor Co. Mr. Baker was formerly president of the Cole Motor Co. of Buffalo and is now in charge of the sales in western New York, western Pennsylvania, West Virginia northeastern Ohio, southern Michigan and the Province of Ontario. Wm. L. Colt, president of the Colt-Stratton Co., will have charge of the extreme East and in the South W. P. Dorough will be in charge, with headquarters in Atlanta. J. E. Roberts has been appointed to take care of the western territory.

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Torbenson Buys Land and Adds

CLEVELAND, OHIO, Aug. 7—Four acres of land have just been purchased here by the Torbenson Gear & Axle Co. of this city. This is in addition to the buildings which are now under construction and which will, by Aug. 15, place 50,000 sq. ft. of manufacturing space at the disposal of this concern. The principal product of the company is the Torbenson drive internal gear rear axle for commercial vehicles. The new factories will be of the monitor type, constructed of brick and steel with metal sashes.

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Stewart-Warner Expands Plant

CHICAGO, ILL., Aug. 7—Beginning Sept. 1, the manufacture of Warner Auto-Meters will be carried on in the new additions to the Chicago plant of the Stewart-Warner Corp., and the Beloit plant will be devoted exclusively to foundry operations connected with the production of Stewart-Warner products. Plans have been made to double the size of the Beloit plant, the new portion being exclusively a foundry and the present building will be utilized in preparing the castings for machining.

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Wade Is Buick Purchasing Agent

FLINT, MICH., Aug. 4—Fred A. Wade has been appointed purchasing agent of the Buick Motor Co., succeeding J. T. Wilson, who resigned to enter some other line of business. Until a few months ago Mr. Wade was purchasing agent of the Maxwell Motor Co. Previous to that he was connected with the Studebaker, E-M-F and Ford companies.

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Leverton Is Briscoe Plant Manager

JACKSON, MICH., Aug. 4—A. C. Leverton, formerly general manager of the Chalmers Co., has been appointed factory manager of the Briscoe Motor Corp. Previous to his Chalmers connection Mr. Leverton was works manager of the Cartercar Company, and before that general superintendent of the Brush Runabout Co.

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Hastings Goes with Empire

INDIANAPOLIS, IND., Aug. 7—Don T. Hastings, formerly of the Packard and Hupmobile engineering staffs, has joined the Empire Automobile Co. as consulting engineer. Mr. Hastings has been, for some time mechanical engineer of the Herbert Mfg. Co., makers of automobile bodies, fenders and stampings.

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Maxwell Directors Meet Aug. 15

NEW YORK CITY, Aug. 9—Directors of the Maxwell Motors Corp. will meet Aug. 15 to take action on dividends.

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Detroit S. A. E. Moves

DETROIT, MICH., Aug. 3—The headquarters of the Detroit section of the Society of Automobile Engineers have been moved to more spacious quarters at 706 Kreage Building.

Simplex in Aircraft Merger

Part of $10,000,000 Co. Made Up of Wright and Martin Interests

NEW YORK CITY, Aug. 8—The Simplex Automobile Co., which for a year has been part of the Wright aircraft organization, is included in the $10,000,000 Wright-Martin aeroplane merger just completed. The Simplex company has for some time been manufacturing aeroplane motors for foreign countries along with a high-priced automobile chassis. The merger will not cause any changes in this policy. The Simplex plant at New Brunswick, N. J., which has been entirely rebuilt, will be used to manufacture the aviation motor which is of the Hispano-Suiza type, and the simplex cars. There are 2200 employees at the New Brunswick plant.

About a year ago the original Wright company which was then owned by Wilbur and Orville Wright, was purchased by a syndicate headed by William B. Thompson, Harry Payne Whitney and T. Frank Manville. The Simplex Automobile Co. was purchased from the Lockhart interests and the capital stock of the Wright company was increased to $5,000,000. E. M. Hagar, formerly president of the Universal Portland Cement Co. of Chicago, a subsidiary of the U. S. Steel Corp., was elected president of the Wright company, in March, 1916.

The principals in the deal are the Wright Co. of New York and the Glen L. Martin Co. of Los Angeles. The new consolidation will be known as the Wright-Martin Aircraft Corp. It will be incorporated under the laws of New York with $5,000,000 7 per cent cumulative convertible preferred stock and 500,000 shares of common stock with no par value. The Martin plant at Los Angeles will continue to be operated and another large factory will be erected in the East near New York. The factory of the Wright company in Dayton, Ohio, will be used as an experimental station.

While the Wright company is probably the largest aircraft patent holder, Glen L. Martin is one of the pioneers of practical aviation in this country. His machines are used largely by the U. S. Government for army work. He will be in charge of the aeroplane department of the new organization and is also, with C. S. Jennison, a vice-president of the new merger. Mr. Hagar is president.

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Merrithew Is Rayfield District Manager

KANSAS CITY, MO., Aug. 4—H. E. Merrithew has been appointed district manager by the Findeisen & Kropf Co., manufacturer of the Rayfield carbureter.

Rickenbacher Wins at Tacoma

Takes Montamarathon in Maxwell at 89.3 M.P.H.—Milton's Duesenberg Second

WINNERS AT TACOMA RACES

Car	Driver	M.P.H.	Prize
Maxwell	Rickenbacher.	89.3	$4,000
Duesenberg	Milton	88.6	2,500
Crawford	Lewis	88	1,500
Mercedes	De Palma	87	1,000
Maxwell	Henderson	84.5	750
Omar	Toft	84.4	250

TACOMA, WASH., Aug. 5—Eddie Rickenbacher's Maxwell won the 300-mile Montamarathon to-day at an average of 89.3 m.p.h. Ralph de Palma's Mercedes led consistently until his jinx reasserted itself at 175 miles and engine trouble delayed him, giving him fourth money.

Rickenbacher's 100th lap at 96 m.p.h. was the fastest of the day.

Milton received the regular price of $2,000 and an extra $500 and the Golden Potlatch trophy for leading at 100 and 200 miles.

D'Alene, Duesenberg, at sixty-four laps went out with a broken universal. Mossie, Gandy Special, retired at the thirtieth lap with burned bearing. Johnson, Crawford, injured his eye in the first lap with broken goggles but returned at the third lap and stayed until the sixty-ninth lap until a broken valve put him out. Latta, Dodge Special, ran consistently until the ninety-eighth lap, when engine trouble stopped him. Oldfield, Delage, was forced out nine laps from the finish through valve failure.

Lewis drove a thrilling race, running open on the curves and frequently taking the lead until the eighty-first lap, when he went to the pits with his car afire. After a quick tire change, he brought the crowd to its feet by sweeping into third place and making one lap at the rate of 94 m.p.h. Henderson covered 150 laps without a stop. Fast work by the pit men of De Palma and Rickenbacher helped them greatly. The winners' cars were equipped with Goodyear cord tires.

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77,496 Cars Exported

(*Continued from page* 211)

Perhaps the greatest change in our exports during the past year are those for South America, where the total for the year is 6725 cars as compared with 1264 in the preceding year. Thus the business has increased more than fivefold. Heretofore South America has had one general classification, but now several of the important countries are given separate divisions, Argentine leading by long odds with 4444 cars. Chile comes next with 843, then Venezuela with 524 and Brazil, the largest country in South America, is in fourth position with 283.

There is at present a nip-and-tuck race between the West Indies, including Bermudas and Asia with Oceania as consumers of U. S. A. cars. Oceania has the lead with a total of 5496 as compared with West Indies with 4658. The West Indies business is nearly three times what it was the previous year.

An analysis of the exports to Europe shows that the Allies have during the year been very heavy buyers, taking practically 96 per cent of all cars. The United Kingdom leads with 18,428; France is second, 7768, and Russia third, 5177. Italy took 387 and Denmark 847. Russian business shows a tremendous increase, as previously it was not classified. Exports to England and France show an increase of approximately 50 per cent over the preceding year.

There has been a heavy increase of cars sold into Asia and Oceania during 1916 as compared with 1915, but not nearly so great as to South America, West Indies, Canada and Australia.

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King Finishes High-Gear Run

DETROIT, MICH., Aug. 5—A King eight has just finished a high gear trip from Providence, R. I., to Detroit and back, the total distance covered being 1800 miles. This performance was made by A. F. Justin, the Providence dealer, and a party of five. The shifting lever was removed and the gears sealed in high, the car being a stock job.

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32 Entries for Pike's Peak Climb

DENVER, COL., Aug. 5—At five o'clock this afternoon, 7 hr. before the official closing time for entering cars in the first annual Pike's Peak hillclimb next Friday and Saturday, Aug. 11 and 12, there were thirty-two cars entered to compete for the $1,200 Penrose trophy and the $4,800 in cash prizes offered by the Pike's Peak Auto Highway Co. The entries represent twenty makes of cars, all specials, and the list of drivers includes names known throughout the motoring world. The entries follow:

Make (All Specials)	Driver
Cadillac	Brinker
Studebaker	Morgan
Cadillac	Marksheffel
Grant	Jones
Chalmers	Stentz
Chalmers	Walden
Buick	McCoy
Hudson Supersix	Mulford
Wisconsin	Weir
Hudson	Patterson
Duesenberg	Hughes
Peugeot	Hill
Milac	Whalen
Stutz	Duaray
Delage	Oldfield
Maxwell	(Not announced)
Ford	Peterson
Pathfinder	Hughson
Ford	Henry
Packard	Johnson
Ford	Spangler
Peerless	(Not announced)
Ford	Knowles
Giddings	Federman
Stutz	(Not announced)
Buick	(Not announced)
Romano	Lentz
Saxon	Wetmore
Peugeot	Mulford
Duesenberg	Buzane
Duesenberg	Buzane
Hudson	(Not announced)

Packard 12 Breaks Track Record

Aviation Racer Sets New Mark for 300-in. Cars at Indianapolis

INDIANAPOLIS, IND., Aug. 4—The Packard aeroplane twelve exceeded the Speedway record here to-day by ½ sec. This is the first time that a lap of the 2-mile track has been made by a 300-in motor at more than 100 m.p.h. The unofficial time was 1 min. 29.32 sec. The best previous time for a motor under 300 cu. in. was that of Boillot in a Peugeot, 1 min., 30.13 sec. in 1914.

This is the same car that J. G. Vincent, vice-president of engineering of the Packard company, had at New York during April and May this year, with the exception that a new intake header had been added for better performance at high speeds. The car was driven by Rader, who carried a mechanic and 10 gal. of gasoline. This is the first of a series of tests which are to be made by the engineering department to demonstrate the efficiency of the small bore twelve. Mr. Vincent states that the twelve-cylinder engine was of great advantage at Indianapolis as the steady torque made the car hold the turns at the high speed.

Electrical Timing Used

Electrical timing and five stop watches were used, the electrical instrument being the same as that used in timing the classics over the Hoosier track.

Displacing exactly 300 cu. in., this car has already distinguished itself as of exceptional speed. Laps were made with it, during the spring, at speeds of from 100 to 110 m.p.h. on the Sheepshead Bay track. The motor is a V-twelve of 2 21/32 by 4½ in. bore and stroke. The valve diameters are 1 7/16 in. and the lift is 0.34 in., giving a large area for gas flow. A full description of the car appeared in THE AUTOMOBILE for May 4, 1916.

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Two Peugeots for Harvest Classic

INDIANAPOLIS, IND., Aug. 5—Entries for the Harvest Classic to be held on the local speedway Sept. 9 have started to come in. The two Peugeots driven by John Aitken and Charles Merz are the first two entries. There will be a total of $12,000 in prize money in this race, which will be over a distance of 300 miles. The entry of the two Peugeot cars is made by the Indianapolis Speedway Team Co., and the car which Aitken is to drive is the same as that with which he won the Coney Island cup at New York this spring.

Fisher Body Corp. Formed

Consolidation of Fisher Body Cos. to Issue $5,000,000 7% Preferred

NEW YORK CITY, Aug. 9—The Fisher Body Co., the Fisher Closed Body Co., both of Detroit,, and the Fisher Body Co. of Canada, Ltd., Walkerville, Ont., have been consolidated to form a new organization under the name of the Fisher Body Corp. with a capitalization of $5,000,000 in 7 per cent cumulative $100 par preferred stock and 200,000 shares of no par value.

The additional capital provided by the reorganization will enable the company to greatly expand its facilities and consequently its volume of production. It furnishes bodies to Ford, Buick, Cadillac, Maxwell, Chalmers, Hudson and others, and its business for the current year is estimated at $20,000,000. Last year it amounted to $10,000,000.

Hallgarten & Co. and Eugene Meyer, Jr., & Co., this city, have bought the $5,000,000 preferred and part of the 200,000 shares of common, and the stock will be placed on the New York curb market in a few days. Later, application will be made to have the stock listed on the stock exchange.

I. A. L. Barred From Mails

(*Continued from page* 213)

"In addition to the league, Bidwell has organized and absolutely controls another corporation, namely, the International Automobile League Tire Co., whose stock, in pursuance of a contract between it and the league, the league is selling on a commission basis of 40 per cent. The par value of the stock is $100 per share. No stock is sold by the league for less than par value. The prospectuses and other publications upon which the public was induced to subscribe for the stock in the tire company contained representations which have been varied from time to time. In substance, they are to the effect that a tire factory or factories would be constructed and put into early operation, that large dividends would be paid upon the stock, that purchasers would be furnished all the tires required at actual cost of manufacture.

"The league is also engaged in selling a so-called jobbers' contract, under which the jobber is promised the tire company's tires for resale at the same price as such tires are furnished to stockholders. The undertaking of the league in this connection is subject to the following conditions: Strikes, fires, acts of God, contingencies beyond the control of the league, and its ability to fill the order. The jobber is also entitled to sell memberships on a commission basis of 50 per cent. The jobbers' contract, while a consideration of $1,000 is specified on its face, if that amount cannot be obtained, is sold for practically any sum that can be procured between $100 and $1,000."

About 1912 a reorganization committee of the stockholders of the International Automobile League Tire and Rubber Co. was formed, and after a long controversy Bidwell was finally compelled to discontinue his association with the company, it having been found that he had appropriated to his own use all the money obtained in the sale of the company's stock.

After losing control of the International Automobile League Tire and Rubber Co. Bidwell went to California and organized a corporation first known as the Western I. A. L. Purchasing Corp., the name very soon thereafter being changed to the International Automobile League Tire Co.

The memorandum further says: "The organization and conduct of the California company when compared with the organization and conduct of the Northland Co. while under the control of Bidwell clearly demonstrates the fraudulent character of his recent operations with the California company. In the promotion of the New York company the number of active members of the league, which was to furnish the market for the output of that tire company, was grossly exaggerated in order to sell the stock. Similar misrepresentations were made in the promotion of the California company. With the New York company the league received 40 per cent commission for the sale of stock. The same kind of an agreement was made between the league and the California company.

"When the organization committee took control of the Northland, although it should have been entitled to assets of some $600,000, there was not a dollar in the treasury and little or no available assets in its name. In that matter Bidwell had brought home to him in the most forcible manner the fact that his entire conduct with respect to the Northland company had been illegal, and he was forced to make restitution to the extent of over $500,000. When Bidwell was cited to appear and show cause why a fraud order should not issue against him in March of this year there was not a dollar in the treasury of the California company, notwithstanding the fact that over $112,000 had been actually taken in cash on the sale of the stock, not including 40 per cent commission paid to the league, all of which had been appropriated by Bidwell through various means, but there was also a charge against the California company of something like $192,000 by the league on account of various items, many illegal.

American Corp. Car Is a Six

Will Use 3 by 5 L-Head Block Amco Engine—45 Hp. at 2100 R.P.M.

PLAINFIELD, N. J., Aug. 7—A six-cylinder car will be marketed by the American Motors Corp., which has erected a plant at this city. It is expected that the first cars will be finished in the fall. They will be equipped with the Amco motor, built by the Amco Motor Co., South Norwalk, Conn. This is a 3 by 5 L-head block design, stated to develop 45 hp. at 2100 r.p.m. It has pump cooling, three-bearing crankshaft, two-unit lighting and starting and three-point suspension. Louis Chevrolet, well known as a racing driver and developer of speed cars, is chief engineer and vice-president.

McCord Capital Now $2,500,000

DETROIT, MICH., Aug. 8—The McCord Mfg. Co., which makes radiators and other specialties for the automobile trade, has increased its capital stock from $1,000,000 to $2,500,000, of which $2,000,000 is common. None of the stock has been or is for sale. The company's business has been steadily growing and is said by officials to be in a most satisfactory condition. It is likely that ere long it will be necessary to add to the plant's production facilities through the erection of several additions.

Page Co. Plans Ford Starter

ADRIAN, MICH., Aug. 7—The Page Fence Co., which has been making windshields, is to begin soon the manufacturing of a starter and light regulator for Ford cars. The company has made an arrangement with the inventor, B. S. Baldwin, Hicksville, Ohio, to that effect, it is said. In the windshield department, work is being rushed, as orders on hand are at least 50 per cent ahead of what they were at this time a year ago.

Hub Gas-Electric Truck Started

COLUMBUS, OHIO, Aug. 5—The Hub Motor Truck of Columbus, manufacturing a gasoline-electric commercial vehicle, has now started to manufacture its first truck, which will have a capacity of 2½ tons. This will be completed by fall, and tested for experimental purposes.

9 Out of 59 Bills Allowed to Pass in Bay State

BOSTON, MASS., Aug. 5—Fifty-nine measures relative to motor vehicles were introduced in the Bay State Legislature this year, according to the report of Sec.

James Fortesque of the Massachusetts State A. A. Mr. Fortesque's report covers the legislative work of this organization. He is assisted by James T. Sullivan, Bay State A. A., and John B. Sullivan, Jr., Boston Automobile Dealers' Association, in preventing drastic legislation.

When it is considered that out of that number there were only nine measures passed, and of that nine but one was against the motorists, it shows that the legislative committee did excellent work. The one bill against which the motorists worked in vain made more stringent the law for reckless and intoxicated drivers, but it is so worded that it makes no distinction between a man who has taken one glass of beer and the fellow who is incapable of handling a car, nor between the really reckless driver and the man who may go a mile faster than the law allows.

All the other laws enacted were advocated by the motor organization.

One of these called for lights on all vehicles using the highways to be lit uniformly from ½ hr. after sunset to ½ hr. before sunrise. In other years the horse-drawn vehicles were lighted 1 hr. after, and the motor vehicles ½ hr. A law was passed also compelling all vehicles that have become stalled, or stop on a road at night for any reason, to show two white lights.

The nuisance caused by contractors spreading tar and oil over the entire surface of the highways has been made an offense now, and the new law provides that only one-half the width of the road be so treated at one time, thus allowing vehicles to pass without danger from skidding or occupants getting all over tar and oil. There was passed also a law allowing owners in other states within 15 miles of the boundary of Massachusetts to register in the Bay State for a $2 fee. Another bill allowed all the motor vehicles of a city or town to be registered for a fee of $2. In the past some paid a full rate according to horsepower and others did not pay anything.

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Lancaster Can Use Midgley

LANCASTER, OHIO, Aug. 5—The Lancaster Tire & Rubber Co. has the right to continue the use of the name of Midgley, the petition of Thomas Midgley, Sr., for an injunction restraining the company from the alleged use of his name having been refused by the court.

Armored King Tested by U. S.

Severe Hills and Ditches Used by Marine Corps to Test War Vehicle

WASHINGTON, D. C., Aug. 5—A test on an armored car mounted on a King eight-cylinder chassis was successfully held this week in Washington. The conditions which the car had to meet were equivalent to those of severe active service and the affair was in the nature of a demonstration to army officers of the U. S. Marine Corps. A severe climb over jagged rocks had first to be negotiated. This was up a grade of 18 per cent, full equipment being carried. Then came a climb up a tortuous sand hill in which there were sunken boulders, tree tops, etc., to interrupt the passage of the car. Finally a test was made in the ravine used for trying out the army motor trucks. At the bottom of this there is a drop of 4½ ft. into a water-filled ditch and the car was compelled to drag itself out of this with the front wheels in the mud and the rear wheels on the bank above.

Those who witnessed the test were Major Casad of the Ordnance Department, and Captains Williams and Ellis of the Marine Corps. The car was built by the Armored Motor Car Co. of Detroit and is mounted on the stock King eight-cylinder chassis. It has now been taken to Philadelphia, where it will be put through a series of tests approximating actual warfare conditions, even being placed on a battleship, taken to sea and accompanying a landing party.

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Gasoline Down 1 Cent

(*Continued from page* 211)

steadily declining prices for all crude oils. There will be a very decided drop in the price of gasoline this month if the prediction of the Federal Bureau of Mines is correct. The prediction is based upon the report of bureau agents who state that new wells are being opened and that all existing wells are being worked to capacity.

It is also reported here that the Federal Trade Commission investigation of the Standard Oil Co. will disclose no illegal activities, although the Commission's report will show strong evidence of greed on the part of some oil men. It is also understood that the commission found that approximately twenty directors controlled the different gasoline companies and that gasoline could be sold with profit at 17 cents.

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Petroleum Output Worth $179,462,890

WASHINGTON, D. C., Aug. 7—More crude petroleum was marketed in the United States in 1915 than in any other year of the industry, the increase being about 6 per cent over 1914. In actual figures the quantity was 281,104,104 bbl. valued at $179,462,890. The average price received at the well for this output was 64 cents a barrel.

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Gasoline from Canadian Shale?

OTTAWA, ONT., Aug. 5—A proposal to get gasoline from the shale of Canada is now being put before the government. These oil-bearing shales are located in New Brunswick, in parts of Saskatchewan and Alberta, and to some extent also in British Columbia. It is stated by those in favor of the project that the resources are rich enough to more than provide for all the Canadian requirements. The oil imports from the United States are increasing by large amounts every year as the Canadian consumption increases. The price of gasoline in Canada is advancing steadily, and the shale-oil project is being put forward as a measure of relief.

The armored car body mounted on the standard King chassis going through strenuous tests conducted by United States army and naval officers

To Boom Guayule Rubber

Rockefeller-Aldrich Interests Plan to Develop Cultivation of Shrub in Texas

MARATHON, Tex., Aug. 5.—Rubber from Texas is the plan of the Rockefeller-Aldrich interests which have been operating in Mexico manufacturing guayule rubber. This organization intends to turn its facilities to the guayule shrub, which grows in this part of the upper border region of Texas. The only factory in the United States for extracting crude rubber from this plant is located at Marathon and it has been operated intermittently for several years, having practically exhausted the shrub in this section.

There are millions of acres of semi-arid land in this altitudinous part of Texas that are admirably adapted for growing guayule.

The Rockefeller-Aldrich interests, operating under the name of the International Rubber Co., which has its principal offices in New York, are also preparing to engage in the growing of the guayule shrubs and the manufacture of crude rubber in Arizona, according to an authoritative announcement which has just been made here by a representative of the company. It is stated that it has purchased 100,000 acres of land belonging to the Canoa Ranch, situated in the Santa Cruz valley, 20 miles north of Tucson, and that it will immediately plant about 10,000 acres in the guayule shrubs. The stock will be obtained from a nursery which the International Rubber Co. established more than a year ago.

Materials Markets Inactive

NEW YORK CITY, Aug. 8—The automobile materials market was dull and inactive during the past week, most of the commodities remaining practically unchanged. The most important feature, to car owners, at least, was the cutting of crude prices 10 to 20 cents with the resultant decline of gasoline 1 cent per gallon and the prediction that further reductions are not far off. The higher steel prices, on the other hand, give the manufacturers some concern, Bessemer having gone up $3 a ton. Cottonseed oil gained 6 cents a barrel and linseed oil picked up 2 cents. Lead lost 25 cents per 100 lb. and tin 50 cents. Rubber prices were steady, Up-river Para losing 1 cent and Ceylon first later ½ cent per pound.

McGraw Rubber to Redeem $475,000 Preferred

EAST PALESTINE, OHIO, Aug. 7—The McGraw Tire & Rubber Co., will redeem $475,000 of its preferred stock at 110 with accrued interest. This is part of a refinancing scheme and is part of a big deal in which 1,000,000 of 7 per cent cumulative preferred stock has been sold to the Maynard H. Church Co., Cleveland. The capacity of the plant is said to be 5000 tires a day and it is estimated that $4,000,000 business done during 1915 will be doubled for 1916.

$1,500,000 Tire Co. Incorporated

DOVER, DEL., Aug. 4—The Post Tire & Rubber Corp. has filed a charter to make and deal in automobile tires with an incorporation of $1,500,000 under the laws of Delaware. The incorporators are W. F. O'Keefe, G. G. Steigled and E. E. Wright.

Plymouth Castings Doubles Plant

PLYMOUTH, MICH., July 28—The plant of the Plymouth Motor Castings Co. is to be enlarged. The plans include doubling the capacity of the concern.

Warner Adds Heavy-Duty Trailers

BELOIT, WIS., Aug. 4—A. P. Warner, formerly of the Warner Auto Meter, will shortly put on the market heavy duty trailers of 2, 3 and 5-ton capacity. The Warner trailer coupling will also be manufactured and is expected to be used as standard equipment on several well-known trucks. The Warner Prairie Schooner and trailers are made by the Warner Mfg. Co.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.58	.58	.58	.57	.57	.57	— .01
Antimony	.12½	.12½	.12½	.11	.11	.10½	— .02½
Beams and Channels, 100 lb.	2.67	2.67	2.67	2.67	2.67	2.67	...
Bessemer Steel, ton	40.00	40.00	43.00	43.00	43.00	43.00	+3.00
Copper, Elec., lb.	.26½	.26½	.26¾	.26¼	.26¼	.26¾	+ .00¼
Copper, Lake, lb.	.26½	.26½	.26¾	.26¾	.26¼	.26¼	+ .00¼
Cottonseed Oil, bbl.	9.39	9.40	9.40	9.40	9.32	9.19	+ .06
Fish Oil, Menhaden, Brown	.55	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.23	— .01
Lard Oil, prime	1.05	1.05	1.05	1.05	1.05	1.05	...
Lead, 100 lb.	6.35	6.35	6.00	6.00	6.00	5.95	— .25
Linseed Oil	.69	.69	.71	.71	.71	.71	+ .02
Open-Hearth Steel, ton	42.00	42.00	42.00	42.00	42.00	42.00	...
Petroleum, bbl., Kans., crude	1.25	1.25	1.25	1.25	1.25	1.15	— .20
Petroleum, bbl., Pa., crude	2.50	2.50	2.40	2.40	2.40	2.40	— .10
Rapeseed Oil, refined	.90	.90	.90	.90	.90	.90	...
Rubber, Fine Up-River Para	.66	.66	.66	.66	.65	.65	— .01
Ceylon, First Latex, lb.	.56½	.56½	.56½	.56½	.57	.57	— .05
Sulphuric Acid, 60 Baume	2.50	2.50	2.50	2.50	2.50	2.50	...
Tin, 100 lb.	38.25	38.25	38.25	37.75	37.75	37.75	— .50
Tire Scrap	.05½	.05½	.05½	.05½	.05½	.05½	...

50% Gain in Southwest Car Sales

20 Los Angeles Dealers Report Increase of 109% in First 7 Months of 1916

LOS ANGELES, Cal., Aug. 4—Automobile sales throughout Southern California and Arizona have been 50 per cent better this summer than last. This figure is reached from a canvass of twenty of the largest dealers in Los Angeles, and is in spite of the fact that it has been difficult to secure the 1917 shipments in many instances.

Taking the figures of the same twenty dealers, representing the trade in Los Angeles, for the first 7 months of 1916 and comparing these with the figures of the same dealers for the corresponding period of 1915, an increase of 109 per cent in volume of business is shown. This increase has been steady. Each month of this year has been well ahead of the same month of last year. Four houses reported greater sales during the month of June alone than during the entire first half of last year.

By actual count, one of the largest houses in the Southwest has done just double the amount of business in the first 7 months of 1916 that was done in the same period of last year, and the increase represents 200 cars, sold and delivered at retail, with another 300 cars delivered through agents in Arizona and southern California towns.

In arriving at the totals, the dealers used only sales of new cars actually sold and delivered, and paid no attention to the orders from agents and private buyers on file.

Houghton Buys Ohio Tractor Co.

MARION, OHIO, Aug. 4—W. H. Houghton, president of the Houghton Sulky Company, has purchased at receiver's sale the personal property of the Ohio Tractor Mfg. Co., which includes the material on hand, finished product, machinery, patterns and patents, which have been in the hands of Charles H. Lewis as receiver.

Mr. Houghton may go on manufacturing tractors, using the patterns of the Ohio Tractor Mfg. Co. It is understood that Mr. Houghton and his associates will purchase the building from the receiver. The company will be reorganized by the election of Ellis H. Houghton as general manager of the tractor concern.

General Rubber Increases Capital

AKRON, OHIO, Aug. 5—The General Tire & Rubber Co., this city, has increased its capital by 150 per cent. The capitalization is $500,000; was $200,000.

Security Prices Are Lower

Chevrolet Declines 21 Points, Saxon 7 and Overland 6⅜—List Is Weak

NEW YORK CITY, Aug. 8—The announcement of lower prices for Ford cars, and numerous rumors to the effect that other companies' earnings would be materially affected, as well as others predicting other price reductions, served to render the automobile and allied stocks the weakest group on the list during the past week. In spite of record earnings reported by several of the leading companies of the industry, the stock quotations showed practically no effects of the optimism which they would naturally be expected to arouse. On several occasions the bear element directed raids against one or more of the automobile stocks with the result that prices sagged and sank, recovering now and then but ending the week substantially below the quotations at the end of the previous 7-day period.

Many Large Declines

A glance at some of the more striking price changes will suffice to reveal the general character of the market. Chevrolet lost 21 points, declining from a bid of 208 to 187, the preceding week having seen a loss of 8 points. Saxon went down 7 points, Overland common 6⅜, Packard and Chalmers common issues each lost 5 and United Motors declined 4½. The only stocks to show any strength were the tire issues, Miller gaining 25 points, Swinehart 15 and Portage 2.

On the Detroit exchange there was comparatively little activity, General Motors losing 10 points on the common and Maxwell 4, Studebaker common 3½ and Kelsey Wheel 294, the latter following a decline of 100 last week.

Stromberg Refinancing Completed

NEW YORK CITY, Aug. 7—Final details for the financial expansion of the Stromberg company were completed last week in New York. As reported 2 weeks ago, the Stromberg Motor Devices Co., Chicago, with a capital of $50,000, has been taken over by the Stromberg Carbureter Co. of America, recently incorporated in New York with a capitalization of $5,000,000. The directors of the new company are Charles A. Brown, Charles W. Stiger, William L. O'Neill of Chicago, H. E. Gunnison, C. L. Saylor, Allan A. Ryan, of New York, and Harry E. Stutz, of Indianapolis. Mr. Stiger, president of the old company, becomes president of the new one and Mr. Ryan becomes vice-president, these two, with Mr. Gunnison composing the executive committee.

Same Officers

The officers remain as before except that Ryan replaces Carleson as treasurer. There will be no change in the policies of the company. Factory capacity is being doubled.

Republic Truck Has Bonus System

Rewards Employees for Working Toward Standard Time for Each Operation

ALMA, MICH., Aug. 5—The Republic Motor Truck Co. has adopted a bonus system in its plant whereby it expects to bring about a great increase in production, and at the same time enable its hundreds of shop workers to earn a great deal more than their present wages.

A standard, or unit of time has been established for each and every operation, and employees are urged to work toward that standard, with the end of attaining greater efficiency and greater wages. The man who reaches this standard, or unit will be rated 100 per cent efficient, and those who become 75 per cent efficient, or are able to complete one operation in three-quarters of the time set by the standard, or unit, will be placed at once upon the bonus list.

The rate of the bonus for 100 per cent efficient men is to be 20 per cent of the daily wages. With the increase of the efficiency of the employee and, of course, the increase in the amount of his actual production, comes an increase in the rate of the bonus. No limit will be placed on the amount of work an employee can do, as is the practice in many factories and no change in the limit for 1 year.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co. (new)	..	..	63	66	+1
J. I. Case pfd	70	78	85	90	..
Chalmers Motor Co. pfd	96	97	98	101	..
Chalmers Motor Co. com	90	93	170	180	—5
*Chandler Motor Car Co	..	..	102	104	—2
Chevrolet Motor Co	..	..	187	195	—21
Fiske Rubber Co. com	..	..	120	160	..
Fisk Rubber Co. 1st pfd	..	..	112	120	—2
Fisk Rubber Co. 2d pfd	..	..	120	..	..
Firestone Tire & Rubber Co. com	506	510	915	930	..
Firestone Tire & Rubber Co. pfd	109	111	111	113	..
*General Motors Co. com	203	205	500	520	..
*General Motors Co. pfd	105	107	113	116	—2½
*B. F. Goodrich com	50¾	51¾	70½	70¾	—2
*B. F. Goodrich pfd	104	105	113¾	114	+ ¾
Goodyear Tire & Rubber com	268	270	223	238	..
Goodyear Tire & Rubber pfd	105	106½	106½	107	+1½
Grant Motor Car Co	2	..	8	9	—1
Hupp Motor com	..	..	6½	7	..
Hupp Motor pfd	..	..	80	100	..
International Motor Co. com	19	20	5	8	—1
International Motor Co. pfd	43	45	18	23	..
*Kelly-Springfield Tire & Rubber com.	170	175	70	71	—1¼
*Kelly-Springfield Tire & Rub. 1st pfd..	85¼	86½	96	97¼	+ ¾
Kelsey Wheel pfd	..	..	..	..	..
*Lee Rubber & Tire Corp	..	..	43	44	—½
*Maxwell Motor Co. com	35	36	77	77½	—4½
*Maxwell Motor Co. 1st pfd	84	85	85¾	86	—1¼
*Maxwell Motor Co. 2d pfd	32¾	33¾	54½	57	—2½
Miller Rubber Co. com	196	199	225	235	+25
Miller Rubber Co. pfd	104	106	104	106	..
Packard Motor Car Co. com	..	120	170	180	—5
Packard Motor Car Co. pfd	..	101	100	104	..
Paige-Detroit Motor Car	..	..	45	50	+1
Peerless Truck & Motor Corp	..	..	20½	22	—1½
Perlman Rim Corp	..	..	..	..	..
Portage Rubber Co. com	36	38½	115	118	+2
Portage Rubber Co. pfd	92	95	115	118	..
Regal Motor Co. pfd	..	..	17	21	..
Reo Motor Truck Co	17¼	18	36½	37½	— ¼
Reo Motor Car Co	33¼	34½	42½	43½	+ ½
Saxon Motor Car Co	..	..	67	72	—7
Springfield Tire & Rubber com	..	..	..	..	..
Springfield Tire & Rubber 1st pfd	..	..	..	..	..
Standard Motor Co	..	..	5	7	..
Stewart Warner Speed. com	61½	63	101½	102½	— ½
Stewart Warner Speed. pfd	105	107	..	..	..
Stromberg Motor	..	..	41½	41¾	..
*Studebaker Corp. com	83¾	84¼	125¼	125¾	—2¼
*Studebaker Corp. pfd	103	104½	109	111	..
Stutz Motor	..	..	63¾	64	..
Swinehart Tire & Rubber Co.	85	90	100	105	+15
United Motor Corp	..	..	63	63½	—4½
*U. S. Rubber Co. com	47	48	53½	54¼	+1
*U. S. Rubber Co. pfd	104	105	108¼	109	+ ¼
White Motor Co. (new)	103	108	51½	53	—1¾
*Willys-Overland Co. com	146	147	51¾	52	—6¾
*Willys-Overland Co. pfd	103	105	104	104¾	—1

*At close August 7, 1916. Listed New York Stock Exchange.
Quotations furnished by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co	..	..	36½	38	..
Chalmers Motor Co. com	..	..	..	175	..
Chalmers Motor Co. pfd	85	88	..	103	..
Continental Motor Co. com	..	300	..	34½	..
Continental Motor Co. pfd	83	86	9½	10½	..
Ford Motor Co. of Canada	1475	1525	325	345	..
General Motors Co. com	195	200	480	530	—10
General Motors Co. pfd	105	107	112	118	..
Maxwell Motor Co. com	35	37	76	78½	—4
Maxwell Motor Co. 1st pfd	83½	85½	84½	87	—1
Maxwell Motor Co. 2d pfd	32	34	53½	56½	—2½
Packard Motor Car Co. com	..	120	..	180	..
Packard Motor Car Co. pfd	..	101	..	104	..
Paige-Detroit Motor Car Co	..	..	45	50	+1
W. K. Prudden Co	20¼	..	41	43	..
Reo Motor Car Co	33¼	34½	41¾	42¾	..
Reo Motor Truck Co	17¼	17¾	..	36½	..
Studebaker Corp. com	82½	84	122½	125½	—3½
Studebaker Corp. pfd	101	103	105	..	..
C. M. Hall Lamp Co	..	..	..	30	..

INACTIVE STOCKS

Atlas Drop Forge Co	25½	..	..	..	..
Kelsey Wheel Co	205	..	56	60	—294
Regal Motor Car Co. pfd	..	21	..	..	..

Close Dealers' Contracts at Missouri Tractor Show

(*Continued from page* 213)

and even Texas and Kansas. Here we have no great areas to be broken such as there are in Texas, for example. Nor do we have the extreme climatic conditions that make the Texas farmer's life a burden and kill off his horseflesh.

Missouri is essentially a state of moderately small farms. All told, according to the latest available figures, there are some 277,244 separate farms in the State. The average size per farm has been computed to be about 125 acres, and the average value per farm is in the neighborhood of $7,400.

Farms Big for One Man

It is peculiarly a condition in Missouri that a great many of these farms are just slightly too large for one man to work, yet they are not sufficiently profitable to warrant the employment of help. It is expected that the small tractor will be of inestimable value because of these conditions and because it will then permit one man to work his farm, to get better crops from it and larger crops. Whether it will get larger crops is problematical. Statistics do not show that a man who purchases a tractor gets larger crops from his land though they do show that when a man purchases a tractor he generally increases his land holdings. But figures almost invariably show that the tractor improves the value of the yield and so increases the farmer's profit.

Another important bearing which the tractor will have in Missouri, because of what may be termed the uneconomic size of farms in general is that it will permit the work on these farms to be done at just the proper time. Where a man has a farm that is slightly too large for him to handle himself, or is, perhaps, just about as large as he can handle, weather conditions often will make it necessary for him to delay putting in his crops at the proper time. Some of the crop will be too early for the normal market and some of it will be too late. The result often is a dead loss of several hundred dollars. The tractor will save this because all the work can be done at the proper time.

Corn the Main Crop

Corn is the big crop in Missouri, with blue grass second and stock raising third. This year it is estimated that the state will market about 200,000,000 bushels. This week there has been heavy rain through the corn belt and it has come at the proper time. In a great many cases corn has been put in late and rain at this time will insure a nearly normal crop.

The demonstration here has not been as well attended as have previous demonstrations but there are several reasons for this. The first is that most farmers are busy at this time getting their corn in. This was put in late and now is being harvested. A second reason is that on Tuesday there was a primary election, which naturally kept the farmers at home. Another reason is that the demonstration field, which is in Kinloch Park, is 16 miles from the city and the transportation facilities are not all that might be desired. It is expected that later in the week the farmers will flock to the field and that dealers and distributors also will put in an appearance.

Unfortunately—here again is demonstrated the smallness of Missouri farms—it was not possible for those in charge of the demonstration to secure one large field, as in Dallas and Hutchinson, where all the machines might plow at once. Ground for plowing is limited and for this reason many of the companies are compelled to demonstrate only their small machines. Some of the machines are in one field and the remainder in another field, perhaps a quarter of a mile distant. At least the smallness of the available field has had the advantage of bringing into prominence the work of the smaller tractor and in the opinion of agricultural experts it is the small tractor that Missouri must look to for the most part.

Kerosene is used somewhat more extensively here than at either Dallas or Hutchinson. During the first day of plowing thirty-three of the machines were working on kerosene as against twenty-one operating on gasoline.

The accessory exhibit, instead of being in one large tent, as heretofore, is in two tents and is attracting quite as much attention as in Dallas and Hutchinson.

French Adopt Uniform Carbureter

(*Continued from page* 212)

liters to 31 liters. The Sterling is not used very extensively in the French army, and no army records have been made of its consumption, but there are more than 100 of them employed by the munition factories around Paris. The first attempt to economize was made by Chief Engineer Michelat of the Delage factory, who cut his gas from 11 to 6.6 gal. per 100 kilometers. This example was followed by other users, until about sixty of these trucks have been converted to European carbureters.

Pierce Holds Tests

Complaints of high gasoline consumption having been brought to the notice of the Pierce-Arrow engineers in France, it was decided to hold a comparative test in order to show that the high consumption was not due to any fault in the truck or the carbureter. Two of the factory representatives took ordinary trucks in army service, obtained the proper carbureter adjustment and took their place in a convoy driven by soldiers and commanded by an officer. The factory men had to maintain their place in the convoy, were not allowed to coast on hills, and had no fitments not on the other trucks in the convoy. For the 5-ton models the average for the soldier-driven trucks was 4.7 miles to the gallon; the average for the two factory driven trucks was 7.8 miles to the gallon. Similar tests were made with 2-ton trucks, the results being 7.12 miles to the gallon for the soldier-driven trucks and 8.74 miles for the average of the two vehicles driven by the factory representatives. Translations have been made on the basis: 1 American gallon = 3.79 liters.

Hyatt Sends Party to Tractor Meeting in Private Car

CHICAGO, ILL., Aug. 5—The Hyatt Roller Bearing Co. has arranged for a special private car to convey some of its representatives and a party of engineers and friends from Detroit to the national farm tractor demonstration which opens at Fremont, Neb., to-morrow. The car will leave Detroit to-night, and reach Chicago to-morrow morning. Tuesday will be spent in Chicago, with headquarters at the Hotel Blackstone. The party will leave at 6.05 p. m. on Tuesday, arriving at Fremont Wednesday morning. Following are those who will make up the party:

George W. Dunham, Society Automoblie Engineers; A. P. Sloan, Jr., general manager Hyatt Roller Bearing Co.; C. W. Nash, Nash Motors Co.; G. S. Mott, Western Mott Co.; C. S. Kettering and E. A. Deeds, Dayton Engineering Laboratories Co.; John W. Bate, Micheli Motors Co.; Harry Bassett, Weston-Mott Co.; C. L. Barnes, Barton W. Currie, *Country Gentleman;* Henry Ewald, Campbell Ewald Co.; P. G. Koether, general sales manager automobile department Hyatt Roller Bearing Co.; R. L. Lane, chief engineer Detroit office, Hyatt Roller Bearing Co.; J. G. Weiss, works manager, Hyatt Roller Bearing Co., Newark, N. J.; C. M. Eason, manager tractor bearing department Hyatt Roller Bearing Co., Chicago.

In addition the following Hyatt representatives will be at the Fremont demonstration: H. O. Kuchemmeister, assistant sales manager; H. M. Carroll, advertising department; O. W. Young and J. R. Bateman, sales engineer; J. E. Martin, dynamometer department; L. S. Newman, mechanical inspector.

Ford Tractors at Fremont

DETROIT, MICH., Aug. 7—Henry Ford and his son attended the Fremont, Neb., national tractor demonstration with three of Ford's new machines. Ford and his son traveled to the demonstration in a private car. The three tractors are of exactly the same type, but operate on gasoline, kerosene and alcohol respectively. In addition to the tractors, Ford also brought a comprehensive display of the various parts which enter into the construction of this machine.

Factory Miscellany

Diamond Chain to Build—The Diamond Chain & Mfg. Co., Indianapolis, Ind., will begin the erection of a complete manufacturing plant on the 6-acre tract of land which it acquired 4 years ago, located on Kentucky Avenue. The plans contemplate a concrete structure containing four stories with 150,000 sq. ft. of floor space. The new building will be 380 by 60 ft. with two L's, 100 ft. long making the entire frontage 700 ft.

To Make Vulcanizers—F. A. Whitten, Charles Palmer and A. Lewis have organized a company in Grand Rapids, Mich., for the purpose of manufacturing vulcanizing machines.

Haynes Makes Sixth Addition—The Haynes Automobile Co., Kokomo, Ind., is starting the sixth factory addition built during the past year. The new building, a two-story structure to house the repair department, will bring this year's increase in floorspace to a total of 180,000 sq. ft. The latest addition will be ready for occupation Sept. 1.

Seat Co. Makes Ambulances—Construction of motor ambulances is the latest addition to the factory of the Excelsior Seat Co., Columbus, Ohio, the first vehicle turned out by the firm having been placed in the service of the Second Ambulance Co. of the troops now at the mobilization camp. Several months ago this manufacturing company, which for years has been making buggy seats and buggy bodies, installed new machinery and began the manufacture of automobile bodies. A regulation Ford chassis was rebuilt so that it has a wheelbase of 130 in.

American Forging Adds Again—The American Forging & Socket Co., Pontiac, Mich., maker of small motor vehicle forgings and automobile top accessories, is rushing the construction work on an 80 by 100 ft. building, the second large addition to its plant since the first of the year. Other additions are also planned.

Holt-Welles to Expand—The Holt-Welles Co., New York City, will increase its capital from $50,000 to $200,000, as a result of plans for increasing both the manufacturing and distributing facilities for Browne and Browne-Branford carbureters, for which this company is sole selling agent.

E. H. Stickels will remain president of the company, with the sales work under his direct supervision. A. B. Browne, designer of the carbureter and consulting engineer for the Malleable Iron Fittings Co., where the Browne carbureters are made, will have entire charge of the laboratory and experimental work.

Holihan Mfg. Co. to Build—The Holihan Mfg. Co., Detroit, Mich., has bought 3½ acres of ground on Milford Avenue and Pere Marquette Railroad and has let the contract for the immediate erection of a large factory, 80 by 400 ft., with adjoining buildings for steel storage, shipping and enameling. The new plant will be occupied by September, and the production will be doubled.

This is the second time the company, which manufactures hoods, tanks, fenders, and stampings, has been compelled to seek larger quarters and it will employ about 500 men in the new plant.

Republic Truck to Build—The Republic Motor Truck Co., Alma, Mich., will erect two new factory buildings in which to manufacture the new Model 9 ½-ton truck.

The new buildings, are to be erected just east of the old plant and will extend from Michigan Avenue along Bridge Street to the river. The main structure is to be 60 by 1000 ft., and one story high. Parallel to the large building will be built a stockroom 36 by 500 ft. The two buildings will have a floorspace of 48,000 sq. ft. and will cost about $38,000. The company at present employs 700 men in the old factory, and this number will be practically tripled upon completion of the new buildings and as soon as the new model gets well under way.

The Automobile Calendar

ASSOCIATIONS

Aug. 15—Metropolitan Section, S. A. E. Meeting at Automobile Club of America. Subject, "South America."

Aug. 28-Sept. 1—Milwaukee, Wis., Booster Tour of Milwaukee Automobile Dealers.

Sept.—Indianapolis. Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.

Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.

Oct. 13—Flint, Mich., Fall Meeting National Assn. of Automobile Accessory Jobbers.

Dec. 2-9—Electricians' Countrywide Celebration.

CONTESTS

Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.

Aug. 12—Portland, Ore., Track Race, Hiller-Riegel Co.

Aug. 18-19—Elgin Road Race, Chicago Auto Club.

Aug. 26—Kalamazoo, Mich., 100-Mile Track Race.

Sept. 1-2—New York, N. Y., Sheepshead Bay Speedway, 24-Hour Race, Trade Racing Assn.

Sept. 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.

Sept. 4—Cincinnati, Ohio, Speedway, Cincinnati Speedway Co.

Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.

Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.

Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.

Sept. 9—Indianapolis Speedway Race.

Sept. 16—Providence Speedway Race.

Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.

Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.

Sept. 30 — New York City, Sheepshead Bay Speedway Race.

Oct. 7—Philadelphia Speedway Race.

Oct. 7—Omaha Speedway Race.

Oct. 14 — Chicago Speedway Race.

Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.

Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.

Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 1-9—Cincinnati, Ohio, Good Roads Exposition and Convention, Music Hall, Hamilton County Dixie Highway Council of Cincinnati.

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

SHOWS

Aug. 7-19—Atlantic City, N. J., First Show, Young's Pier.

Sept. 2-9—Cleveland, Ohio, Show, Industrial Exposition and Fair, Edgewater Park.

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.

Sept. 4 - 8 — Hartford, Conn., Show, Connecticut Fair Assn.

Sept. 4-11 — Indianapolis, Ind., Show, Indiana State Fair, Indianapolis Automobile Trade Assn.

Sept. 10-16 — Milwaukee, Wis., Show, Wisconsin State Fair, Machinery Bldg.

Sept. 25-30—Salem, Ore., State Fair, Joseph M. Rieg, manager.

Oct. 14 - 31 — Dallas, Texas, Show, State Fair.

Jan.—First Pan American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 13-20 — Montreal, Que., Show, Montreal Automobile Trade Assn.

Jan. 27-Feb. 3, 1917 — Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb.—St. Louis, Mo., Show, Auto Manufacturers and Dealers' Assn.

TRACTOR

Aug. 7-11—Fremont, Neb., Tractor Demonstration.

Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.

Aug. 21-25—Bloomington, Ill., Tractor Demonstration.

Aug. 28-Sept. 1—Indiana Tractor Demonstration.

Sept. 4-8—Madison, Wis., Tractor Demonstration.

Sept. 11-16 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Week in the Industry

Goodyear Makes Appointments—The Goodyear Tire & Rubber Co., Akron, Ohio, has appointed the following: M. D. Montgomery, who has been acting manager of the Denver district during the illness of the late S. E. Gillard, has been confirmed as manager of that district.

F. C. Meyer, who has been in charge of the Des Moines branch, becomes manager of the Minneapolis branch vice G. H. Barmore, who has been appointed manager at Milwaukee.

F. W. Telford, former supervisor of motor truck sales at Chicago, becomes manager of the Des Moines branch.

T. J. Fitzgerald will fill the managership of the El Paso branch left vacant by the death of F. G. Dennis.

Gibson Heads Edison in West—F. C. Gibson has been appointed Pacific Coast manager for the Edison Storage Battery Co. with headquarters at 65 Columbia Street, Seattle. The new firm, which will handle the agency for the Edison line in Washington, Oregon and Idaho, will be known as the Edison Storage Battery Supply Company. Mr. Gibson formerly held the agency for the Edison Storage Battery line in the State of Oregon.

Jones Joins Budlong—H. W. Jones, Hartford, Conn., has resigned as sales manager of the Britton Co., Stearns-Knight distributor, to become associated with Milton J. Budlong of the firm of Gaston, Williams & Wigmore, 140 Broadway, New York City. Mr. Jones was formerly secretary of the Columbia & Electric Vehicle Co. and later associated with the New Haven Carriage Co.

Thompson Returns to Detroit—E. E. Thompson, at present connected with the branch of the Maxwell Motor Co. in San Francisco, will return to Detroit in September to assume the duties of sales superintendent of the Maxwell Motor Co. for the Pacific Coast.

Sell Cars Day and Night—The local retail branch of the Studebaker Corp., Los Angeles, Cal., has inaugurated a day and night selling system. Beginning July 24 the salesroom has been kept open day and night and the sales force has been reorganized accordingly so that the men work in regular shifts.

Johnson Joins Monroe—T. S. Johnson, for the past 2 years branch manager of the Oakland Motor Car Co. branch in Philadelphia, has been appointed eastern distributor by the Monroe Motor Co., Pontiac, Mich., with headquarters in Philadelphia.

Reo Opens Branch in Chicago—The Reo Motor Car Co. has purchased the business of Owen & Buxton, Chicago Reo dealers, and will operate as the Reo Motor Car Co. of Illinois.

Twin City News—The Maxwell Motor Co., Inc.. has opened a factory branch at 134-136 West Seventh Street, St. Paul, with J. W. Martin as manager.

The Ford Motor Co. has opened a factory branch in St. Paul. Heretofore it has been operated from Minneapolis. W. H. Schmelzel has been transferred from the branch at Fargo, N. D., to succeed A. H. Sargent as manager here. The latter is transferred to Grand Rapids, Mich. W. P. Winders is advanced to manager at Fargo and F. C. Seiss, superintendent there, has been made assistant manager at Sioux City.

Northwest News—W. J. Doyle and S. J. Doyle of Carrington, N. D., have formed the Overland-Doyle Co. to manage the Overland distribution in the Fargo district. W. J. Doyle, veteran implement dealer, will move there.

The Glide Automobile Co., Inc.. has been formed by managers of the Avery Co. and others to manage a factory branch of the Glide car. Its territory will be western Minnesota, North Dakota and eastern Montana.

St. Louis Trade Items—The Moon Motor Car Co. reports shipments last month of 6-66 cars to Copenhagen, Denmark and to Valparaiso, Chile. and a 6-43 to Pahiatua, New Zealand. The latter car was ordered by cable. which also gave notice that the Barlow Motor & Cycle Co. of that place had been made agents for the north section of the island. The car went to San Francisco for boat shipment, the total journey being 8500 miles.

Geller, Ward & Hasner, St. Louis, hardware firm that recently took the agency of the Hood tires and which handles many accessories, has opened an uptown store at 3328-32 Olive Street, where the automobile lines will be handled exclusively. Complete lines will be handled at the Fourth Street store.

Moerschell Electric & Supply Co., St. Louis, announces that P. J. Newsom has been made manager of the service department.

Supreme Motor Car Co., St. Louis, recently organized to handle the Simplex cars has opened show-rooms at 3019 Locust Street.

G. F. Farasey, with the Kelly-Springfield Tire Co. at Boston and Cleveland, has taken charge of the St. Louis branch for the same company, succeeding C. R. Higgason.

The Prest-O-Lite Co. announces the immediate construction of a building for its especial use at Locust and Beaumont Streets, St. Louis. The office will be on the Locust Street front and in the rear will be a service station for all Prest-O-Lite products. There will be a large driveway for cars midway of the building on Beaumont, so that automobiles to be served can enter the building. The building will be ready Sept. 1. The St. Louis station now is at Locust and Thirty-fourth Streets.

New England Trade Items—The E. R. Benson Motor Car Co., Portland, Me., has promoted C. A. Laidlaw, its retail sales manager, to be the wholesale man for Maine.

T. F. Russell has taken the agency for the Inter-State line at Springfield, Mass.

G. J. Coleman, for 2 years with the sales force of the F. W. Roberts Auto Co., Northampton, Mass., has taken the agency for Studebaker cars in Hampshire County, with headquarters in that city.

F. H. Kenny, who has the Chalmers agency at Worcester, Mass., has taken a 5-year lease of new salesrooms on Main and Oread Streets.

Edward Cross has been appointed New England traveling representative in charge of the entire district by the Hood Rubber Co., maker of Hood tires at Watertown, Mass.

The Packard Motor Car Co., Boston, Mass., has approved plans for a service station on Shrewsbury and Atchison Streets, Worcester, Mass., that will be the largest building of its kind in that city.

C. L. Lowd, for some time with the Oldsmobile company of New England, has been appointed assistant general manager.

The Maxwell Motor Sales Corp. at Providence, R. I., has appointed T. A. Clarke to its salesforce. He was formerly with the Crow Motor Sales Co. at Washington, D. C.

The Stoddard Motor Car Co., Springfield, Mass., that handled the Pierce-Arrow line for many years until a few weeks ago, has now taken on the Locomobile and Riker truck agency.

The International Motor Co. of New York has opened a branch for Mack trucks at 101 Liberty Street, Springfield, Mass.

The AUTOMOBILE

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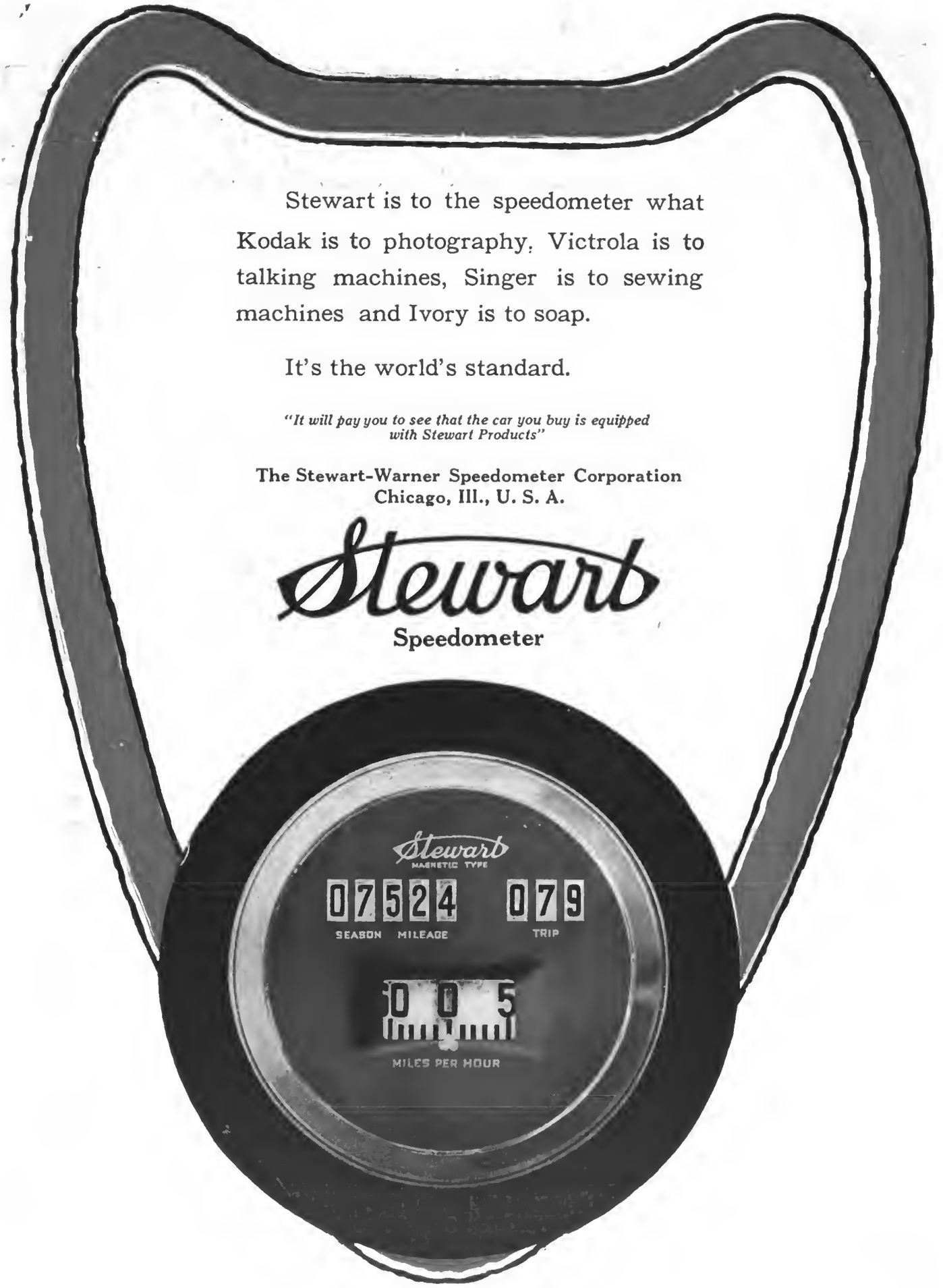

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The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, AUGUST 17, 1916—CHICAGO No. 7

Ford to Drop Retail Sales

To Market Cars in Same Way as Plows and Other Hardware — Dealers to Have No Territory Rights

DETROIT, Aug. 14—The Ford Motor Co. will discontinue the selling of cars at retail, although it will probably be some little time before the new plan of marketing is worked out completely. Briefly, the new merchandising scheme is similar to the methods of distributing any manufactured article, in that the actual distribution to the ultimate users will be through dealers who will have no exclusive territory rights and who will be allowed to sell the machines anywhere or everywhere. The many Ford branches throughout the country are to be nothing more than assembly stations and wholesale distribution points to these dealers. The dealers in turn will be required to maintain regular Ford service and garage methods.

It is believed that the Ford car to-day is well-nigh a standard product, just as a lawn-mower or other implement might be regarded, and nearly everyone who knows anything about machinery or mechanical matters should be able to take care of it and do ordinary repairing. With this thought in mind the service matter clarifies greatly, and with the wholesale branch near by it is no great problem to take care of any condition in connection with the car that may arise. The dealer will have the branch from which he bought his cars to fall back upon in every way, and he will also get all his parts through that branch.

In short, the new Ford selling methods are revolutionary, so far as the automobile industry is concerned, but they are the principles of merchandising any standard article of commerce. Take any piece of merchandise, such as any of the well-known brands of breakfast food, for instance. The maker of this distributes to jobbers, who in turn supply the grocers, and any grocer can get a stock with no restrictions as to where he sells. Suppose we consider the marketing of plows. If a certain man with a general store wants to handle a line of plows he can secure such merchandise with no territory restrictions. The store across the street might also carry the same make of plow for his trade.

So with the sale of Fords. The Ford branch houses in all parts of the country will distribute the finished cars to the dealers at wholesale, and one garage might handle them across the street from another. Each would retail them to his own trade. These retailers of Fords will, of course, have to be reputable dealers before they can get a supply of cars and they will have to contract to give recognized service, but they can sell anywhere they are able to sell.

No information as to the number of cars a dealer will have to buy in order to get them through the branch at wholesale

(*Continued on page* 291)

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Haynes Declares 108% Stock Dividend

KOKOMO, IND., Aug. 12—The Haynes Automobile Co., this city, declared a stock dividend of 108 per cent at its annual meeting on Aug. 8 in this city. The capital stock was increased from $1,400,000 to $4,000,000, and it was decided to proceed immediately to the erection of a new factory that will turn out the light sixes.

Net earnings of $1,600,000 are reported. The company built 6700 cars and will be able to produce 12,000 the ensuing year, 3000 of which will be twelves and the remainder sixes.

The directors re-elected Elwood Haynes, president; Stephen Tudor, secretary; A. E. Starbuck, treasurer, and A. G. Seiberling, general manager.

90,000 People See Ford Tractors

Fremont's Tractor Show Rivals Metropolitan Automobile Exhibits in Interest and Attendance

FREEMONT, NEB., Aug. 11—Nearly 90,000 interested farmers and friends have been in this town the last 3 days to see the annual tractor demonstrations and incidentally get their first glimpse of Henry Ford's new tractor that has been looked for for over a year. Ford's tractor is here; so is Henry, and so is his son Etzel. As usual, Ford has come up to expectations and perhaps gone a little beyond, for his tractor will use gasoline, kerosene or alcohol. It will not make much difference whether gasoline continues to go up or down, for the machine performs equally well with any of the three fuels.

In price it has already worsted Ford's new automobile schedule, as rumor has it placed at $300, although definite figures have not been announced. The tractor is very light, weighing less than a ton.

You cannot mistake Ford's new tractor from being a Ford machine. It has a lot of the conventional Ford earmarks. It is a four-wheel design that can plow at 2.5 to 3 miles per hour and run along the road at 5 to 6 miles per hour, and for night plowing has a set of headlights that get current from the magneto.

The motor is a larger edition of the Ford passenger car motor with a block of four cylinders, each 4 by 4.25 in., and having the familiar Ford flywheel magneto, thermo-syphon cooling, etc. From the motor there is a multiple-disk clutch, three-speed, with reverse gearset of the constant-mesh type and worm transmission to the rear axle.

As a farm implement it is capable of

(*Continued on page* 295)

Production Increasing in Mich.

Hudson, Chalmers and Reo All Speeding Up Outputs—Dealers Urging Haste

DETROIT, MICH., Aug. 15—Detroit automobile production continues to increase. Both the Hudson and Chalmers companies report large increases and are preparing to further add to their outputs. The Reo company in Lansing is also preparing for a large increase.

There are now approximately 6000 men on the payroll of the Chalmers Motor Co. The daily output is running from 125 to 150 cars, and within a short time a new schedule of more than 150 cars a day will be put into operation. It is expected that from 35,000 to 40,000 Chalmers will have been made by Dec. 31, 1916, which is the end of the 1916 fiscal year of the Chalmers company.

Since the beginning of this month production at the Hudson Motor Car Co. is averaging 150 cars a day. It is expected that this daily output will be gradually increased, as the company, which originally planned to build 35,000 sixes for its 1917 season, has increased its schedule 45,000 recently, and even this increase is reported to be below the number of cars which have been asked for by the Hudson distributers and dealers.

For the fiscal year 1917 the Reo Motor Car Co., Lansing, Mich., has laid out its plans for a production of at least 36,000 passenger cars, which is considerably more than were made during the 1916 fiscal year. The Reo Motor Truck Co. plans to build 6000 trucks, or more than twice the number made during the past season. There are now 5500 men employed at the two plants.

Wahlberg Joins Nash Motors

PONTIAC, MICH., Aug. 14—N. E. Wahlberg, chief engineer of the Oakland Motor Car Co., has resigned to become associated in a similar capacity with the Nash Motors Co., Kenosha, Wis., the new organization headed by C. W. Nash, formerly General Motors president, which company is to manufacture Jeffery cars. Mr. Wahlberg has been with the Oakland company for a number of years, first as assistant engineer and later as head of engineering.

Willard Battery Business Increasing

CLEVELAND, OHIO, Aug. 15—Four new buildings are to be erected by the Willard Storage Battery Co. in addition to the ten buildings now occupied. There are now more than 150 builders of cars and trucks who are using Willard storage batteries. One of the new buildings will contain a power house of the largest size. It will be capable of producing 40,000 amperes at 110 volts.

Buda Motors to Sell Direct

CHICAGO, Aug. 12—The Buda company is organizing a sales department and will handle the sales of the Buda motors direct, instead of through Bradenburg & Co. As head of the new motors sales department, Lon E. Smith, western representative of the Eisemann Magneto Co., with headquarters at Indianapolis, becomes sales manager on Sept. 15 of the motor department of the Buda Co., and C. V. Richardson, recently chief engineer of the Republic Motor Truck Co., has become sales engineer of the Buda Co. The headquarters of the new department will be at Harvey, Ill.

Drake Returns from Orient

DETROIT, MICH., Aug. 14—After an extended trip through Japan, China and Australia, Joseph R. Drake, vice-president of the Hupp Motor Car Co., is again in Detroit, being accompanied by R. F. Cole, Hupp representative in the Orient. Mr. Drake has made a number of world tours in the interests of his company and reports conditions very favorable for extension of American car selling in those countries he visited.

Simplex to Market Its Cars Direct

NEW YORK CITY, Aug. 14—The Simplex Automobile Co., New Brunswick, N. J., has taken over the Metropolitan distribution of its car. John G. Dale, who has handled the car for several years, will take over the Jordan car and another high-priced town car, which will be announced in the near future.

The Simplex company, which takes over all of the unfilled orders and contracts, has rented for a term of 5 years the store and basement of the new building at the southeast corner of Fifth Avenue and Fifty-eighth Street and will establish there its local sales and showroom.

The Jordan car will be handled at the old location of the Simplex, 240 West Fifty-ninth Street. According to present plans, the territory included under the new arrangement will include the Metropolitan district and the surrounding territory, reaching as far as Bridgeport, Poughkeepsie, New Jersey and Long Island.

Hastings Empire Engineer

DETROIT, MICH., Aug. 14—D. T. Hastings, formerly on the engineering staff of the General Motors Co., is engineer for the Empire Automobile Co., Indianapolis.

Thianna Car Now on Market

Will Sell at $6,000—Company in Newark, N. J. and Capitalized at $500,000

NEWARK, N. J., Aug. 15—Another high-priced car will soon make its appearance in the East. This is the Thianna, which will be built in special body designs for town car use.

The Thianna car is made by the Thianna Motor Co., Newark, N. J., capitalized at $500,000, all paid in. This company has just started manufacturing and will turn out 200 cars of special body work during the first year. The car is not an assembled product and all parts will be made at the factory. The chassis sells at $3,600 and with the coupé or closed body at $6,000. T. M. Pepperday, former Simplex agent in Pittsburgh, is president.

The car has 62-in. cantilever springs and a four-cylinder 3⅞ by 6-in. four-cylinder motor. The wheelbase is 125 in.

Severe Fines in Traffic Court

NEW YORK CITY, Aug. 14—July was the first complete month of New York's experience with its traffic court, which opened June 14. A study of the accompanying tabulation will show that there has been no inclination toward leniency, Magistrate House imposing severe fines, and, in default of payment, jail sentences of 10 days or over on every driver convicted. A total of $18,610 in fines was received during the month. This money goes to the fund for policemen's wives.

N. Y. Traffic Court's First Month

Arraignments	1,280
Chauffeurs' licenses revoked	2
Owners' licenses suspended	2
Imprisoned for non-payment of fines	44
Total fines received	$18,110
Speeding, first offense	426
Speeding, second offense	32
Speeding, third offense	3
Improper license plates	116
Passing trolley cars, first offense	78
Passing trolley cars, second offense	1
Reckless driving	35
Failure to show badge	28
Unlicensed chauffeurs	13
Swinging number plates	2
Intoxication	5
Smoking	50
Court days	20
Cases per day, average	64

Buys 1915 Ford for $377

ST. LOUIS, MO., Aug. 12—Henry Schnuhr of Mascoutah, Ill., does not read the newspapers. Last Tuesday he attended a public sale at the Louis Forcade farm in his neighborhood, and bought a 1915 Ford car for $377. Not until Friday did he learn of the cost of a new one and then he consulted a lawyer to learn if there was anyway by which he could get "out of his bargain."

New Ford Radiator and Fenders

Alterations Entirely Change Appearance of Car—Moulded Unbroken Body Lines

DETROIT, MICH., Aug. 15—The new Ford for 1917 has to be seen to appreciate how greatly the few alterations improve its appearance. The average person will have to look twice to be sure it is a Ford. These changes are principally in the externals. They are:

1—*The fitting of an entirely new radiator of black enamel, which is of about the same width and height as the present one, although it has the appearance of being of slightly less thickness.*

2—*The use of a sloping hood that eliminates any break where it adjoins the body.*

3—*The addition of crowned fenders front and rear which conform to the curve of the wheels in most modern fashion.*

There is no other change. The wheelbase and body remain identical with the previous model. The new radiator shell is a stamping in two pieces: one, the shell proper and the other the top portion that bears the Ford name stamped in it. The familiar Ford filler cap and radiator spout of brass protrude at the top.

Now that the radiator is enameled, there is really very little brass about the car, only the filler and hub caps being of this metal. The shape of the new radiator is very pleasing in that there are no abrupt edges as in the type that has become familiar the world over, the new shell having rounded edges where the side parts of the shell curve into the top portion, and the front edge is also rounded over.

Louvres in Hood

The new hood is provided with louvres in the sides, and is shaped so that there is an unbroken line from the radiator to the body proper and it, as well as the radiator and fenders, have been given a high finish. The fenders are substantial pressings that are free from vibrations when in position on the car. They are well attached to the chassis and body.

Besides these external changes, which add a great deal to the general appearance of the car, there are two minor changes under the hood. One is the fitting of a shield around the fan, this concentrating the air and insuring its going to the whole of the radiator surface, as an aid to cooling, and the other is the fitting of an electric horn. This horn is mounted at the right rear side of the cylinders between them and the steering column. It is of the vibrator type and is arranged to operate from the current of the flywheel magneto. The operating button is mounted on the steering column just under the steering wheel.

New Ford touring car with altered radiator

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NEW YORK CITY, Aug. 15—Parts for the new Ford bodies have been received in the assembly plant at Long Island City and in about 2 weeks the cars should be coming through regularly.

—

Schwarz Wheel to Expand

PHILADELPHIA, Aug. 14—The Schwarz Wheel Co. has purchased 6 acres at Holmesburg near its present plant for extensions.

—

Falls Motors Plans 120 Engines a Day

SHEBOYGAN FALLS, WIS., Aug. 12—The Falls Motors Corporation, which succeeded the Falls Machine Co., on Aug. 1, has definitely decided not to remove the plant from Sheboygan Falls, Wis., to Cleveland, Ohio, or other cities which have made offers. Additional buildings required to bring the capacity up to the requirements of contracts will be built. A large assembly shop, 250 ft. long, has been completed and work will be started at once on an addition, 120 by 180 ft., to this department. The present output of fifty engines daily will be increased to eighty before Oct. 1, and by Jan. 1 the daily capacity will be 100 motors. The assembling department, with the addition to be erected, will have a capacity of 120 motors daily. The new interests are represented on the board of directors and the official personnel remains as before, with the exception of adding a new vice-president, Leroy Miser, and an assistant secretary, J. G. Lude, formerly purchasing agent. Gustav Huette is president; R. W. Randall, first vice-president; Leroy Miser, second vice-president; Angelo R. Clas, secretary.

Standardize Truck Lever Controls

S. A. E. Truck Division Recommends Standard Gearshift Positions and Lever

BUFFALO, N. Y., Aug. 14—Standard controls for trucks which will permit any driver to change from truck to truck without trouble were recommended at a meeting of the S. A. E. Truck Standards division held here to-day.

It was considered best not to specify either right or left hand steering wheel location as this does not affect the operation of the truck if all other things are the same. Thus the recommendations are as follows:

Gearshift and hand brake levers always to be at driver's right. The gear lever nearest the driver and the brake lever to the right of the gear lever.

A latch or its equivalent for guarding the reverse slot should be provided for both three- and four-speed transmissions.

The position of the lever to give the different gears in a three-speed transmission should be the same as that already recommended for passenger cars.

In a four-speed transmission the highest gear to be in the same position as the highest in the three-speed with the same successive motions for changing down. The low gear will then occupy the place taken by the reverse in the three-speed transmission. No particular position specified for the reverse position on a four-speed layout. The gear lever positions are as shown:

Three Speed	Four Speed
R 2	1 3
1 3	2 4

The gear positions should be clearly indicated on the gate or the base of the gearshift lever.

The hand brake lever should be pulled back to apply the brakes.

Spark and throttle levers should be so mounted that they do not turn with the steering wheel. They should be pushed forward to advance the spark or open the throttle.

The accelerator pedal should be placed to the right of the brake pedal. These recommendations will be put before the full standards committee at the meeting in October. They are based upon practice to some extent and also on what, in the opinion of the division members, is really best for easy manipulation.

Discuss Military Requirements

After the matter of controls had been settled there was a discussion of the military requirements. It transpired that the Quartermaster's, the Ordnance, En-

(*Continued on page* 287)

South America—IV

Three Months' Credit Necessary with Argentine Dealers—Longer Credits Not in Good Repute—Supply Depot Essential

By David Beecroft

THIS article is in sequence to that of last week. It is the tail end of it. Last week we analyzed the major considerations in connection with selling automobiles in South America, including the kind of cars needed, the selling seasons, and lastly came to the question of credits which formed the sixth consideration. Three months' credit will generally be necessary in South American sales.

We mention 3 months' credit because that is the figure generally fixed by many concerns. Three months allows for automobiles leaving your factory and being on the salesroom floor for 2 weeks or perhaps a month. The dealer in Argentina does not ask for anything more, he has reasons for asking for this.

He cannot possibly finance himself if he has to pay for his cars 2 months before he receives them, and particularly if they reach him at the end of the selling season instead of at the beginning. The dealer does not believe he is unreasonable in his 3 months' demands.

Many European countries gave much longer periods, 9 months, and some German credits extended for a year and as long as 15 and 18 months. It will not be necessary for any U. S. A. house to give such credit extensions. Argentina is not favorably disposed to such long credits. The good Argentine business man blames long credits for some of his recent troubles, and they blame those credits very largely for the crisis of 1911. So if you have heard that is is necessary to give credits of a year or longer, we believe that you can forget such and prepare for not over 90 days and you can cover yourself on these 90 days at as high as 8 per cent interest, in fact, that is what many of the older houses giving similar credits do.

Long Credits After War?

But you ask what will the credit terms after the war be. That is a question I am not prepared to even voice an opinion on. All through South America you hear comments of a widely varying nature as to what will happen when England, Germany, France and Italy get back into South America. You hear that Germany will come back with credits of a year or 15 months, but nobody has any assurance of such. You hear that England will give 9 months and France perhaps as long. Nobody knows. Many South American dealers wonder if it will be possible for these countries to extend such credits. That will depend to what extent they have been impoverished by the war. Depend on it that if these European countries can extend such credits they will not hesitate to do so.

England has been established in Argentine trade circles since 1862 when she opened her first banks there. Before the present war she had over $5,000,000,000 invested in Argentine railroads and other utilities and naturally she is not going to let that trade be plucked away from her for the sake of a few months' credit. Germany has her big business houses all through Argentina and Brazil and she, too, is going to come back with every drop of energy remaining. So with France, and Italy and Belgium and Switzerland. They have all had their fingers deep in the South American pie and are not going to let Uncle Sam run away with it very easily. Keep this sanely in mind when contemplating your future South American policy.

SEVENTH:—Be prepared to establish a good depot for spare parts in each of the South American countries where you hope to do business. Your good faith to stay permanently in the South American field will largely be measured by the faith you show in your invasion by backing up all cars sold with a liberal supply of spares of every part from engine crankcase to the smallest ball bearing. The South American buyer is keen on this spare parts program. He insists on it before he will purchase a machine. He knows that parts will break in the best of machines. He knows that he is 3 weeks by the fastest boat from New York. It is 3 weeks back. You may wait a week for the boat at each end. You may wait several days for the customs and then the repair or replacement has to be made. The car owner sees his car laid up for 2 whole months if there is not an adequate supply of spares for every model. A stock of spare parts is the greatest selling asset that any U. S. A. car has in Argentina, Brazil, Chile or any other South American country. If you lived in Buenos Aires or Santos, or Lima you would see it the same way. The distance you are in those lands from the factory terrifies you at times. The situation is so entirely different from anything in the U. S. A. that you can be pardoned for not having given the spare parts matter that mature consideration that you may have given all other factors in the deal.

With the supply of spare parts it is scarcely fair that the Buenos Aires dealer should carry the entire load. All of Argentina must be served. A better way is to establish your own depot for spare parts and put one of your own men in charge. That is what General Motors has done in Buenos Aires, and that was the reason why the organization got established early. Ford has done that all over. Studebaker is doing it. You must do it. One depot of this kind in Buenos Aires will serve for Chile, for Uruguay and for Paraguay. You will require a similiar depot in Rio which will serve for all Brazil. From such a depot or two it will be possible to sell the local agents a relatively small supply of replacements to meet exigencies. From these supply depots it will be possible to reach nearly any part of the territory in a few days.

Lesson from Tire Trade

Tires.—Just here take a page from the policy of the Michelin Tire Co. of France, which has had the great majority of the South American tire business until the war, since which time our U. S. A. companies and some of the Italian concerns have been cutting heavily into Michelin's trade. Take Brazil for example. Michelin has for years maintained a depot in Rio de Janeiro and another in Santos. In each he carries a very large supply of all sizes and types of pneumatic tires. He has paid the import duties on these tires and has his own organization looking after the depots.

What is the result of this system? The dealer in Sao Paulo in the coffee country can write out his order for any number of tires to-day and forward it with check to the Michelin depot in Santos. In two days the tires have arrived at his store. It is this two-day service that has built up the Michelin trade, and how can any of our firms hope to compete if they are not prepared to give something better than 2 months. A 2-month program of delivery will never compete against a 2-day program. Michelin dealers are always stocked up with tires and tubes and tire repairs. They do not object paying cash when they can get stock in 2 days.

EIGHTH:—It will be necessary for our automobile concerns to send some of their best men to South America to establish the business and to look after it until it gets well under way. Then you will have to put in permanently one of the best men you can get and he should be from your factory. A very large New York business house a few months ago decided to investigate the Argentina and Brazilian fields. It is in the printing business. The original intention was to send one of its best salesmen. Take a man from the road in the U. S. A. and put him in Argentina for a month and in Brazil for a similar period. Fortunately the board of directors saw that one of the best officers of the concern should go. This was done and with beneficial results. The same is being done with several other concerns, whose representatives we met while in Argentina and Brazil. Opening a business in South America is a big man's job. The fact that you can speak Spanish or Portuguese is not sufficient. You must know how business has to be done and is done.

You must also be prepared to keep one of your best men there. That is the way Ford did. Studebaker is following the same plan. Many others will have to do so. Singer Sewing Machine company did this. The National City Bank of New York has U. S. A. managers in every branch and several of the department heads are also from the U. S. A. So it is with the United Steel Products Co., so it is with our express companies, so it is with the International Harvester Co., so it is with Armour, Swift and the other large packing interests, so it is with the J. I. Case Co. and so it is with every other strong U. S. A. concern that has got in strong in South America. They went there to stick and they are sticking and doing well. The head men of the West Indian Oil Co., which is the Standard Oil Co., has its U. S. A. men in charge.

Have U. S. A. Staff

This policy of manning the South American business with home men is not anything that Uncle Sam has a patent on. England does the same, and so does Germany, France, Italy, etc. But England and Germany go much further. Generally England sends an entire office force. The manager will always have his stenographer from England and if one leaves he immediately cables the home office in London for another. This is because it is hard to get good men stenographers in many South American cities, and if you have not a good stenographer it means that the manager may have to write many of his own letters to the home office. This is actually being done by many of our concerns. I have seen many men, managers in a large territory, who were writing their own letters on typewriters, simply because they could not get satisfactory help. It was pathetic to see a man whose time was worth $200 a week doing work that a $30 clerk should have been engaged to do.

England and Germany have both profited on this score and have counted the value of sending a good quota of office help. Male help only should be sent. You can get much competent office help but you must have your own manager, preferably your own department heads, and also a few good clerks to take much of the load off the manager and others high up so as to conserve their energies for developing the business. They have been sent down for development work and you must not make clerks of them.

These men should go prepared to stay for 5 or 10 years. They should go to remain permanently. In Buenos Aires the U. S. Steel man has been there for 10 years. Some of the head men of the Singer Sewing Machine Co. have been there for nearly 15 years. The same is true with regard to Standard Oil. You can say the same of many other companies. The South American does not like changes in his business relationships with foreign countries. It is hard enough to do business with the U. S. A. even if the same man remains head, but how much harder is it if the Argentine merchant has to get acquainted with a new manager every year or so. There is nothing so detrimental to good Argentine or Brazilian business as frequent changes in management. Consequently you must pick your men carefully and they should have in mind a residence of several years in South America.

Living in South America is not so pleasant as in the U. S. A. but it is not nearly so bad as it was 4 or 5 years ago. Conditions are changing very rapidly. It is much easier on men than on women. Woman's life in Argentina and Brazil cannot be compared with that in the U. S. A. and so they tire very soon of life there. The men get on immeasurably better, but so often they are always living for the day the steamer sails and then hope never to have to go back; it is well known that a few of our older and larger business houses not in the automobile industry have stopped sending married men as managers to South America. They send experienced young bachelors who generally get married a few years afterward to native Argentines, Brazilians or Chileans, as the case may be. They become good citizens and are very contented.

Living Expenses High

NINTH: Be prepared to stand the expense of establishing a business in South America. This expense is greater than you to-day imagine. It is more expensive living in Buenos Aires than in New York City. It is expensive traveling in all parts of South America. On the return trip the representative of the Singer Sewing Machine Co., who has been in charge of the South American and Latin-American business of the company, said that it was the experience of their concern that young men had to be paid considerably more for living and traveling expenses in Argentina, Brazil, Chile and other South American countries than in the U. S. A. Others who have had years of experience in older lines of merchandise have learned this lesson.

In Argentina and Brazil you hear of many representatives of U. S. A. automobile concerns running short of funds, not having been given sufficient traveling money. Three or four specific instances came up during the months of May and June. In general it requires about $20 per day U. S. money to care for a representative who has considerable traveling and who must do a limited amount of dinner entertainment. The manufacturer who sends his representative down on a too scant allowance is proportionately reducing that representative's ability.

Railroad traveling is expensive, and there are a score of other expenses that have to be met, which frequently do not enter into business in the U. S. A. We know of one case where a maker objected to an item of charges for carrying baggage on the railroads in Brazil because he compared the rates with those in America and imagined that his representative was attempting to pad his expense list. To carry a small trunk with you on a railroad in Brazil costs nearly as much as your own railroad ticket. For a steamer trunk you will pay as high as $5 U. S. gold for a night trip such as Chicago to Buffalo. You will pay $3 to $4 for a bed per night on the railroads and often double of this amount. These are conditions that must be considered. Get it out of your head that South America is a cheap country to live in. It is not. It is not a cheap country to do business in.

Typical Argentine carts with capacity for 6 to 10 tons on a highway leading to a depot. These carts are the lords of the highway and with their 62-in. treads dictate what tread the automobile for the Argentine must have. In bad roads as many as thirty-five horses are hitched to one and the speed is not over 2 miles per hour. Note the great width of Argentine roads, which in some cases are as wide as a field. In rainy weather these carts are tremendous loads to draw

Attractive Homes for South America's Motor Agencies

1—*The Cadillac agency in Buenos Aires owned by Fehling Hnos, or Fehling brothers. This firm has had the Cadillac agency for nearly 14 years*

2—*The Cadillac agency in Cordoba, a city a night's ride by train from Buenos Aires and situated near a short range of mountains. This section has the best roads of any part of Argentine due to a good supply of gravel. There are five or six excellent gravel roads radiating from the city and piercing the mountain sections*

3—*Bosch magneto headquarters in Buenos Aires. This house is located in the best section of the city and on the leading motor thoroughfare*

4—*This is a large Buenos Aires garage, and while the exterior is plain plaster, the interior is well laid out. This garage has two entrances, the garage being divided centrally into equal halves*

5—*Buenos Aires is well acquainted with various devices to accelerate loading and unloading. Here is shown a power conveyer loading sacks of grain, each sack weighing 132 lb. The bags are carried direct from the warehouse to the hatches*

This is the famous immigration department in Buenos Aires, which is considered the best in the Americas. Note the wide, well-paved streets. This is a characteristic of South American cities. They have given good areas for railway depots, steamboat wharves and freight terminals. This makes these cities ideal for motor car and motor truck uses. Add to this the fact that power loading devices are very widely used and two or three obstacles to truck use are overcome

Buildings Reflect Atmosphere of Industry in South America

6—*Exterior of a new Buenos Aires garage located in a residential section of the city and intended solely for passenger cars. This garage uses a ramp instead of an elevator*

7—*Here is another example of modern power cranes being used for loading and unloading and the general handling of merchandise in Buenos Aires. Each wharf is lined with power cranes for lifting loads off railroad cars*

8—*This is the interior of the second floor of the garage shown in Fig. 9. The exit from the ramp is in the center just in advance of the wire fencing. The garage is typical of the latest construction in Buenos Aires and has steel construction throughout*

9—*Showing ramp for second floor of garage, Fig. 8. This ramp is so located as not to interfere with cars stored on the main floor, in that it has a separate entrance with room for running a car from the main floor up the ramp without having to drive it outside of the garage.*

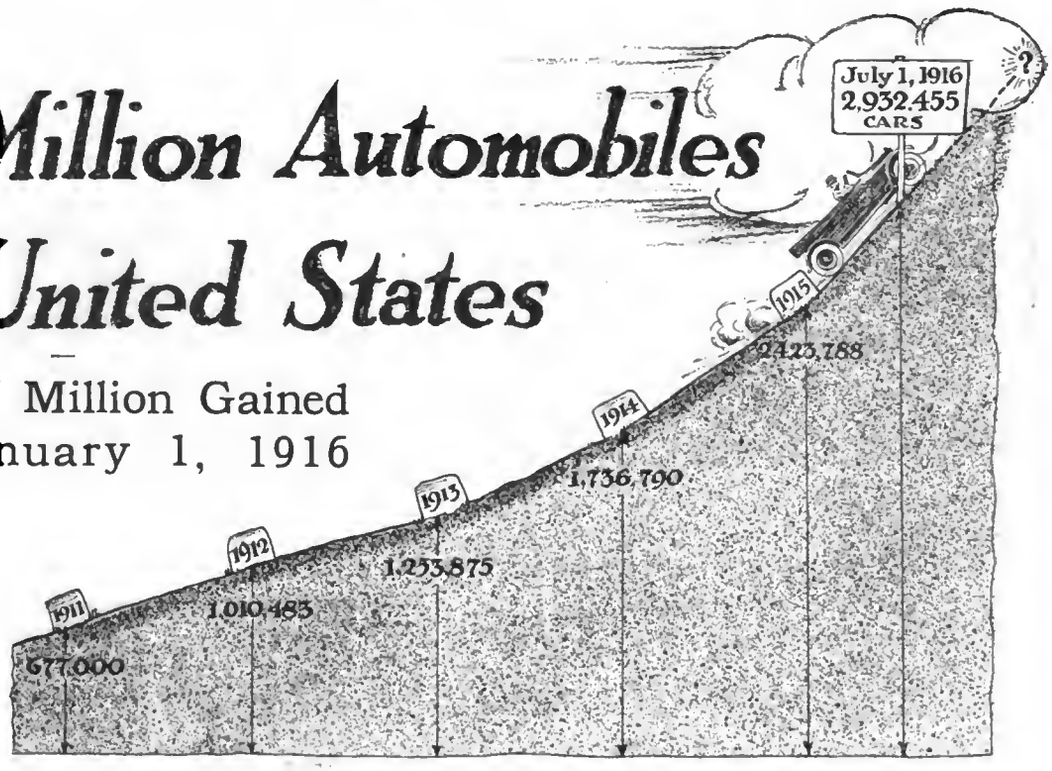
10—*Interior of large taxicab garage in Buenos Aires, operating 300 cabs. In the rear is a complete repair department and the organization of this garage is a model of its kind.*

Three Million Automobiles in United States

Over Half Million Gained Since January 1, 1916

By Donald McLeod Lay

THERE are 508,677 more cars in use to-day than there were on Jan. 1, 1916. There are over 3,000,000 automobiles in use in the United States to-day, including both passenger cars and trucks. Between Jan. 1 and June 30, 1916, the increase which had taken place was not far short of the total increase for the whole year of 1915. There are now three States having over 200,000 cars apiece, New York, Ohio and Illinois, whereas on Jan. 1 of this year only New York had as many as this. Eleven States have over 100,000 machines each, Minnesota, Massachusetts, Indiana and Texas having passed into this class since Jan. 1.



Registration Hill is constantly growing steeper as the rate of increase climbs

At the present time there is one car to every thirty-five persons in the United States

In thinking of these big figures it must not be forgotten that the industry has been producing a good many more cars than those absorbed in the United States. Since Jan. 1 the exports have totaled 43,265.

Taking up a few exact figures, the total registrations July 1, 1916 were 2,932,455 cars and trucks. The largest State registration, that of New York was 259,105. Ohio, taking second place for the first time, had 208,705 and Illinois 203,757. New York now holds the place at the head of the list by a margin of 50,400 registrations. The bottom of the list is occupied by Nevada with 3900 cars but Nevada ranks fourteenth in the tabulation showing the number of people per car, New York taking the twenty-eighth place in this list.

Iowa has a motor vehicle now for each 13 people, California one to each 15 people and Nebraska one to each 16, while New York has as many as 39 inhabitants to every car.

A striking feature brought out by a comparison of the registration statistics of July 1 and those recorded at the first of the year is the constant increase which indicates the stability and normal progress of the automobile industry. The average increase in registration in the United States for the entire year of 1915 was 39.6 per cent; for 6 months of 1916 the average is 21 per cent, or approximately 40 per cent on a yearly basis, since the registration tapers off to some extent during the last 6 months of the year.

A study of the tables herewith, both the complete registration figures for each State and the statistics of gain in each, brings out the underlying economic factors which have made a registration of 3,000,000 automobiles and trucks possible in the United States to-day. Prosperity has been the rule throughout most sections of the country and the sale of cars naturally follows the spread of prosperity. A glance at the tabulation of States showing the increase in registration suffices to bring out that those which have made the largest gains are the ones most affected by the unusual industrial conditions prevailing in this country since the outbreak of the European war. New York, the leading State, represents

Registrations by States

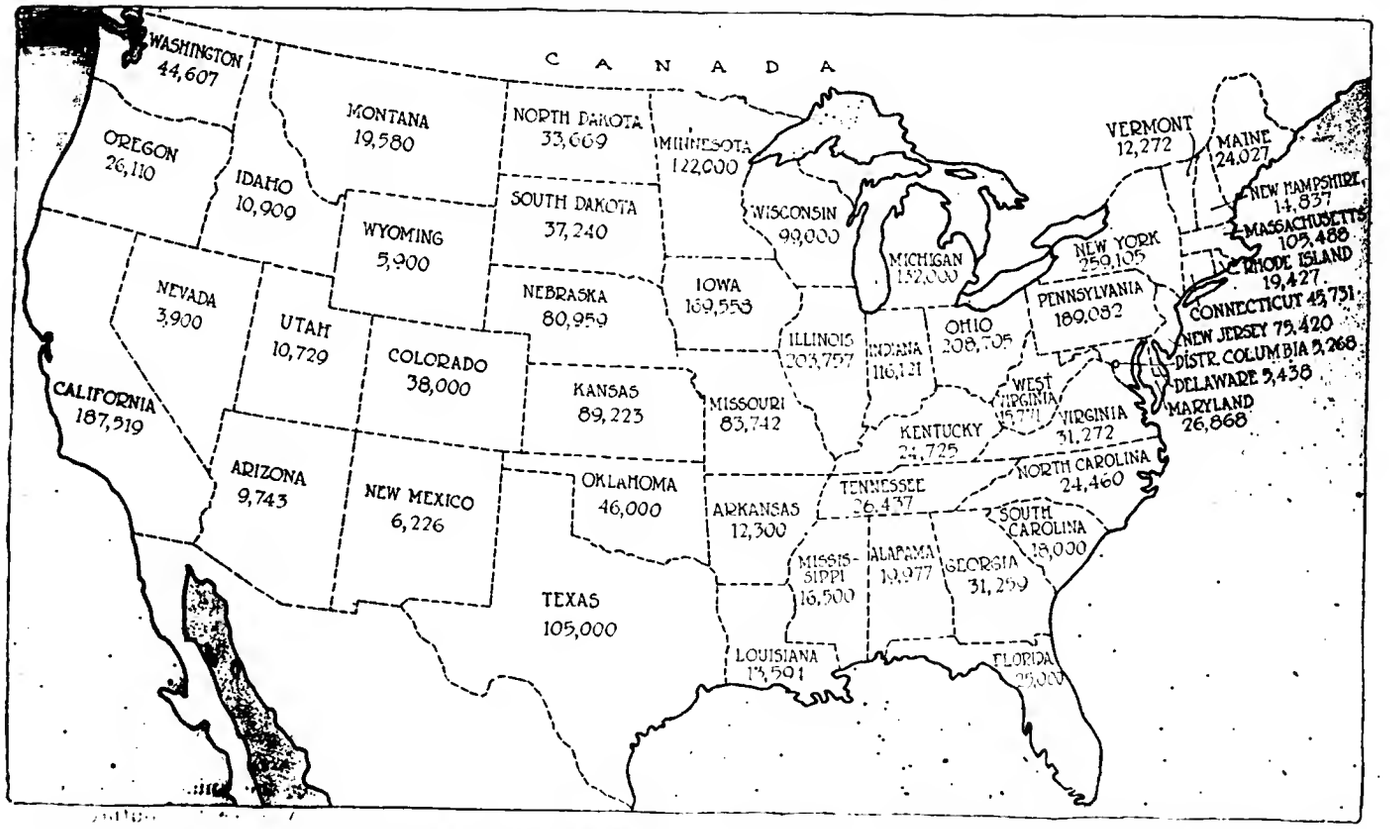
ALL DUPLICATES DEDUCTED

State	Cars and Trucks	State	Cars and Trucks
New York	259,105	Oregon	26,110
Ohio	208,705	Florida	25,000
Illinois	203,757	Kentucky	24,725
Pennsylvania	189,082	North Carolina	24,460
California	187,519	Maine	24,027
Iowa	169,558	Alabama	19,977
Michigan	132,000	Montana	19,580
Minnesota	122,000	Rhode Island	19,427
Indiana	116,121	South Carolina	18,000
Massachusetts	105,488	Mississippi	16,500
Texas	105,000	West Virginia	15,771
Wisconsin	99,000	New Hampshire	14,837
Kansas	89,223	Louisiana	13,594
Missouri	83,742	Arkansas	12,300
Nebraska	80,959	Vermont	12,272
New Jersey	75,420	Idaho	10,909
Oklahoma	46,000	Utah	10,729
Connecticut	45,731	Arizona	9,743
Washington	44,607	New Mexico	6,226
Colorado	38,000	Wyoming	5,900
South Dakota	37,240	Delaware	5,438
North Dakota	33,669	Dist. of Col.	5,268
Virginia	31,272	Nevada	3,900
Georgia	31,259		
Maryland	26,868	Total	2,932,455
Tennessee	26,437		

Car and Truck Registration in Each State from Jan. 1, 1916, to July 1, 1916

State or Territory	Total Registration	New Registration	Registration up to Jan. 1, 1916	Gasoline Passenger Cars in use	Gasoline Commercial Cars in use	Electric Passenger Cars in use	Electric Commercial Cars in use	Non-Resident Registration*	Re-Registered**	Chauffeurs Registered	Total Fees	Remarks
Alabama	19,977	6,179	13,798	***	***	***	***	***	***	***		
Arizona	9,743	2,423	7,320	***	***	***	***	***	***	***	$64,158.00	
Arkansas	12,400	4,379	8,021	***	***	***	***	***	100	245	124,245.00	
California	187,519	23,718	163,801	***	***	***	***	***	***	***		
Colorado	38,000	11,389	26,611	***	***	***	***	***	***	***		
Connecticut	45,731	6,781	38,950	39,557	6,174	***	***	***	***	17,579	114,272.00	
Delaware	5,850	926	4,924	***	***	***	***	***	412	***		
Dist. of Col.	16,307	6,107	10,200	***	***	***	***	11,039	***	***	20,950.00	Perennial reg.
Florida	25,000	11,877	13,123	***	***	***	***	***	***	***		Local reg.
Georgia	38,267	14,188	24,059	36,377	1,500	350	40	7,008	None	3,092	140,854.00	
Idaho	10,909	3,816	7,093	10,634	250	25	***	***	***	784	177,833.00	
Illinois	203,757	21,467	182,290	***	***	***	***	***	***	25,359	1,047,196.64	
Indiana	116,121	19,206	96,915	***	***	***	***	***	***	3,209	726,864.00	
Iowa	169,558	29,750	139,808	***	***	***	***	***	***	***		
Kansas	89,223	14,267	74,956	87,623	1,600	***	***	***	***	***		
Kentucky	24,725	5,225	19,500	***	***	***	***	***	***	***	161,797.49	
Louisiana	13,744	2,864	10,880	13,494	225	25	None	***	150	***	70,000.00	
Maine	24,027	5,427	18,600	22,407	1,620	***	***	***	***	***	269,685.00	
Maryland	26,868	§	27,638	***	***	***	***	***	***	***		New law.
Massachusetts	105,488	16,355	89,133	90,688	14,800	***	***	***	***	***	1,232,164.63	
Michigan	135,000	20,155	114,845	***	***	***	***	500	2,500	7,000	1,501,089.23	
Minnesota	122,000	30,171	91,829	***	***	***	***	***	***	3,500		Triennial reg.
Mississippi	16,500	5,000	11,500	***	***	***	***	***	***	***		
Missouri	85,619	9,157	76,462	***	***	***	***	***	1,877	***	3,487,046.50	
Montana	19,580	5,058	14,520	***	400	***	***	***	***	***		
Nebraska	80,959	21,819	59,140	***	***	***	***	***	***	***		
Nevada	3,900	1,723	2,177	3,775	125	***	***	***	***	***	18,000.00	
New Hampshire	14,837	4,018	10,819	***	***	***	***	***	***	5,052	242,122.92	
New Jersey	84,519	16,963	67,556	73,790	10,729	***	***	***	9,099	***	1,123,400.50	
New Mexico	6,301	1,354	4,947	6,181	110	10	***	4	71	***	41,445.23	
New York	259,105	46,261	212,844	***	***	***	***	***	***	84,112	2,199,229.00	
North Carolina	24,460	3,300	21,160	***	***	***	***	***	***	***	130,000.00	
North Dakota	33,669	8,991	24,678	***	***	***	***	***	***	***		
Ohio	212,058	32,291	179,767	194,876	12,000	4,282	900	220	3,133	***	1,091,997.00	
Oklahoma	46,000	20,385	25,615	***	***	***	***	***	***	***		New law. Many cars previously not registered.
Oregon	26,110	2,352	23,758	***	***	***	***	***	***	3,122	125,932.00	
Pennsylvania	189,082	38,353	150,729	***	***	***	***	***	***	***	1,834,992.00	
Rhode Island	19,427	3,065	16,362	15,658	3,522	193	54	***	***	***		
South Carolina	18,000	3,500	14,500	***	§§	***	§§	None	None	***		
South Dakota	37,240	12,904	29,336	***	***	***	***	***	***	***		Local reg.
Tennessee	26,654	§	27,266	***	***	***	***			***		
Texas††	105,000	15,000	90,000	***	***	***	***	***	217	327	150,000.00	New law.
Utah	10,729	2,739	7,994	9,876	796	57	***	***	***	***		
Vermont	12,691	1,192	11,499	11,098	584	6	3	***	***	744	$0,317.75	
Virginia	31,272	9,915	21,357	***	***	***	***	***	419	10,874	236,410.47	
Washington	44,607	7,702	36,905	***	5,086	***	***	None	***	***		
West Virginia	15,771	2,515	13,256	***	***	***	***	***	***	***	284,086.25	
Wisconsin	99,000	17,629	81,371	***	***	***	***	***	***	***	133,765.11	
Wyoming	5,900	1,934	3,976	***	***	***	***	None	‡ None	***	513,750.00	
											29,509.00	
Total	2,969,204	551,790	2,423,788	616,034	59,521	4,948	997	18,771	17,978	164,999	$14,261,112.72	

NOTE.—Steam cars and trucks included in gasoline vehicle statistics as well as electric vehicles where these are not segregated. *Number of cars registered owned by citizens of other States **Number of cars re-registered, owing to transfer of ownership, etc. ***Not listed separately by registration officials. †Estimated by State registration officials. ††Estimated by Dallas Automobile Club. §Registration low due to new law. §§Registration not required.



Map showing the number of cars registered in each State. The tabulation above gives this information with other interesting data

in large degree the enormous financial operations connected with the war order business throughout the country as well as the huge profits derived from the reorganization of capital and securities in foreign countries. Its normal growth has been accelerated by the increase in the foreign commerce of the United States, the bulk of which is transacted through New York City.

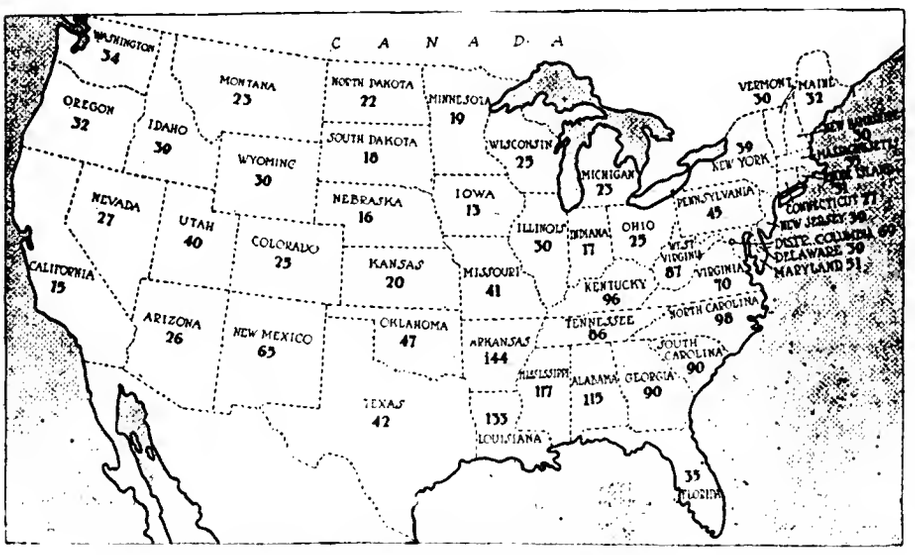
Pennsylvania, which stands second in growth of registration with a gain of 38,353 cars and trucks, has shared in almost every form of industrial boom that has taken place, utilizing the high prices of the commodities which it produces in such large volume. The price of steel has been steadily going up and Pennsylvania is one of the largest producers. The price of coal is higher and Pennsylvania is one of the leading States in coal mining; agricultural products are selling for higher prices than ever before and Pennsylvania's contribution to this field of industry is enormous; and last, but not least, there has been an unprecedented boom in the oil industry, which also has redounded to the profit of the Keystone State.

Increase in Registration

State	Increase in Cars	Per Cent Increase
New York	46,261	22
Pennsylvania	38,353	25
Minnesota	30,171	33
Iowa	29,750	21
Ohio	29,415	16
California	23,718	14
Nebraska	21,819	37
Illinois	21,467	12
Oklahoma	20,385	80
Indiana	19,206	20
Wisconsin	17,629	22
Michigan	17,255	15
Massachusetts	16,355	18
Texas	15,000	17
Kansas	14,267	19
Florida	11,877	90
Colorado	11,389	48
Virginia	9,915	47
North Dakota	8,991	36
New Jersey	7,864	12
South Dakota	7,904	27
Washington	7,702	21
Missouri	7,280	10
Georgia	7,200	30
Connecticut	6,781	17
Alabama	6,177	45
Maine	5,427	29
Kentucky	5,225	27
Montana	5,060	35
Mississippi	5,000	43
New Hampshire	4,018	87
Arkansas	4,279	58
South Carolina	3,500	24
North Carolina	8,300	16
Rhode Island	3,065	19
Idaho	2,916	41
Utah	2,725	34
Louisiana	2,714	25
West Virginia	2,515	19
Arizona	2,428	38
Oregon	2,352	10
Wyoming	1,924	49
Nevada	1,723	79
New Mexico	1,279	26
Vermont	773	7
Delaware	514	10
Total	514,210	
Average increase		21

Registrations and Population

State	Pop. to Jan. 1, 1916	Cars and Trucks	Pop. Per Car
Iowa	2,220,681	169,558	13
California	2,893,465	187,519	15
Nebraska	2,264,999	80,959	16
Indiana	2,807,480	116,121	17
South Dakota	689,277	37,240	18
Minnesota	2,263,182	122,000	19
Kansas	1,818,383	89,223	20
North Dakota	726,142	33,669	22
Michigan	3,035,148	132,000	23
Montana	452,774	19,580	23
Colorado	948,980	38,000	25
Ohio	5,119,491	208,705	25
Wisconsin	2,486,941	99,000	25
Arizona	251,422	9,743	26
Connecticut	1,234,031	45,731	27
Nevada	104,732	3,900	27
Illinois	6,110,888	203,757	30
New Hampshire	441,545	14,837	30
Vermont	368,075	12,272	30
Wyoming	176,853	5,900	30
Rhode Island	608,540	19,427	31
Maine	770,064	24,027	32
Oregon	822,615	26,110	32
Washington	1,502,632	44,607	34
Florida	882,148	25,000	35
Massachusetts	3,690,748	105,488	35
Delaware	212,489	5,438	39
Idaho	420,291	10,909	39
New Jersey	2,914,928	75,420	39
New York	10,179,971	259,105	39
Utah	429,191	10,729	40
Missouri	3,401,241	83,742	41
Texas	4,386,638	105,000	42
Pennsylvania	8,453,004	189,082	45
Oklahoma	2,158,194	46,000	47
Maryland	1,357,874	26,868	51
New Mexico	408,600	6,226	65
Dist. of Col.	361,330	5,268	69
Virginia	2,181,516	31,272	70
Tennessee	2,279,691	26,437	86
West Virginia	1,372,756	15,771	87
Georgia	2,836,177	31,259	90
South Carolina	1,116,610	18,000	90
Kentucky	2,372,412	24,725	96
North Carolina	2,886,916	24,460	98
Alabama	2,316,948	19,977	115
Mississippi	1,939,226	16,500	117
Louisiana	1,815,218	13,504	133
Arkansas	1,726,413	12,300	144
Total	101,208,315		
Average for U. S.			35.00



Population to car ratio in each of the United States shown graphically

Minnesota next in line with an increase of 30,171 registrations is one of our largest agricultural and lumber States so that its 33 per cent gain is largely due to the wide market and highest prices for these products.

Iowa, another big farming State has been steadily forging toward the front rank in motor vehicle registrations for the past 5 years and during the first 6 months of 1916 shows an increase of 29,750, or more than the entire number of registrations at the end of 1911 when the State boasted of 27,936 automobiles.

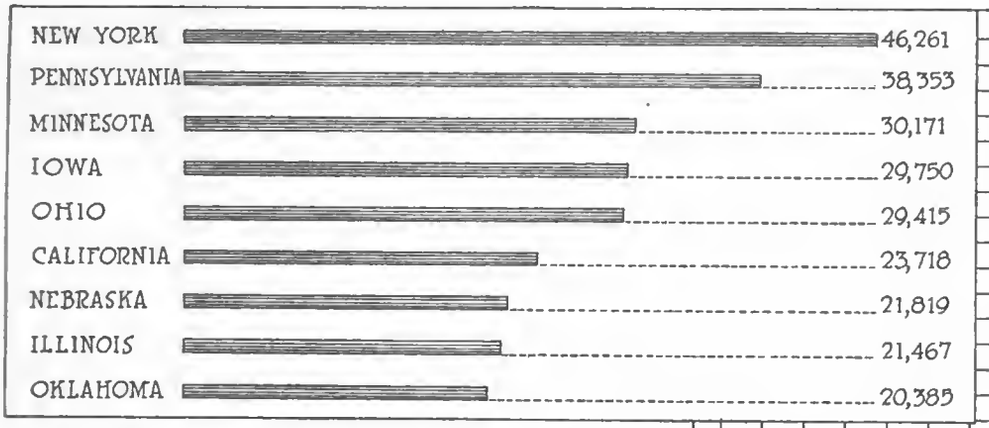
Ohio, with its big oil fields, its large manufacturing industries and extensive farming interests, has increased its registration 29,415, or 16 per cent, and without question a large part of this gain is directly attributable to the prosperity marking the State during the past 6 months.

Some of the other States which may be mentioned in this connection are Nebraska, a leading agricultural center, which is credited with an increase of 37 per cent over its 1915 registration; Oklahoma, which has an apparent increase of 20,385 cars or 80 per cent, a large part of which is due to the boom in the oil industry, although it must be noted that, it is only recently that registaration has bas enforced, so that the statistics recorded Jan. 1 were really incomplete.

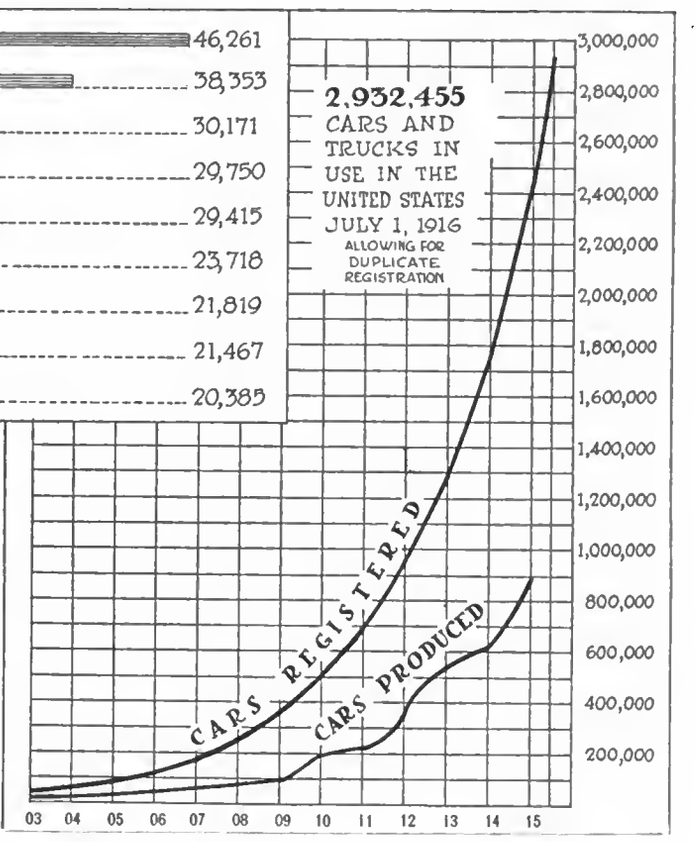
A similar condition may be noted in New Hampshire which shows an increase of 37 per cent during the 6 months. This State is a big center for tourists and summer residents and it is undoubtedly due in a large measure to this fact that the gain has been so marked.

In Florida, there has been a gain of 11,877, or 90 per cent, part of which represents cars previously unregistered, but the bulk of the gain may be attributed to prosperous conditions in the lumber business and other leading industries of the State. Lumber and agriculture also had much to do with the increase of 7702 made in Washington, while high metal prices combined with farm activities to give Missouri 7280 more cars than were registered in that State at the beginning of the year.

War orders and their consequent profits are responsible for some part



Nine States which increased by more than 20,000 during the last 6 months



of the 17 per cent expansion of Connecticut registrations, and high prices for cotton and lumber contributed to Georgia's 30 per cent gain. Louisiana shows a gain of 25 per cent due to high sugar prices and the big cotton market. Arizona's copper mining industry played its part in giving that State an increase of 33 per cent.

Several of the States which formerly constituted the tail-end of the list have shown larger gains than others which formerly led them. Nevada, which was last on Jan. 1 has moved up three places, similarly Wyoming, which was second, has moved upward in the same degree as Nevada and several other similar alterations of position have taken place.

On a basis of ratio of cars and trucks to population Iowa's lead, with thirteen people for each motor vehicle, compares with sixteen people per car at the beginning of the year. California is still in second place in this respect, having increased its ratio from eighteen people per car to one car for every fifteen of its population. Nebraska continues third but it has now made a signal gain, showing only sixteen people for every motor vehicle as compared with twenty-one people per car on Jan. 1. Indiana is now fourth, having come up from ninth place by increasing its car-to-population ratio from twenty-nine to seventeen. Indiana has thus displaced South Dakota which was formerly fourth, but is now fifth, showing a decrease of five people to every car. Min-

Distribution of Car, Truck and Motor Manufacturers in the United States

States	Automobiles	Commercial Vehicles	Motors	Totals
California	3	14	..	16
Colorado	1	2	..	2
Connecticut	3	4	2	7
Delaware	1	..	..	1
District of Columbia	..	1	..	1
Georgia	..	2	..	2
Illinois	26	31	8	60
Indiana	32	16	6	47
Iowa	1	5	..	6
Kansas	2	2	..	3
Kentucky	3	3	..	5
Louisiana	1	..	..	1
Maryland	3	3	..	4
Massachusetts	7	13	2	20
Michigan	49	44	14	97
Minnesota	3	21	1	21
Missouri	8	14	..	20
New Jersey	2	6	1	8
New York	23	42	8	13
North Carolina	1	1	..	1
Ohio	34	40	8	72
Oregon	1	1	..	1
Pennsylvania	14	32	9	42
Rhode Island	..	1	1	2
South Carolina	1	..	..	1
Texas	1	2	..	2
Virginia	1	..	..	1
Washington	1	3	..	4
West Virginia	1	..	..	1
Wisconsin	7	9	9	23
Canada	19	11	1	26
Nebraska	1	2	1	2
Maine	..	1	..	1
Total	249	326	70	513

Dealers, Garages, Supply, Repair and Charging Stations in the United States

	Dealers	Garages	Repair Shops	Supply Houses	Charge Sta.	Totals
Alabama	142	91	50	28	18	225
Arizona	77	67	40	8	10	123
Arkansas	112	74	51	11	14	175
California	973	1,127	639	102	130	1,828
Colorado	295	291	143	14	31	455
Connecticut	311	348	158	49	35	581
Delaware	56	60	21	5	5	84
Dist. of Columbia	53	46	27	19	7	122
Florida	216	232	108	27	29	386
Georgia	254	235	102	34	26	452
Idaho	118	87	40	16	18	172
Illinois	1,659	1,479	820	93	231	2,492
Indiana	857	740	346	46	94	1,357
Iowa	1,448	1,201	575	46	148	1,830
Kansas	884	674	306	25	69	1,223
Kentucky	220	169	64	13	23	292
Louisiana	88	63	30	10	24	133
Maine	236	236	102	16	23	393
Maryland	189	211	99	24	22	339
Massachusetts	670	770	395	89	101	1,249
Michigan	813	688	285	69	77	1,263
Minnesota	1,052	732	394	45	71	1,374
Mississippi	107	69	37	10	12	156
Missouri	717	566	342	62	70	1,170
Montana	195	166	86	10	19	275
Nebraska	799	161	215	22	55	917
Nevada	44	41	20	2	4	69
New Hampshire	150	186	96	5	21	265
New Mexico	76	67	36	4	7	128
New Jersey	525	763	364	49	62	1,079
New York	1,637	1,985	998	296	170	3,233
North Carolina	243	290	85	14	12	333
North Dakota	455	301	158	7	19	610
Ohio	1,450	1,174	574	111	157	2,183
Oklahoma	315	267	84	21	18	479
Oregon	171	204	89	21	15	304
Pennsylvania	1,447	1,158	666	169	172	2,377
Rhode Island	77	128	82	14	8	238
South Carolina	125	107	43	14	9	203
South Dakota	336	254	124	8	22	508
Tennessee	164	117	60	27	21	250
Texas	586	457	234	51	66	974
Utah	67	49	24	11	10	112
Vermont	156	138	67	7	8	239
Virginia	203	147	94	27	21	214
Washington	296	258	140	34	33	475
West Virginia	161	109	45	12	19	211
Wisconsin	876	703	360	34	94	1,172
Wyoming	55	49	36	5	8	74
Hawaii	6	8	2	4	4	12
West Indies	25	22	5	..	6	30
Canada	728	637	278	74	82	1,045
Mexico	8	12	2	..	2	15
Total	22,923	20,882	10,621	1,913	2,427	35,898

nesota has passed Kansas, having nineteen people per car as compared with twenty-five on Jan. 1, Kansas being now in seventh place in this respect with twenty people per car as against twenty-four at the beginning of the year. All the rest of the States have over twenty people per car, beginning with North Dakota which has twenty-two and ending with Arkansas which has 144. It will be noted that practically all the States at the bottom of the table comparing population and cars, are in the South, and the large number of people per car in these States is due to the large impecunious negro element in their population.

The statistics in the tabulation appearing on page 263 are all furnished by the registration officials of the various States, with the exception of Texas where such figures are not available because of local registration. In this case several estimates were furnished by various interests in the State and that of the Dallas Automobile Club was accepted as it agreed with several of the others and because it was the most conservative. It is very probable, however, that there were 110,000 cars and trucks in use in the Lone Star State on July 1, instead of the 105,000 with which it is credited. In the District of Columbia a large non-resident element had to be deducted, as will be seen by reference to this table, and comparison with the statistics in the tabulation on page 262. Since registrations in the District are perennial it is possible that the total number of cars and trucks actually in use by the 361,330 residents is somewhat in excess of the 5268 given. Other points worthy of mention are the apparent decreases in Maryland and Tennessee. These States have new laws in effect and registration under these new laws has not been completed. Colorado and Oklahoma are other States with new laws but these have been in effect long enough to enable the bulk of the registrations to be completed and an accurate line to be drawn on the number of cars.

It is worth mentioning that the fees received by the various States for the registration of automobiles and motor trucks for the first 6 months of the year totaled $14,261,112.72, this including the revenue from only thirty of the forty-eight States and of the District of Columbia. It is certain that if information were available as to the fees taken in by the other States the total would be well over $15,000,000.

The number of automobile factories and their distribution by States may be seen in the tabulation on page 265. On the same page appears a complete table of statistics showing the distribution of dealers, garages, repair shops, supply houses and charging stations in each State up to July 1. Both these tables have been compiled by the Automobile Trade Directory.

Rhode Island Registrations Analyzed by Makes

OF the 19,427 automobiles and motor trucks registered in Rhode Island up to July 1, there were 15,402 gasoline passenger cars bearing the names of American manufacturers, 226 machines of the same class which represent European factories, and 193 electric passenger cars. A total of 3576 commercial vehicles were registered of which 3522 were gasoline machines and fifty-four were electrics. The large number of European cars in use in Rhode Island is due to the large summer population of New York and Philadelphia people at such summer resorts as Newport, Westerly and Narragansett Pier. During the first 6 months of 1916 there was an increase of 3065 automobiles and trucks as compared with the registration on Jan. 1, 1916. This is at the rate of 19 per cent which is about the normal increase in States not affected by such unusual prosperity as resulted from war orders, bumper crops at high prices, or booms such as that in the oil industry. It is a continuation of the rate of increase of the past few years.

Passenger Cars

Ford	4,701
Cadillac	1,162
Overland	1,134
Buick	832
Studebaker	526
Packard	474
Reo	467
Chalmers	418
Maxwell	400
Hudson	344
Hupmobile	309
Dodge	267
Pierce-Arrow	262
Oldsmobile	222
Metz	188
Franklin	179
Saxon	167
Paige	146
Stevens-Duryea	139
Pope-Hartford	127
Mitchell	122
Chevrolet	115
Regal	106
Marion	101
Peerless	94
Locomobile	94
Scripps-Booth	85
Cole	80
Jeffery	77
Dayton	76
Winton	72
Rambler	71
Oakland	65
Stearns	65
Autocar	60
Premier	59
Chandler	54
Stutz	51
Jackson	50
Velie	48
Knox	45
Auburn	39
Haynes	38
Simplex	38
Mercer	37
White	35
Kissel	35
King	32
R. C. H.	32
Lozier	31
National	31

Passenger Cars

Thomas	30
E. M. F.	30
Allen	28
American	26
Lenox	26
Special	25
Crow-Elkhart	24
Marmon	24
Selden	24
Carnation	23
Everitt	23
Imperial	23
Krit	23
Warren	22
Corbin	21
Columbia	20
S. G. V.	20
Case	19
Empire	18
Speedwell	18
Briscoe	17
Herresnoff	17
Davis	16
Grant	16
Apperson	15
Pullman	15
Cartercar	14
Partin-Palmer	14
Abbott	13
Interstate	13
Lancia	12
Westcott	12
Willys-Knight	12
Michigan	11
Palmer-Singer	11
Little	10
Pilot	10
Crawford	9
Detroiter	9
Elmore	9
Herff-Brooks	9
Lexington	9
Moon	8
Royal	7
Sears	7
Sampson	7
Courier	6
Cutting	6
Dort	6
Trumbull	6

Passenger Cars

Bailey	5
Bergdoll	5
Brush	5
Bush	5
Bell	5
Lewis	5
Owen	5
Pathfinder	5
Lambert	4
Mora	4
Nyberg	4
Orson	4
Alpena	3
Enger	3
Grout	3
Healy	3
Keeton	3
Marathon	3
Pennsylvania	3
Brown	2
Chadwick	2
Driggs	2
Hollier	2
Kline	2
Lyons-Knight	2
Matheson	2
Moline-Knight	2
Monarch	2
Paterson	2
Rainier	2
Stewart	2
Thor	2
Vaughan	2
Vera	2
Vulcan	2
Argo	1
Amplex	1
Cameron	1
Cleveland	1
Croxton	1
Glide	1
Great Western	1
Holsman	1
Lion	1
L. P. C.	1
Meteor	1
Monroe	1
Marquette	1
Middlebv	1
MacFarlan	1

Passenger Cars

Northern	1
Parry	1
Miscellaneous	71
Total	15,402

Foreign Cars

Renault	74
Fiat	72
Mercedes	33
Delaunay-Belleville	25
Rolls-Royce	23
Daimler	7
Panhard	7
Clement	4
Leon-Bollée	4
Berliet	2
DeDion	2
Metallurgique	2
Mors	2
Vauxhall	2
Benz	1
Bugatti	1
Isotta	1
Minerva	1
Napier	1
Hotchkiss	1
Sunbeam	1
Total	266

Gasoline Commercial

Ford	996
Packard	422
Autocar	364
Pierce-Arrow	355
Reo	243
Vim	197
Studebaker	160
Peerless	136
Jeffery	81
Cadillac	75
Republic	65
Alco	48
White	43
Federal	39
International	27
Sampson	18
Denby	17
Stevens	17

Gasoline Commercial

Chase	15
Kelly	13
Mais	12
Gramm	11
Selden	10
Koehler	9
Flint	9
G. M. C.	9
Indiana	8
Standard	6
Knox	5
Commerce	4
Crown	3
Decatur	2
Gaeth	2
Modern	2
Motor Wagon	2
Service	1
Signal	1
Sternberg	1
Veerac	1
Miscellaneous	112
Total	3,522

Electric Passenger

Baker	55
Waverly	40
Flanders	24
Detroit	19
Ohio	12
Anderson	12
Rauch & Lang	7
Standard	6
Babcock	4
G. V.	3
Woods	1
Miscellaneous	10
Total	193

Commercial Electric

Baker	14
Waverly	12
Detroit	10
G. V.	10
Miscellaneous	8
Total	54
Grand total	19,427

Securing Even Power in Cylinders

Pulsations in Intake Manifold Can Cause Variations in Mean Effective Pressure in Different Cylinders of the Same Engine—Tests Show Effect of Alteration in Order of Firing

By Robert Antony

THE recent development of engine design in America has been confined, to a great extent, to the increased production of power from cylinders of smaller dimensions than have been common practice in years past. Such developments have been accompanied by improvements in the quality of the materials used for reciprocating parts and a re-arrangement and re-design of moving parts generally, while certain other details appear in many cases to nave been either overlooked or regarded as of secondary importance. The trend toward multi-cylinder development and the adoption of a single carbureter for the supply of a large number of cylinders has, in a measure, eased some of the carburetion problems, when considered from the point of view of the carbureter as a single unit.

Induction Impulses Important

Even many men who are fully alive to the technical points in connection with the carburetion problem appear to overlook the fact that carburetion is seldom complete, nor in any event can it be considered so that the moment the working mixture leaves the main orifice of the carbureter. To give a single example, when the present writer suggested that induction pipe pulsations were a matter of considerable interest, the response he drew was to the effect that the general adoption of multi-cylinder engines had practically quashed all problems arising from vibrations of this nature, and that the matter therefore was not of great general interest. Such a statement is entirely erroneous, and if one considers for a moment any system of induction on any engine, whether of four, six, eight or twelve cylinders, it must be perfectly obvious that insofar as each individual cylinder is concerned, some interference must be felt by reason of the operations of other pistons, valves, and pipe arrangements in the complete unit.

From the earliest days one of the difficulties experienced, both by the maker and the user of a gasoline motor, has been that of producing an approximately equal power output from each of the cylinders in the engine. Perhaps this difficulty was more pronounced in the early days by reason of the very crude methods of effecting carburetion, by the meager mechanical action upon the fuel and by the lack of a streamline formation of the passages and ports in the induction system. All these things tended to aggravate an initial evil.

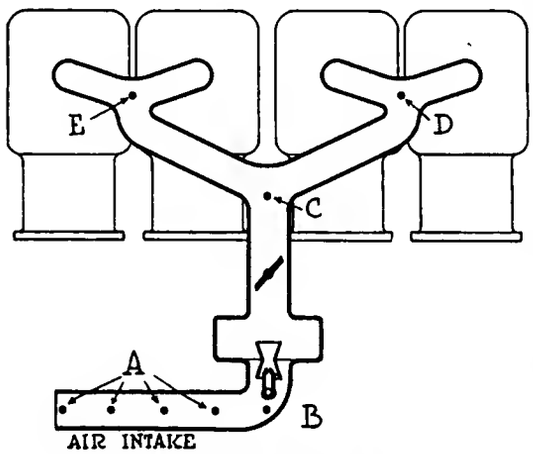


Fig. 1—Points at which readings were taken indicated diagramatically

Variations in Gas Pressure

In any system of pipe arrangement where numerous orifices are supplied from one central source, there must be variations in gas pressure at various points of the system. The endeavor of the designer has been to arrange an equal length of pipe from the carbureter orifice to the valve pockets of all the various cylinders comprising a single power unit. It must be remembered, however, that it is not only the length of the pipe which influences the fluid resistance it exerts, but also the contour and the departure from a straight or streamline form. The frictional resistance of a right angle bend to the flow of a liquid is approximately equal to that of 50 ft. of straight pipe, but in the case of air carrying a liquid in suspension we have the aggravated evil of turbulence setting up precipitation of the liquid in the containing receptacle.

If we had a power unit whose demand for fuel was continuous and uniform, such as, for example, an internal combustion turbine, this article would not have been written. On the contrary, our unit at the present time, although tending in that direction from the point of view of the main intake orifice, is very different when considered from various locations in the distributing system for the working fluid (the term working fluid is here used in the scientific sense and means the air mixed with its correct proportion of hydrocarbons).

In order that the reader may have a graphical idea of

Fig. 2—Variation at point C at one-eighth full power.

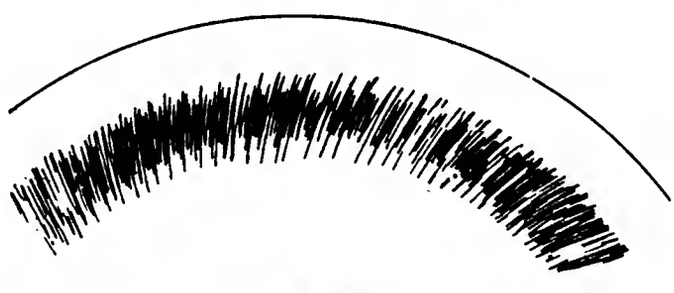


Fig. 3—Effect of increasing speed above that of Fig. 2

what is occurring in an induction system the diagrams here reproduced have been prepared and are direct copies of a few taken from a large series made directly by a suitable instrument connected to an induction system. With the engine in question, observations of pressure variation were made at the following points in the system:

A—At the carbureter inlet.

B—At various positions within the carbureter, between the inlet and the choke tube.

C—At the junction of branch pipe above the throttle.

D—At the junction of two pipes feeding two cylinders in succession.

E—At the junction of two similar pipes in another part of the system.

The accompanying diagrams are made by the pen traveling in a counter-clockwise direction across the paper; that is to say, the chart is moved in a clockwise direction, the pen itself being stationary in the instrument. Their purpose is, primarily, to show the relative pressures at the two positions indicated and also the relative intensities and contours of the graphical reproductions. By reason of the length of the connecting pipe between the engine and the instrument, there is a certain amount of damping of the magnitude of the oscillations as indicated, and this must be borne in mind.

The diagrams are made to a scale which reads from atmospheric pressure at one end to a vacuum of 30 in. of mercury at the other end, and in order that clear diagrams could be obtained, a slow speed engine of large linear dimensions was used.

It must not be concluded that these diagrams do not apply to other types of engines by reason of the difference in conditions, as the physical facts are the same whether the engine be large or small.

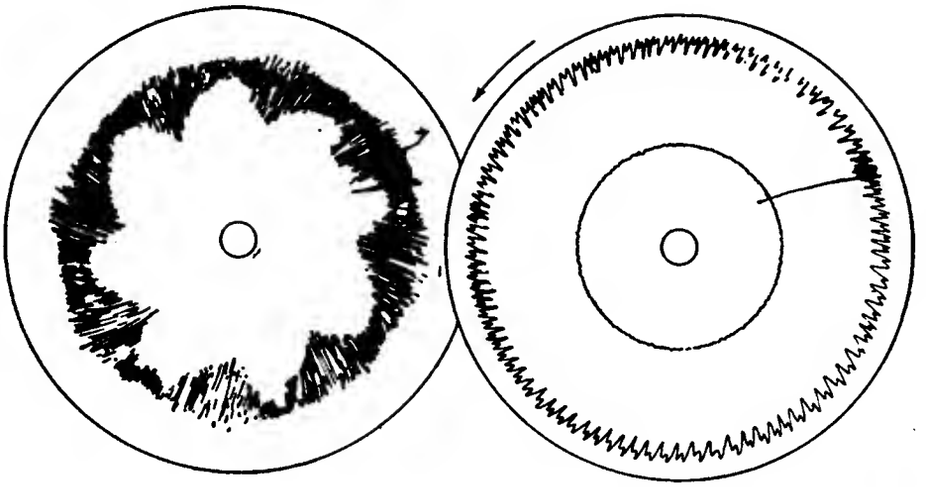
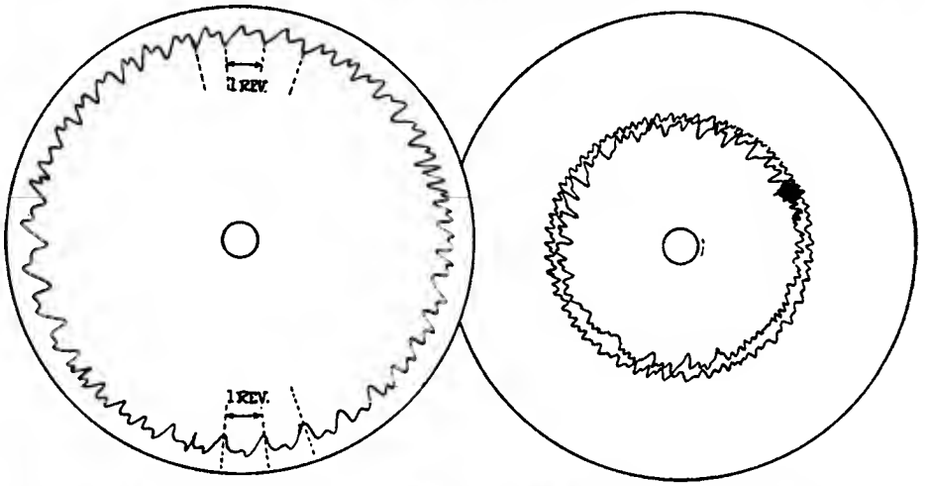


Fig. 4—Effect of fuel loading in the manifold. Fig. 5—Diagram resulting on adjusting carbureter to prevent loading



Left—Analysis of Fig. 5 to larger scale. Right—Fig. 6—Effect of inertia of air stream

Under Different Load Conditions

Fig. 2 shows the variation in pressure at point *C* when the engine was developing about one-eighth of its maximum rated power, and it shows that the negative pressure was from 15 to 21 in. of mercury. At 15 in. the engine throttle was evidently controlling the flow of the working fluid very uniformly, and as each valve opened in turn the pressure in the pipe dropped to approximately the same point. The diagram was taken for the duration of 1 minute, and there is practically no sign of accumulation of liquid fuel causing the engine to hunt.

We will now examine Fig. 3, which shows the state of affairs at point *C* when both the load and the speed had been increased, and we begin to find marked interference, as instead of the pressure returning to 15 in. at the end of each impulse the maximum pressure of minus 10 in. of mercury is only reached once in approximately four oscillations. The minimum pressure of 14½ in. is likewise touched, while in the intermediate stages the pulsations are confined within smaller limits.

Fig. 4 shows the effect of the fuel loading in the pipe, due principally to faulty carburetion. This diagram was taken over a period of 1 minute and the effect of hunting is clearly shown. In this case the maximum negative pressure is minus 2 in. of mercury and the minimum is minus 7 in. The hunting here occurs in regular sequence and is undoubtedly due to accumulations of liquid fuel forming in the pipe and being carried away periodically by the incoming air.

Effect of Adjustment

Under improved adjustment of the carbureter, Fig. 5 was taken, the horsepower output of the engine being approximately one-half its maximum, and in order to give clearness to the diagrams this and subsequent ones were taken over shorter periods, Fig. 5 being for a duration of a quarter of a minute. The inner diagram, showing a wavy line at a negative pressure of ¾ in. of mercury, shows the observation at the air intake, point *A*, of a Schebler carbureter. The outer diagram was taken at point *C* and each complete oscillation occurs during one cycle of the engine, and as four cylinders were fed in this period, the pressure at the junction of the manifold shows that at the moment of valve opening the pressure in the pipe is approximately minus 7½ in. of mercury in one instance, and minus 8¾ in. when the second valve opens in each revolution. It will also be noticed that the intensity of the suction varies slightly, even under such comparatively light loading. Under such conditions, however, the inertia of the air column is scarcely manifest as this comes into play at higher speeds. It may, here, be well to note that it is the effect of the inertia of the air column that has to be taken into account in the consideration or design of an induction system. The motive power of the air stream is the atmospheric pressure, and this being com-

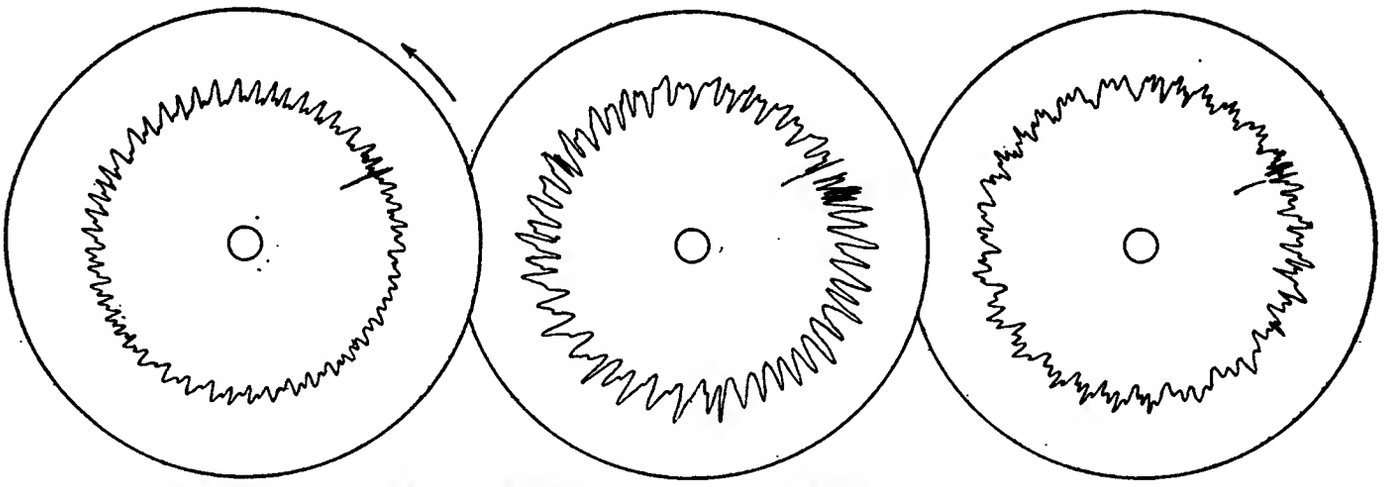


Fig. 7—Closer analysis of Fig. 6. Figs. 8 and 9 taken at points D and E show variations in similar positions in manifold

paratively low as considered in relation to other pressures in an automobile engine, the best advantage must be taken of it in order to obtain a uniform distribution. When the air stream is once put into motion it should be so timed and directed that its energy is expended usefully rather than as an interfering agent, as will be seen in subsequent diagrams.

Fig. 6 shows where the inertia of the air stream begins to take effect. The inner diagram is a record of the pulsations at the point *C*, being the junction of the branch pipe, the outer was taken at a point adjacent to the choke tube of the carbureter. We now begin to see how the pressures in the induction pipe at the times of opening of the various inlet valves vary, and we further notice the influence of sequences of valve closing upon the pressure waves in the pipe.

Periodicity Every Two Revolutions

There is a marked periodicity recurring every two revolutions of the crankshaft and a further smaller intermediate period after two valves have closed in sequence in one location of the induction system. The fact will be observed that the minimum pressure at the point *C* approximately corresponds with the maximum pressure at the point *A*. Fig. 6 is an observation during 6 sec.

When we proceed to analyze Fig. 6 in greater detail, we obtain Fig. 7, which is taken under practically the same conditions as Fig. 6, and which records the summation of the vibrations shown in Figs. 8 and 9, each of which occurs at opposite ends of the pipe at the points termed *D* and *E*. Now one would be led to expect that Figs. 8 and 9 would be similar, in view of the fact that they are taken from mechanically similar positions, the valves are timed and arranged alike, and the relative sequence of operations is the same. Yet, not only are the diagrams dissimilar from each other, but each one in itself is not of very uniform shape. Some allowance must be made for the fact that the charts were rotated by hand, which would cause some error in the lateral dimension of the graph, but the longitudinal dimension also varies from moment to moment. This may possibly be due to the inertia of the valves and their operating mechanism, but the figures are here shown to indicate how the action of the gas may vary. Later tests enabled more uniform graphs to be produced.

It must be noted that in these diagrams the throttle was held fully open and one is therefore able to arrive at some indication of the possible volumetric efficiency of the engine, as the negative pressure adjacent to the valve pockets varied from 1½ to 4 in. of mercury in Fig. 8, and 1½ to 3¾ in Fig. 9.

Fig. 10 is given to show the effect of opening the throttle

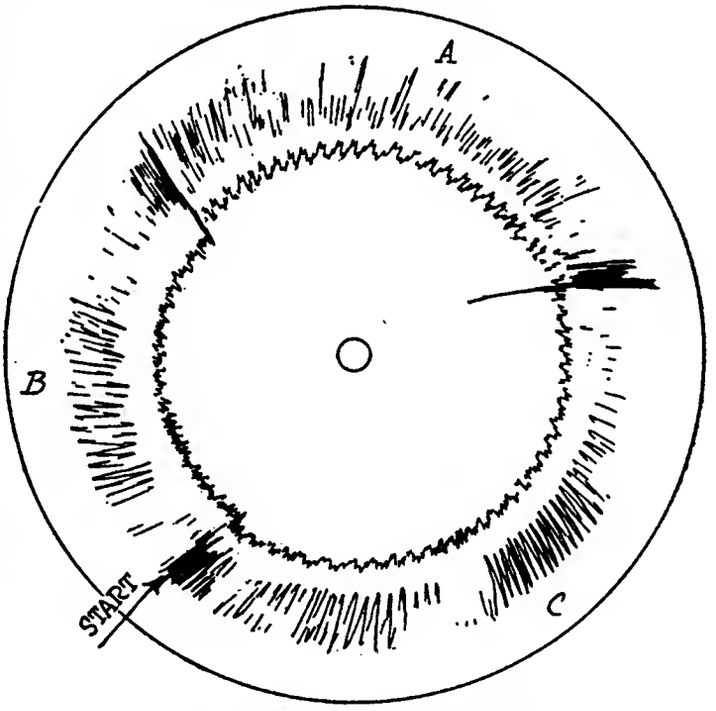


Fig. 10—Effect of opening throttle

under conditions corresponding to those obtained in ordinary road working. This graph taxed the powers of the instrument rather severely, so that its detail is not very clear. It will be noted that it is divided into three segments, *A* corresponding to point *C* on the pipe, and *B* and *C* to points *D* and *E* respectively. The graph was started with the engine running at half its normal speed and load, and the three observations made. The speed was then increased by opening the throttle, but the load was not increased to its maximum, but only to three-fourths of that amount. It will here be seen that at the junction of the induction pipe the negative pressure was an average of 5½ in. to 6 in. of mercury.

Fig. 11 shows a similar set of observations when the maximum load was carried, and in this instance the negative pressure at point *C* varied between 2 and 3 in. Attention must be called here to the interference which is shown in Section *B*, which is taken at point *C* on the manifold and which is indicated by the small loop at the point of maximum pressure when the engine is running at the lower speed. As the speed increases this loop becomes proportionately greater, showing the effect of the inertia increasing with the gas speed.

At this stage another engine was taken, with the sequence of firing reversed as compared with the previous engine; that is to say, that the two valves in any one pocket operated in the reverse order, and the comparison shown between the previous graphs and those of Fig. 12 and the immediate subsequent ones gives the following results:

Pressure Drops on Aspiration

Considering Section *A* taken at point *D*, we notice that in the new arrangement the point of minimum pressure was reached after the second aspiration as contrasted to the third in the previous engine. It will also be seen that the first aspiration reduces the pressure to half the total amplitude, whereas in the previous engine the first aspiration only gave a drop of insignificant proportions. In this engine we find that after the second aspiration there is a rise of pressure of 1 in. of mercury, whereas in engine No. 1 the rise in pressure after the second aspiration is of the order of a quarter of an inch. Engine No. 2 lowers the pressure at the third valve opening an amount of about half an inch of mercury, whereas Engine No. 1 lowers the pressure nearly an inch at the same time. Considering now point *E* shown under Sec. *C* we find that in the new engine the maximum drop of pressure occurs after No. 1 valve has opened; that is, reckoning from the point of maximum pressure in the pipe and from this time each valve opening in turn reduces the pressure an imperceptible amount, that is to say, that after No. 2 valve has opened the pressure is not so low as it was after No. 1 valve had functioned. From this time onward the pressure at the point of observation gradually rises. This shows that after the two valves situated in the location of point *E* have operated, the functioning of other valves in the system has practically no effect upon this part of the pipe so far as pulsations are concerned.

In the previous engine, however, a different state of affairs occurred, which is somewhat difficult to explain. It was discovered, for example, that after the first valve has opened the pressure drops to only half the full extent of its amplitude. The second valve opening increases this somewhat further, but not until the third valve in the system has opened do we find the minimum pressure at point *E*. The fourth valve scarcely affects the contour of the pressure curve.

Comparing again the diagrams Figs. 11 and 13, it is interesting to note that the small kick at the end of the swing of the pen occurs at the inner end or higher pressure point in Engine No. 1, whereas it occurs at the lower pressure point in Engine No. 2.

Referring again to Fig. 13, it is instructive to note that the reversal of the valve closing sequence has brought segments *A* and *C* more nearly alike than was previously the case, the amplitude of the pressure swing in either pocket varying from 1½ to 3 in. of mercury; at the junction of the pipe from 1 to 2 in., and at the carbureter inlet it is an average of 1 in. of mercury, the carbureter in this case being a Master.

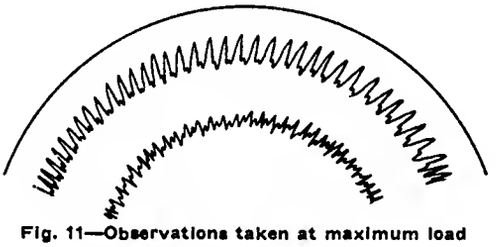


Fig. 11—Observations taken at maximum load

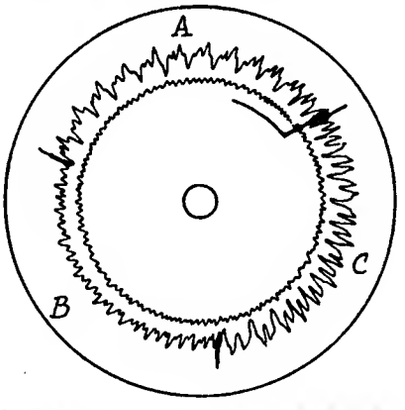


Fig. 12—Effect of reversing the sequence of firing

Pulsations Not Uniform

Figs. 14 and 15 show a similar series of observations upon a more open scale and with a Schebler carbureter in use. In this and subsequent observations, the recording instrument was brought nearer to the engine, thus eliminating some of the damping effect of the connecting pipe. The engine in this case was working under full load and the observed drop of pressure at the carbureter inlet is 2 in. of mercury. It will be noticed that the pulsations at the inlet are not at all uniform and this may be accounted for by the action of the extra air valve. The Master carbureter in Fig. 13 under practically the same engine conditions shows a drop of pressure of only 1 in. at the carbureter inlet and a much more uniform curve at that point. Section *B* in Fig. 14 again shows considerable lack of uniformity, much more so than when the Master carbureter was in operation, and this again may be due to the operation of the air valve.

Fig. 16 is instructive as showing the effect of replacing

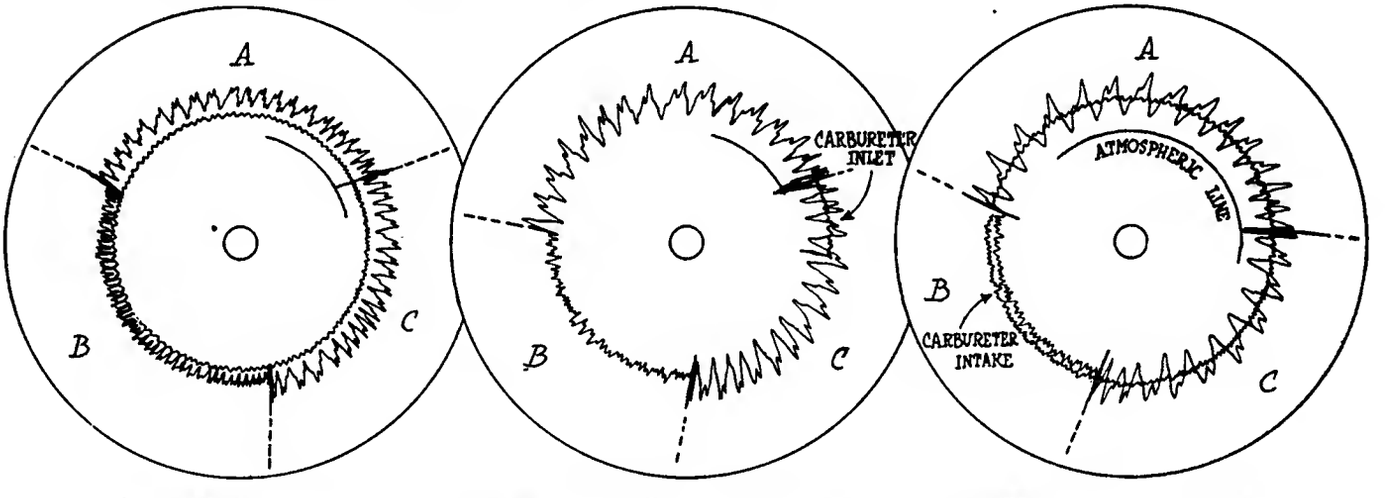


Fig. 13—Same as Fig. 11 but with reversed firing order. Figs. 14 and 15—Similar observations on more open scale

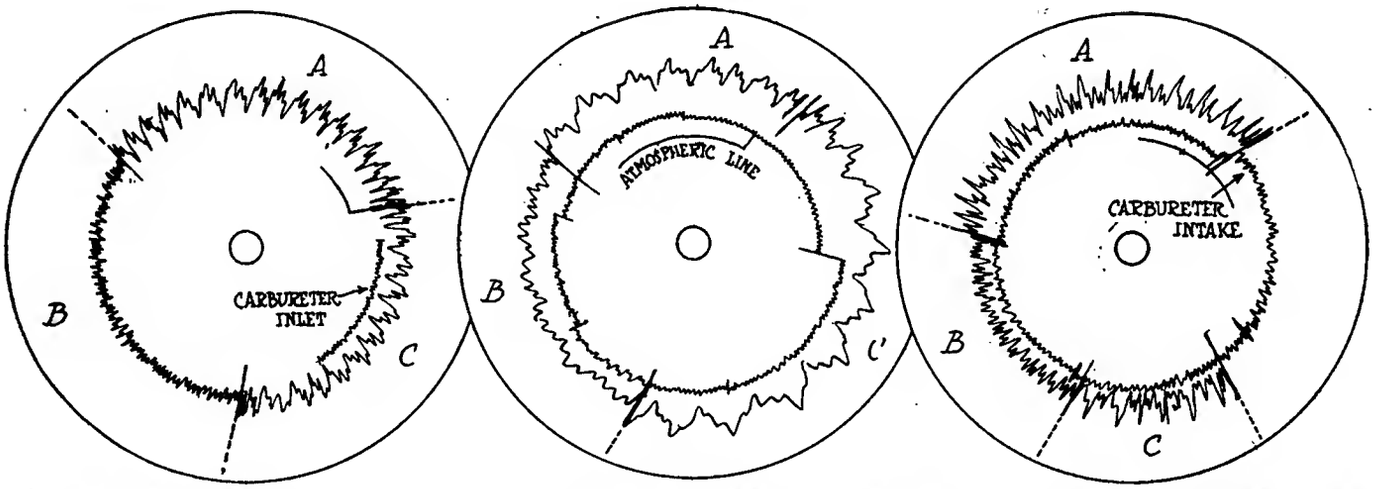


Fig. 16—Effect of returning to original firing order on second engine. Figs. 17 and 18—Showing increases of negative pressure

the camshaft with one similar to that used in engine No. 1, and we here find segment *C* reverting to a similar form to that obtained with Engine No. 1 in operation. This clearly shows the interference which takes place in the air stream by arranging valve closing points in a different manner, and it is very obvious that such arrangements must have a direct bearing upon the volumetric efficiency of any engine, irrespective of the number of cylinders operating. Further, the magnitude of the oscillations of pressure, which show up in the diagram differences of more than one inch of mercury in valve pockets of neighboring cylinders, must have a marked effect upon the uniformity of power production in those cylinders.

Uniform Air Acceleration

Let us finally study the air pressure throughout the system so far as possible in the apparatus. Theoretically, one of two things should occur: In a system relying upon mechanical action, the air should be uniformly accelerated through the carbureter and its velocity maintained at least constant up to its time of entering the engine. If heating is provided and a fuel of low volatility used, such an argument does not entirely hold good, as it may be advisable to provide some form of expansion chamber between the carbureter outlet and the valves.

We will take the former case, and Figs. 17 and 18 show how the negative pressure increases throughout such a system. The observation starts at the center of the diagram. The searching tube is moved from the carbureter inlet gradually toward its narrowest opening, and this observation completes one circuit. The outer circuit then makes observations along the induction pipe as before, segment *B* being the record at point *C*.

Conclusions From Tests

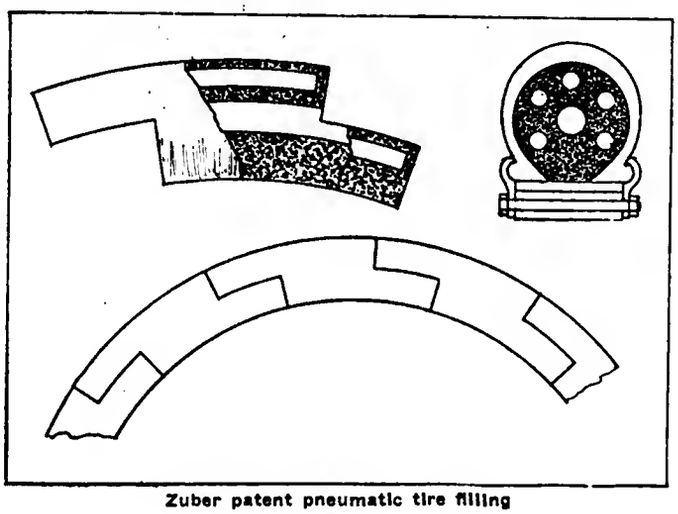
The conclusions to be drawn from the tests and diagrams which form the basis of this article may be summarized as follows:

The variations in absolute pressure during the time of opening of the various valves in any one power unit ordinarily are insufficiently comprehended. These variations are due to the arrangement of branch pipes leading to the valve pockets and also to the valve timing. The closure of any one inlet valve sets up a pressure wave in the induction pipe in the same way that a water hammer is set up in a water pipe, and the effect of this pressure wave depends upon the wave length and the velocity of the working fluid at the moment when its direction of flow is reversed. The interference thus set up in the induction system will be good or bad according to the ingenuity of the designer. In high speed engine work particularly, advantage can be taken of the inertia of the working fluid as it surges backward and forward in an induction pipe, and in an engine of advanced design it is quite possible; in fact the present writer has produced engines having a higher mean effective pressure at maximum engine speeds than at the lower and intermediate speeds. This is obviously an advantage, as it tends to minimize pre-ignition with a high compression motor, and gives the maximum of volumetric efficiency at such times as this is required. Incidentally, the act of charging each cylinder with a uniform weight of mixture at each charge is as important as the mechanical balancing of the engine, but this fact is too often overlooked. It is hoped that the graphical representations accompanying this article will serve to bring home the importance of induction passage design.

Overlapping Tire Filler Sections

MANY attempts have been made to devise a practical tire filler or cushioning body for casings and a number of patents have been issued covering various types. One of the most recent of these is the construction defined in patent No. 1,176,511 issued to Francis Zuber, Brooklyn, N. Y., March 21, 1916. Mr. Zuber's invention is clearly shown in detail by the accompanying illustration.

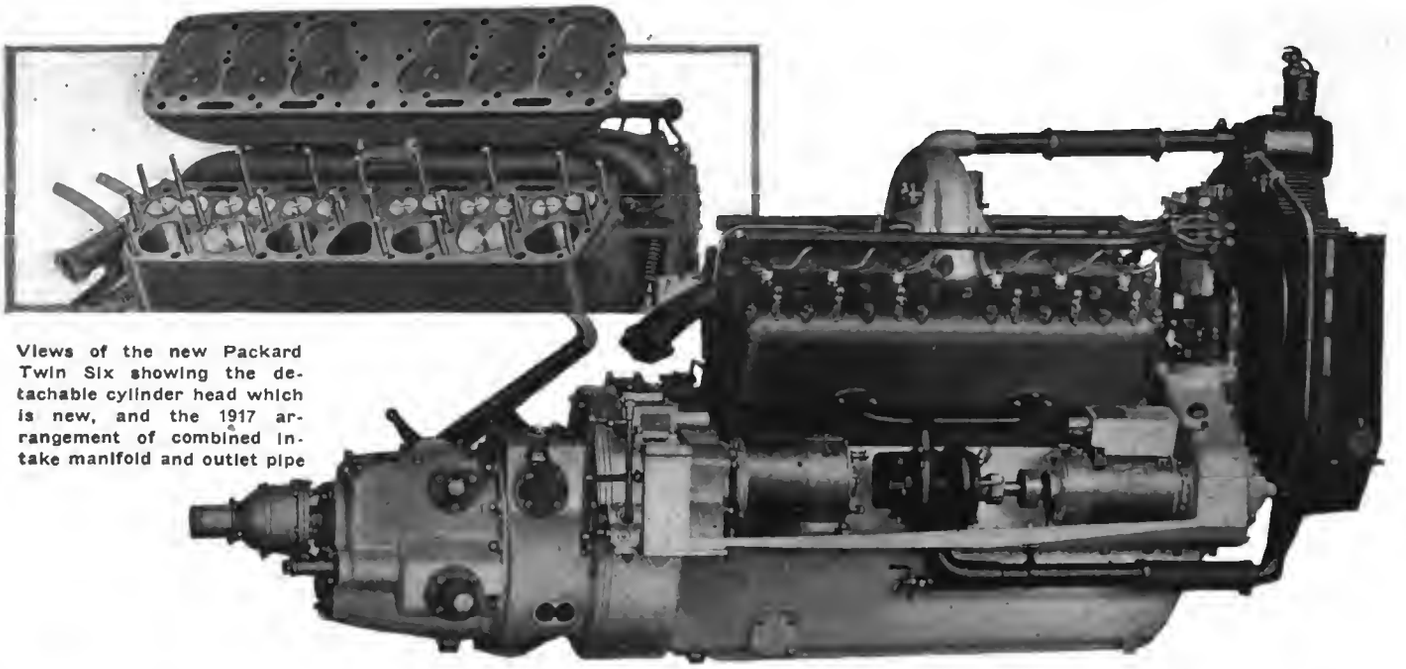
The lower diagram shows the shape and the method of joining the filler blocks, which are of soft, spongy, resilient rubber, the ends overlapping by an ample margin. The filler material is given additional resiliency by the use of air channels in each block, the number and arrangement of these being shown in the two upper diagrams. The air channels of each block have closed ends so that each one forms an air cushion. In practical use in the tire any individual blocks may be removed for repair or replacement.



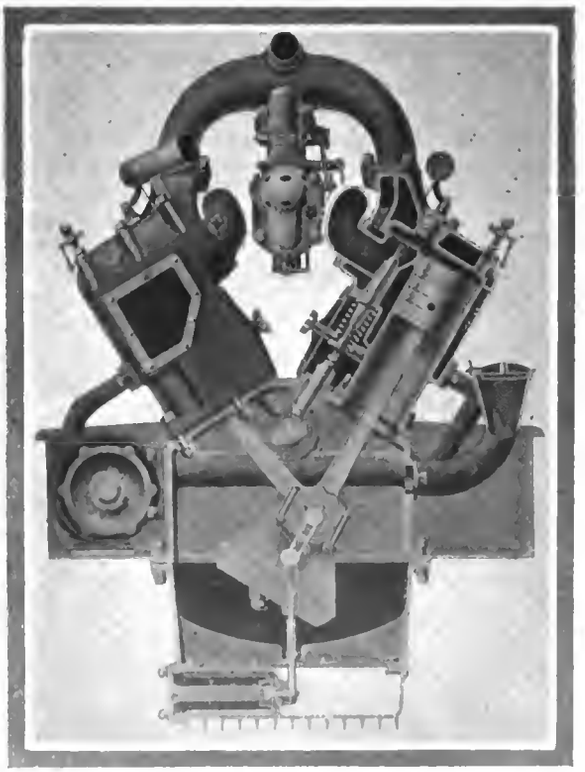
Zuber patent pneumatic tire filling

New Packard Is 2-In. Lower in Build

Detachable Cylinder Head is Only Change on Engine—New Water System Eliminates Pipes—Deeper Frame to Give Body Rigidity—Several Detail Refinements—Prices Raised Slightly



Views of the new Packard Twin Six showing the detachable cylinder head which is new, and the 1917 arrangement of combined intake manifold and outlet pipe



Apart from the detachable cylinder head the only new point in design shown in this view is the crankshaft, of which the webs are now triangular, the same as those used on the crank of the 300 cu. in. aviation engine

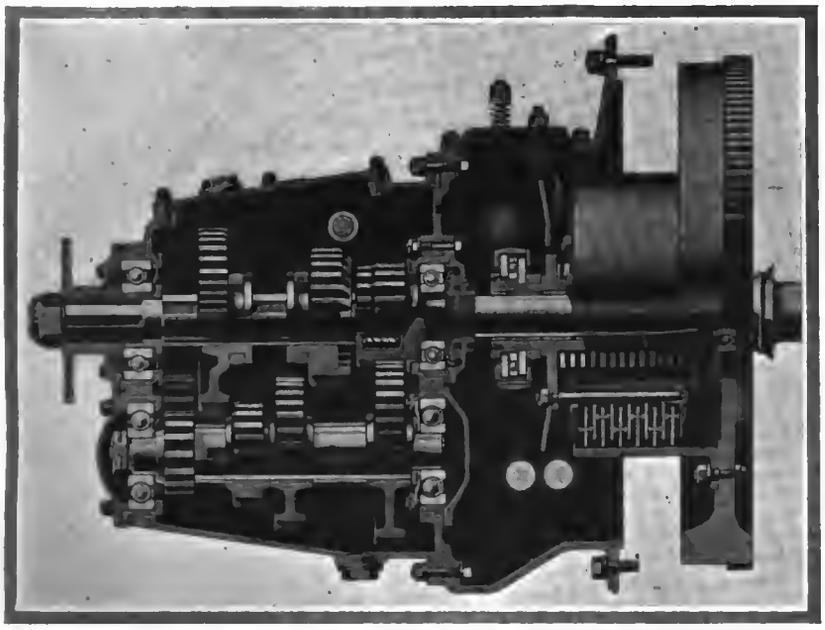
HAVING built close upon 8000 twin sixes the Packard Motor Car Co., Detroit, Mich., are making no changes of real importance for the 1917 series. In matters of detail there are improvements, but the twelve-cylinder engine, the transmission system and the chassis, generally speaking, are the same as before. The twin six Packard was entirely new a year ago, and a year's use has shown no weak spots, no detail that had to be changed.

Equal Size Combustion Spaces

As an example of the sort of changes that have been made, the alteration in the cylinder castings is the most striking. Formerly the Packard has had one piece L-head cylinders, and with these it is not commercially possible to machine every portion of the inside of the cylinder. There is advantage in having the compression exactly the same in all the cylinders, and to do this it is essential to machine everywhere, so the new car has detachable cylinder heads which do not alter the relative positions of any parts of the engine, merely permitting the full machining and, incidentally, making it easier to remove carbon deposit, as the cylinder heads are held on by twenty-five studs and nuts and can be taken off far more easily than could the cylinder blocks.

In conjunction with the detachable cylinder heads there has been a change in the water outlet system. There are now no separate water pipes running from the cylinder heads to the radiator; instead of these the intake manifold is surrounded by a larger pipe, which acts as the water outlet from the cylinders, and a single separate pipe then connects the top center of the manifold to the radiator. The layout makes greatly for accessibility and is excellent for carburetion. The proximity of the exhaust manifolds to the carbureter keep the latter well warmed, and the water surrounding the intake manifold maintains the temperature of the gas.

The position of the thermostat has been altered, instead of being beside the pump it is now mounted in the radiator inlet, that is at the top of the radiator where the outlet pipe from the cylinders attaches.



Gearset and clutch used on the 1917 Packard, which are precisely similar to those employed last year

Here it admits water to the radiator when warm and when cold, by-passes the water down a branch pipe to the inlet side of the pump. This change of position means that the thermostat now occupies the point in the cooling system which normally is at the highest temperature instead of being at the coolest point.

In other respects the engine is the same as before. The dimensions are 3 in. by 5 in., the power output about the same and the details of lubrication, etc., are precisely as on the 1916 car. The aluminum pistons have been changed to the extent that they now have the three rings located two at the top and one at the bottom, the latter acting as an oil scraper. There is also a small detail alteration to the Delco ignition distributer which causes a reduction in the current consumption, while the Bijur generator has been speeded up a little and has an increased output. As formerly, the distributer is situated at the extreme front end of the engine, just behind the fan, but the coils are now located upon the left front crankcase arm instead of being on the cylinders.

New Body Lines

The next change which is noticeable is that the frame has been lowered 2 in., this altering the appearance of the car in a remarkable way. Two inches does not sound a large amount, but it makes a very striking difference in looks. Packard has also abandoned the horizontal end piece on the rear mudguards, which has been a feature for very many years. The fenders now follow the curve of the wheel in a more conventional manner, and this has had the effect of smoothing out the rear end lines of the whole car, giving a much smoother general effect. The touring body is still typically Packard, however, having all the characteristics which give this distinctiveness.

There are two lengths of chassis, the larger is 135 in. wheelbase and the shorter 126½ in., this being an increase of 1½ in. over last year. There are nine bodies for the short chassis and twelve for the long, and all the prices are a little higher, the advance on open cars being $115. This increase is due to the rise in the price of materials the quality of which has not been changed. On the short chassis $2,865 is the price for the five-passenger, and seven-passenger touring cars, for the two-passenger runabout and for a new four-passenger runabout, while there is also a five-passenger salon phaeton at the same figure.

For the long chassis no runabouts are listed, but the price of $3,265 will buy a seven-passenger touring car, seven-passenger salon phaeton, five-passenger phaeton or five-passenger salon phaeton, the word "salon" signifying that the front seats are divided.

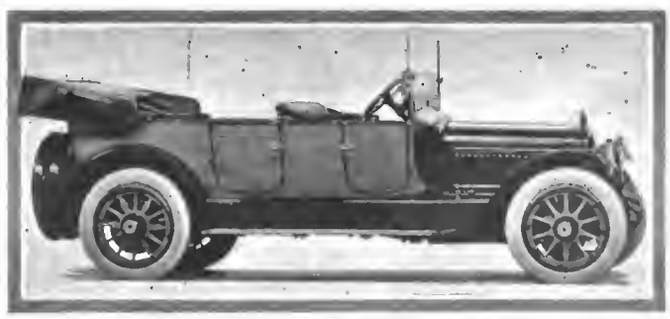
Closed cars on the short chassis are a three-passenger coupé $3,965, six-passenger limousine $4,265, six-passenger landaulet $4,315, and a four-passenger brougham $4,315 also. On the long chassis there are four styles of limousine, one for six passengers at $4,665 and three for seven passengers at $4,715, $4,765 and $4,915. There are also two seven-passenger landaulets at $4,765 and $4,815, a six-passenger landaulet at $4,715 and a four-passenger brougham at $4,715.

Recapitulating some of the details that were new a year ago, and are still retained, mention may be made of the unit power plant which was new to Packard at that time, and is unaltered in any way. The little Hyatt roller bearing in the gearshaft spigot has been entirely satisfactory and, owing to the smooth torque of the twelve cylinders, there has been no difficulty whatever in maintaining the quietness of the constant mesh gears. In describing the 1916 model it was said that the lubrication system, giving pressure-fed oil to every moving part in the motor was probably the most thorough ever used for an automobile. This has proved its worth, and the divided supply inside the crankshaft which gives practically an independent feed to each connecting-rod lower end bearing has worked out entirely in accordance with anticipations. The same is true of the Morse chain front end drive with the eccentric adjustable pinion on the generator shaft, and of the Lanchester vibration damper, which is used as the fan pulley on the crankshaft.

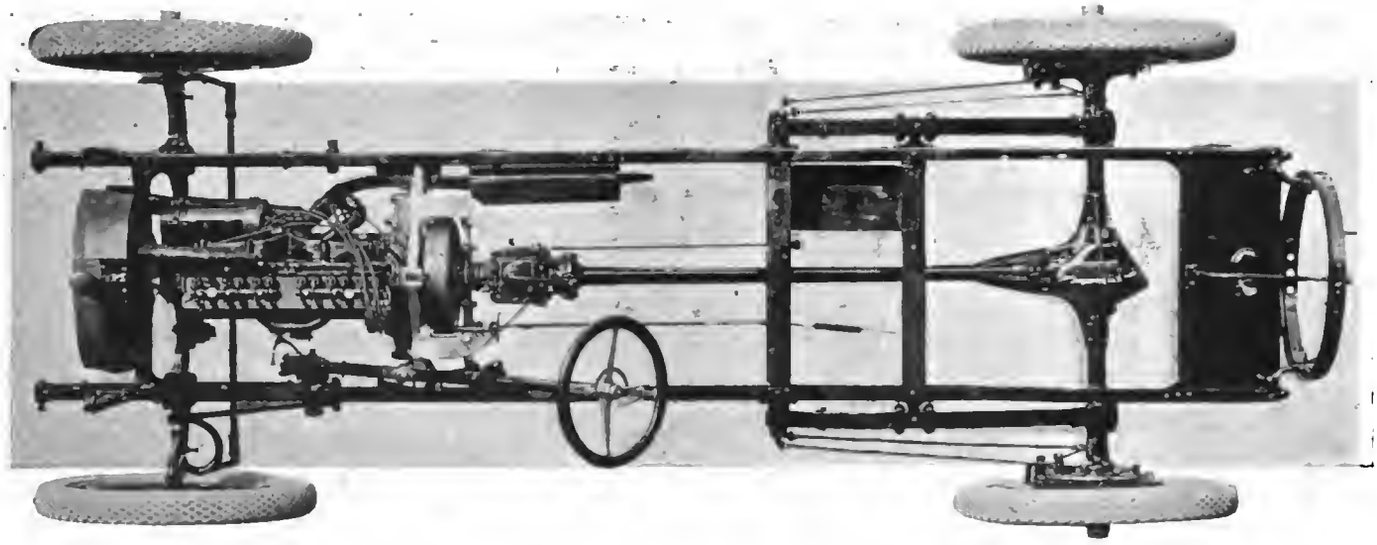
Axles, steering, brakes and springs are unchanged, the platform rear suspension suiting a heavy car particularly well.

Regarding equipment, all Packards will have Goodyear cord tires 35 by 5 in. on all four wheels, the fronts having rib treads and the rears the "all weather" tread; Kelly-Springfield or Goodrich fabric tires can be had instead if the customer so desires. The lamp variations are considerable, as there are side lamps as well as small head lamps combined with the large headlamps. The switch gear is all on the control box on the steering post and gives all the possible combinations of lighting at the touch of a finger.

The accessories include Sparton horn, Waltham speedometer and clock, a complete set of spare lamp bulbs, fuses and a battery syringe. Two extra demountable rims and a tire pump are included. The company wish to draw attention to the fact that they are prepared to vary the specifications of body and equipment when so desired at an extra charge.



1917 Packard touring car which is 2 in. lower than the previous models. Curved rear fenders are used instead of the straight end pattern which Packard has employed for many years



Plan view of chassis showing block six motor on new Hollier car. Detachable head contains valves

Hollier Line Now a Six and an Eight

New Six Sells for $100 Less than the Eight but Has Practically Identical Chassis

A SIX-CYLINDER car as well as the eight is now being manufactured by the Lewis Spring and Axle Co., Chelsea, Mich. It is priced $100 lower than the eight, selling for $1,085 and is a new car throughout. Some of the characteristics of the Hollier eight, however, will be found in the six also, particularly the spring suspension which is the identical 42-in. cantilever and all the chassis frame and structural work.

The six cylinders are cast in a single block with the valves in the detachable cylinder head. With the 3 by 4¼-in. cylinder dimensions a formula rating of 21.60 hp. is given at 1000 ft. per min. piston speed, but the makers claim a much greater output than this due to the high-speed characteristics of the engine and an advantageous shape of combustion chamber due to the use of large overhead valves.

Probably the most noticeable feature of the engine is the accessible arrangement of the valve action. This is entirely contained in the cylinder head, which is detachable, thus allowing the valves to be readily ground besides affording easy access to the pistons and cylinders. All the valves are actuated by a single camshaft by the use of a rocker arm motion. The drive of the camshaft is through helical gears working steel against iron, with the gears inclosed in the usual front case and running in a bath of oil.

Conventional Moving Parts

In the moving parts of the engine conventional practice is used. The pistons are three-ring and the connecting rods alloy steel I-beams. Three bearings support the crankshaft, which is also a special alloy of 1 9/16-in. diameter. The bearings are die-cast white metal, and before the shafts are mounted the running contact parts are ground to a mirror finish.

Oil is supplied by a splash system fed by gravity from a sight feed on the dash. The oil is pumped to the sight feed and at this point has sufficient head to give a positive feed to the splash troughs. The cylinders are oiled from the lubricant thrown off from the connecting rods.

Vacuum feed is used for the gasoline. This is from a 14-gal. tank on the rear of the frame, the tank being connected in the usual manner by a suction pipe which syphons the gasoline to the feed tank on the front of the dash. From here the flow is by gravity to the carbureter.

In the power transmission system there is a leather-faced cone clutch mounted on an aluminum casting. This has a nominal diameter 12 in. and a 2½-in. face. The gearset is in a unit with both the crankcase and clutch forming a unit power plant. It has three speeds forward with the main shaft made from a solid forging of chrome vanadium steel.

Two styles of bodies are furnished as standard. These are a five-passenger touring and four-passenger roadster. On both these bodies, which are designed to be capacious, genuine leather upholstery is used and they are filled with curled hair. The finish is in blue. Full equipment is included at the list price.

New Hollier Six touring car which sells for $1,085

Sawtelle Engine Has Two Fuel Grades

Volatile Fuel for Certain Ignition, Heavy Fuel for Combustion

THE patent rights of a very interesting low-grade-fuel engine invented by Charles A. Sawtelle, have been purchased by Vincent G. Apple of Dayton, Ohio, formerly of the Splitdorf-Apple concern.

Probably the most novel feature of this engine is the fact that it runs on two grades of fuel at the same time. The more volatile fuel is used as an aid to ignition and furnishes very little of the driving power while the heavy fuel is ignited by the explosion of the lighter grade and provides the energy. In working out the details of this design a marked amount of ingenuity has been employed to enable the engine to carry out the somewhat complicated phases of its cycle.

A large part of the mechanism may be comprehended from a study of the vertical section given in Fig. 1. The cylinders are in groups of two, as shown in the section. It will be noted that on each side of the main cylinder *A* there are two smaller cylinders *B* and *C*. These supplementary cylinders are arranged on each side of the main cylinder *A* with cylinder *B* taken care of by the high-grade volatile fuel and cylinder *C* the heavy fuel. It will also be noted that the piston *D* extends across the entire bore at the bottom, carrying two pistons in the cylinders *B* and *C* by means of the rods *E* and also the main driving pistons *F*, which are connected to the connecting-rods *G*.

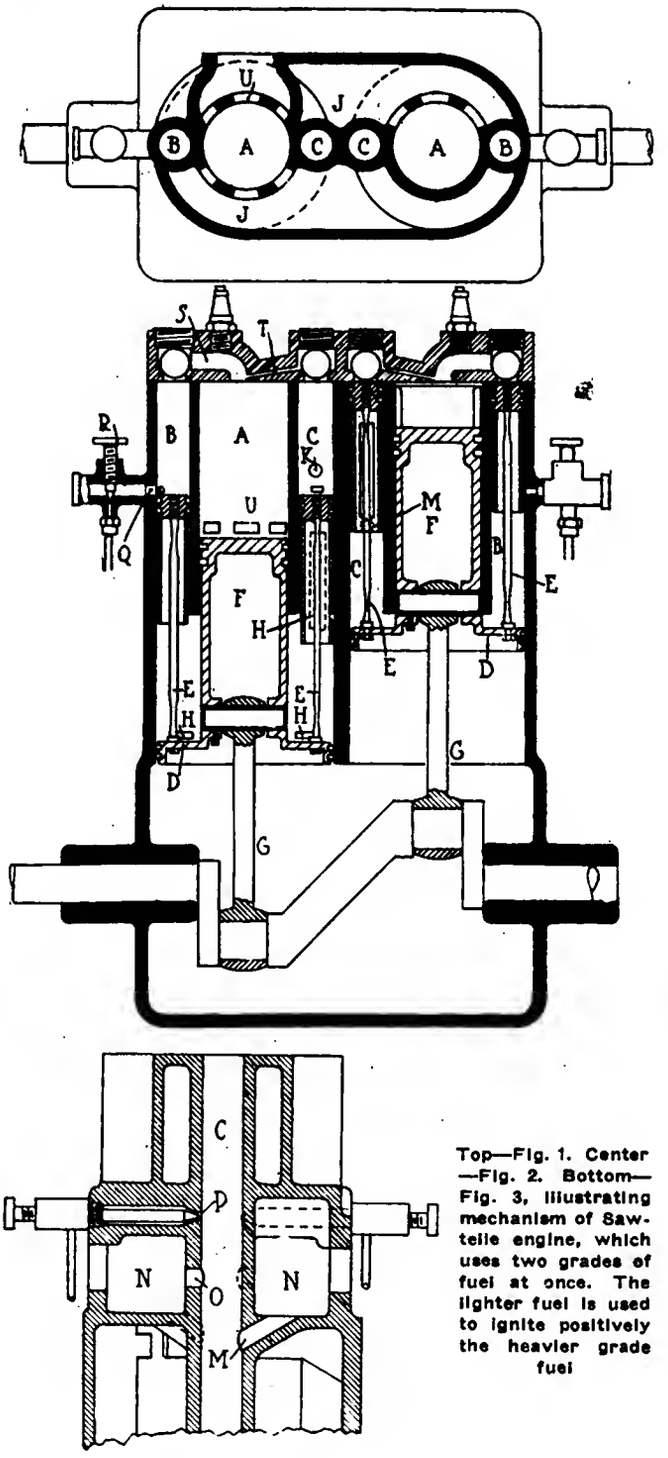
Air ports *H* are formed in the walls of the cylinder and are uncovered when the auxiliary pistons are at the bottoms of their strokes. When the piston *D* moves upward it compresses the air in a passageway *J*, shown in the horizontal section which is so arranged that the compressed air from one cylinder is fed to the adjacent cylinder and acts as a means for scavenging it.

Each of the cylinders *C* carries a piston similar to that in cylinder *B*, but the cylinders *C*, however, have ports *K*, which are uncovered by the pistons and which form admission passages for the heavy fuel. These pistons also differ from the others in that they have slots which are necessary, as will be shown to carry on the operation of admitting the heavy fuel mixed with a proper proportion of air. The mixing means for the heavy fuel and air is shown in Fig. 3. Each of the cylinders *C* has a port *M*, shown in Figs. 1 and 3, which opens into a passage leading to the chamber *N* located in a casting. This chamber extends all around the cylinder *C* and communicates with it again through the port *O*, as shown in Fig. 3, and by means of these ports and passages part of the air compressed by one piston *H* passes over through its slot *O*, the port *M* and the chamber *N* over into the cylinder *C* of the other set.

Piston Uncovers Ports

Studying Fig. 3, it will become apparent that as the piston *H* moves downward it first uncovers the port *P*, drawing in a charge of low grade fuel into the cylinder *C*, then, as it moves down, it uncovers the port *O*, admitting compressed air and thoroughly breaks up the charge of fuel. The cylinder *C* is thus filled with a mixed gas before the piston *H* again starts upward.

Returning to the cylinder *B*, this is in communication by means of port *Q* with the volatile fuel controlled by the needle valve *R*. As it uncovers the port *Q* on the down stroke it admits a charge of high grade fuel and compresses it in the cylinder *B* on the next upward stroke.



Top—Fig. 1. Center—Fig. 2. Bottom—Fig. 3, illustrating mechanism of Sawtelle engine, which uses two grades of fuel at once. The lighter fuel is used to ignite positively the heavier grade fuel

With the cycle thus far explained the main cylinder *A* has on one side the cylinder *B* charged with a supply of high grade fuel and on the other side cylinder *C* filled with low grade fuel under a slight compression due to the admission of compressed air through the port *O*. This gives the low grade fuel cylinder a slight lead on the high grade fuel. The passages *S* for high grade fuel and *T* for the heavy grade are so proportioned that cylinder *A* is filled with the heavy grade fuel, while the volatile product remains in the passage *S*, where the spark plug is located. The effect of a spark is to explode the high grade fuel in the passage *S*, which sends a jet of flame down into the cylinder *A*, thus readily igniting the heavy charge. At the bottom of the stroke the piston *F* uncovers the exhaust ports *U*, allowing the burnt gases to escape by the aid of the compressed-air scavenging arrangement.

Anderson Adds Five-Passenger Roadster

Application of Stewart Vacuum Feed Only Mechanical Change for 1917—Winter Tops for New Models

View of rear deck closed and opened for Anderson five-passenger roadster

ADDING a Stewart vacuum feed system is the only mechanical change that will be made by the Rock Hill Buggy Co., in their Anderson car. In the body line a five-passenger roadster has been added, and this design will be patented. Winter tops can now be furnished on the 1917 cars if desired. A new feature, which is of a merchandising nature, is that all Anderson cars can be painted to suit the purchaser without additional cost.

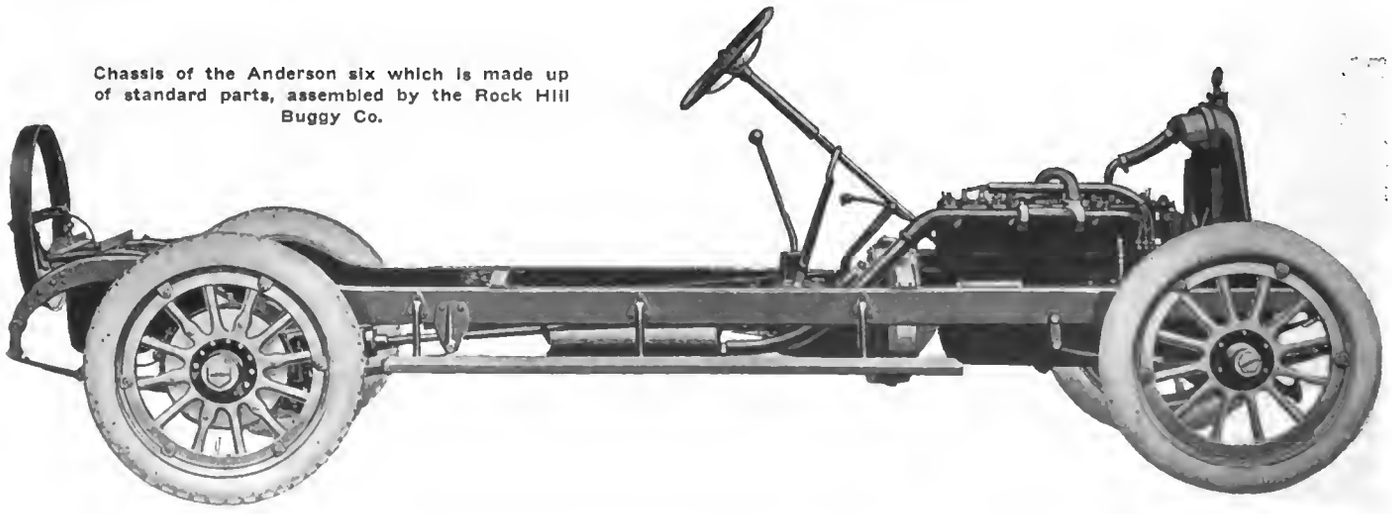
The new body, which is the feature of the announcement of the policy of the company for 1917, was designed to meet the needs of those who prefer the roadster type of body and yet need the passenger-carrying capacity of the touring car. This is different from the general multi-passenger roadster in that the under-deck seat is protected by the top and also has a capacity of three passengers.

When opened to its five-passenger form, the car greatly resembles a five-passenger close-coupled body with divided front seats. The only difference is that there is only one door, but since there is plenty of room between the front seats, it is quite easy to enter and leave the tonneau. When closed, the folding comes down behind the divided seats and makes a body which resembles to a great degree the ordinary two-passenger car with a rear deck.

A full description of the Anderson car was published in THE AUTOMOBILE for April 20, 1916, on page 722.

Standard units are used throughout the mechanical construction of the car. The motor is the Continental six-cylinder 3¼ by 4½-in. L-head type. The S. A. E. horsepower rating is 25.35 and the piston displacement 224 cu. in. The valves are on the right side and are operated through a helical gear drive. Cooling is by pump and oiling by splash pressure with the oil carried in the usual way in the lower part of the crankcase with pressure feed to the main bearings. The cylinders are taken care of by splash. The oil is circulated by a piston type pump.

For carburetion and ignition standard units are used, the Zenith instrument being used on both touring and roadster for carburetion and the entire car being Westinghouse as far as electrical equipment is concerned. The Westinghouse two-unit system is used, operating at 6 volts for starting, lighting and ignition. Ignition advance is automatic, and the system is thoroughly outfitted with ammeter, dimmer switch, etc. The storage battery has a capacity of 80 amp.hr., the electric horn is motor-driven, and armored cable is used in all the wiring. Other electrical instruments used on the car are the cigar lighter, searchlight and trouble light.



Chassis of the Anderson six which is made up of standard parts, assembled by the Rock Hill Buggy Co.

The power tire pump is mounted on the right side of the motor with a sliding gear engagement operated by a hand lever easily accessible on raising the hood. The drive for the tire pump is taken off the water pump shaft which also provides drive for the generator.

The clutch is a Borg & Beck dry disk type, 10 in. in diameter. It transmits the power through a three-speed selective gearbox to an Anderson-Mott floating axle. The front axle is also an Anderson-Mott of reversed Elliott type. The springs are semi-elliptic designed to be flat under normal load. They have phosphor bronze bushings for ⅝ in. bolts in the spring eyes. The front spring has 5-in. play, being 36 in. in length and 2 in. in width. The underslung rear spring has a maximum play of 8 in. and is 56 in. long and 2 in. wide.

The frame construction is simple, being composed of two main members which taper in straight lines from the rear of the car forward. There is a cross member just behind the radiator and another at the rear. Both of these are rigidly connected to the side members by gusset plates. The rear support of the unit power plant and the radiator supporting members also act as virtual cross members, giving the frame construction rigidity although having but few actual parts and consequently being clean and light. The front support of the motor is hung in the front cross member of the frame, giving a three-point suspension of the unit power plant.

Wheels are twelve-spoke types of selected hickory. Spokes are 1⅝ in. wide, and on the rear wheels are 14-in. brake drums. The brakes themselves are completely inclosed within the drums, being of the internal expanding type. The brake linkage is equalized through an equalizing bar which is placed some distance forward of the rear axle.

Hotchkiss Drive

Hotchkiss drive, in which both drive and torque are taken through the rear springs, is employed. This simple type of drive taken in connection with the chassis layout, gives a clean design which should tend to keep the car free of rattle. The speedometer drive is also rattle-proof, being strongly mounted just behind the gearset.

Besides the special equipment mentioned, the car has quick-demountable rims, one-man top, crowned fenders with complete splash guards, ventilating windshield, speedometer, hand pump, repair kit and a complete set of the usual tools.

Inaccessible Nuts

THE detachable cylinder heads now the conventional design in America have been causing a great deal of correspondence in the British automobile magazines this year. The advantages and disadvantages have been reviewed, and many owners of American cars have related their experiences. On the whole there is no question but that the verdict is distinctly in favor of the detachable head, because it makes the cleaning out of carbon so much easier, but there are a few criticisms which are worth noting.

One, perhaps the most common, is that when the cylinder head is detachable the cylinder block should also detach from the crankcase. This is because it is an advantage to clean out the carbon, which deposits behind the piston rings, now and then, while it also permits the condition of the bearings to be judged by feel without the more difficult job of dropping the bottom of the crankcase.

Another is that on some detachable cylinder heads the nuts are so placed that they can only be tightened with a special spanner, and if they are left a trifle loose water leaks into the cylinders. There is nothing but praise for the American gaskets, great surprise sometimes being expressed that these can be used so many times without renewal. Rather curiously, the engine most criticised on account of inaccessible holding down nuts was of British manufacture.

Another point which designers might more often bear in mind is the advantage of using as few sizes of nuts as possible. Really there is no need for more than four sizes on an engine and very little throughout the chassis except for just a few special places which seldom require touching.

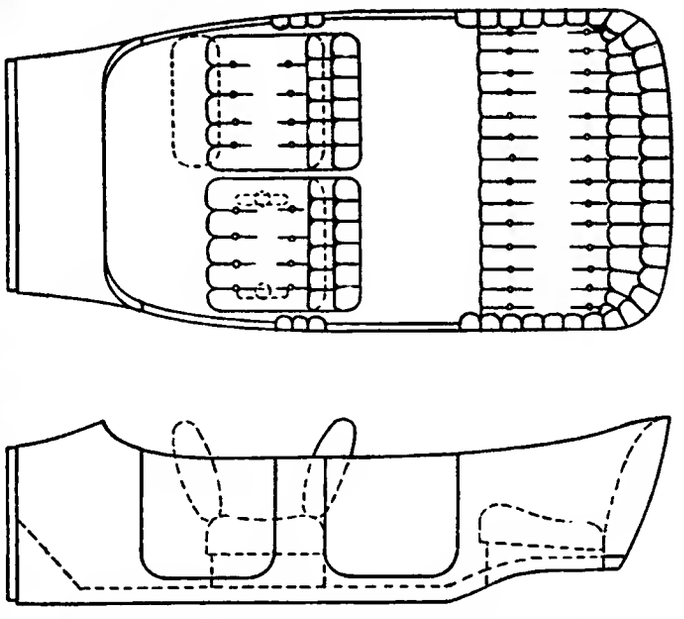
Body Design Permits Swinging Front Seat

Adjustable to Suit the Height of Any Driver—Right Front Seat Can Be Turned Entirely Around

THE accompanying illustration shows a body upon which the designer is applying for a patent. The feature of the body is the front seat which is divided and which is so arranged that the left seat can be adjusted for a driver of any height and can be moved backward and forward so that it will give the necessary leg room to reach the pedals.

The right seat can also be moved and if desired can be turned around so that its occupant can converse with comfort with the occupants of the rear seat. The idea of the body is two-fold. In the first place it is realized that the car cannot be designed to fit other than the average driver and since there are so many people in the world who are not average in stature it is necessary to provide some means for accommodating those who are exceptionally tall or short as the case may be. Thus any driver can take care of the car and operate it in greater comfort and efficiency.

The right front seat on the other hand is often a very bad place to sit because the driver is generally too absorbed to give much of his time to conversation and it is very difficult to talk over the shoulder to the occupants of the rear seat. If a chauffeur is employed the difficulties are greater as the owner of the car, as a matter of form, is compelled to sit in the front seat with the chauffeur while his three guests are back in the tonneau. The movable right seat overcomes this objection. The designer is W. N. Nakamura of Flint, Mich.



Body with adjustable driver's seat and swinging seat for front passenger

The Rostrum

Why Sixteen-Valve Fours Are Made

EDITOR THE AUTOMOBILE:—Regarding the sixteen-valve four, take a four-cylinder engine from 250 to 300 cu. in. displacement and designed to peak at say, 2400 r.p.m., at least not over 2500 r.p.m., would an eight-valve design like the new Wisconsin six-cylinder aluminum motor aviation engine be preferable to a sixteen-valve design?

2—Will an eight-valve motor up to 2500 r.p.m. give as good results as the sixteen-valve, provided one of the eight valves gives the same area of opening as two on the sixteen-valve design? Will not a sixteen-valve four work equally as well as an eight-valve motor at from 500 to 1500 r.p.m., provided the valve timing is proper for the lower speeds?

3—While I realize that the four-valve per cylinder is most appreciated in the higher speeds, the point I wish to determine is: if we have an engine to peak at 2400 to 2500 r.p.m. and still have it work well at from 400 to 1200 r.p.m., is it best to have four valves per cylinder or two valves of an area to give maximum results and equal to the four-valve design?

4—Is it possible to get a satisfactory running motor for a touring car and have it peak at a piston speed of 2500 ft. per minute?

Beemer, Neb. G. S.

—In considering the point that you bring up the actual number of valves should be forgotten. It is simply a question of area and volumetric efficiency. It is comparatively easy to secure quite good volumetric efficiency at low engine speed, but, when the motor reaches speeds of 2500 or more feet per minute piston speed, it is difficult to get the gases into and out of the cylinder in quick enough time and in sufficient quantity to give high engine efficiency. Naturally, the larger the area through which the gases are allowed to flow, the lower the required velocity of the gas and hence the greater volumetric efficiency.

It is impossible to secure what would be the most efficient area with one set of valves for the simple reason that such a large valve as would be required at the highest piston speeds would mean a large exposed disk of thin metal composing the valve head. This disk would soon warp and lose its perfect seat. To overcome this objection makers of high speed engines have been compelled to break the valve opening up into several openings and thus the required area is secured at the expense of extra parts necessary to operate the increased number of valves. This is the sole standpoint which should be borne in mind in questions of comparative merit between engines of different numbers of valves.

2—This is answered under question 1. For a large cylinder it may be necessary to have more valves at lower speeds than it would be for a small cylinder. It is simply a matter of cubic inches piston displacement per minute. If the cubic inches of gas passing through the valves is divided by the area of the valve openings the speed of the gases is given. Hence, the larger the valves, the lower the speed and the lower the speed the nearer the approach to 100 per cent volumetric efficiency.

3—If you could have two valves that would be ample to take care of the needs of the motor up to the speeds that you would require it to run, it would be unwise to use a greater number of valves on account of complicating the valve mechanism.

4—Yes.

Clutch Probably Out of Alignment Causes Plates To Wear Rapidly

Editor THE AUTOMOBILE:—I have a Crow-Elkhart car with a multiple disk clutch, steel against steel. There are twenty-three disks about ⅛ in. thick. I have had several sets of new disks, etc., and had the best garagemen in Burlington at work on it, but they cannot fix it so but that it will leak oil and the disks wear out in a very short time. Could a cone clutch be put in the car without too great an expense and, if so, could I get some clutch used by other cars that would fix it?

If you could advise me any way to get around the trouble it will help me greatly.

Burlington, Vt. J. M. R.

—Evidently the trouble is not so much with the clutch itself as that the alignment is incorrect. What causes this misalignment it is impossible to state without going over the car but it is very possible that it has been given some serious strain which has thrown the drive out of true. Before any clutch can work satisfactorily the parts have to be lined up correctly and therefore the garagemen should be instructed before repairing the worn parts in the clutch to line up the parts so that the shaft from the gearbox is perpendicular to the face of the flywheel and, furthermore, that the center of the shaft is in line with the center of the crankshaft.

Aluminum Pistons for 1912 Chalmers Would Not Give Material Gain

Editor THE AUTOMOBILE:—Desiring to have aluminum pistons fitted to my engine in a 1912 Chalmers 30 car, I would like to have some information before proceeding.

1—Is there any reason why this form of piston would not give satisfaction in an engine of this design? The car is to be used for general purposes.

2—What would be the increase in power? Should the connecting-rods be lightened? If so, in what manner and to what extent?

3—What should the clearance be? Would it be better to have semi-cast-iron pistons fitted to this type of motor? Are aluminum pistons giving entire satisfaction? I have been told that they were unsatisfactory; that they expanded so much under heat that they slapped when cold and were likely to seize when hot. Also that the constant hammering would ovalize the piston pin hole. Who makes Magnalium and is prepared to fit pistons of this metal to this engine?

4—In fitting pistons of this kind, would it be a proper and satisfactory combination to fit one patent ring on the top end of each piston and the remainder of rings to be standard form?

5—In case you do not advise the use of aluminum alloy pistons in this engine, what metal should be used which will

be lighter and give less vibration and more pick-up than regular cast iron?

6—As you know, the upper connecting-rod bearing in this model is a plain ground bearing, the piston pin being secured to the piston and free in the end of connecting-rod. Would it be better to have the pin stationary in the connecting-rod and have bushings in the pistons? If so, would it be satisfactory to alter the construction, by simply drilling a hole through the upper end of connecting-rod and putting a set-screw with extension for cotter pin, inside of the hollow piston pin?

Austin, Tex. H.

—It is greatly to be doubted if there would be any gain from aluminum pistons in this engine. In the first place it is not designed to be run at high enough speeds so that the effect of the aluminum would make any material difference. Secondly, all the other parts are designed for cast iron and hence any benefit in this direction would also be very small.

2—There will probably be a small percentage of power increase, that is, the maximum horsepower or the peak of the horsepower curve would be higher. If you lightened the rods it would probably be still higher. The rods should not be lightened to such an extent that there is too small a factor of safety, but if you lighten the piston naturally the inertia stresses are less and hence the rods can also be lighter.

3—The clearance used with aluminum alloys varies with the alloy employed. In general, the clearances are just about double those of cast iron. Regarding semi-cast-iron pistons you probably refer to semi-steel, so-called, and you would get just as much satisfaction from the regular cast iron. Aluminum is giving entire satisfaction in some cars but in other cars it has not worked out to the satisfaction of the engineering department. It seems to be a fact that a light slap must be put up with before the motor has become warm, but this disappears in a short time and cannot even be detected except by a highly practiced ear. Magnalium, the alloy to which you refer, is an imported alloy and probably cannot be secured in this country at the present time as it is a German metal.

4—This would have to be determined experimentally and would depend greatly on the precise shape of the piston.

5—If any metal will do the work it would be an aluminum alloy.

6—There does not seem to be any great difference between a bearing in which the pin is free in the rod or free in the piston boss.

Installing Ammeter on 1913 Cole

Editor THE AUTOMOBILE:—I have a 1913 model Cole 4-40 touring car that is equipped with a Delco lighting and starting and ignition system and desire to install an ammeter on same. Please give instructions for installing it and what should be the graduations of the ammeter.

2—I use a twelve-cell type SD-3 Exide battery and desire to charge the batteries without taking them off the car. Using a 6-volt direct-current circuit, could I not disconnect the wires from the generator and connect source to them and charge them that way?

3—Which are the generator terminals and at what amperage should the battery be charged? Please give diagrams of the above.

Senath, Mo. L. A. C.

—It is not practical to install an ammeter on this system, as it necessitates running two wires from the ammeter to the cutout relay. This distance being so great, too much resistance is interposed in the charging circuit.

2—The method recommended for charging the twelve-cell SD-3 exide battery is to connect the different groups of cells in series and then charge at a 3-amp. rate. The battery, however, could be charged in another way by disconnecting the wires from the generator terminals and connecting to the wires which were connected to terminals Nos. 3 and 4. With this method, however, 7 volts would be required and the charging rate should be approximately 12 amp. The former method is preferable and is more economical if the battery is charged from a 110-volt lighting circuit. The method is illustrated in the diagram herewith, Fig. 1.

3—This is answered under question 2. The wiring diagram is given in Fig. 2.

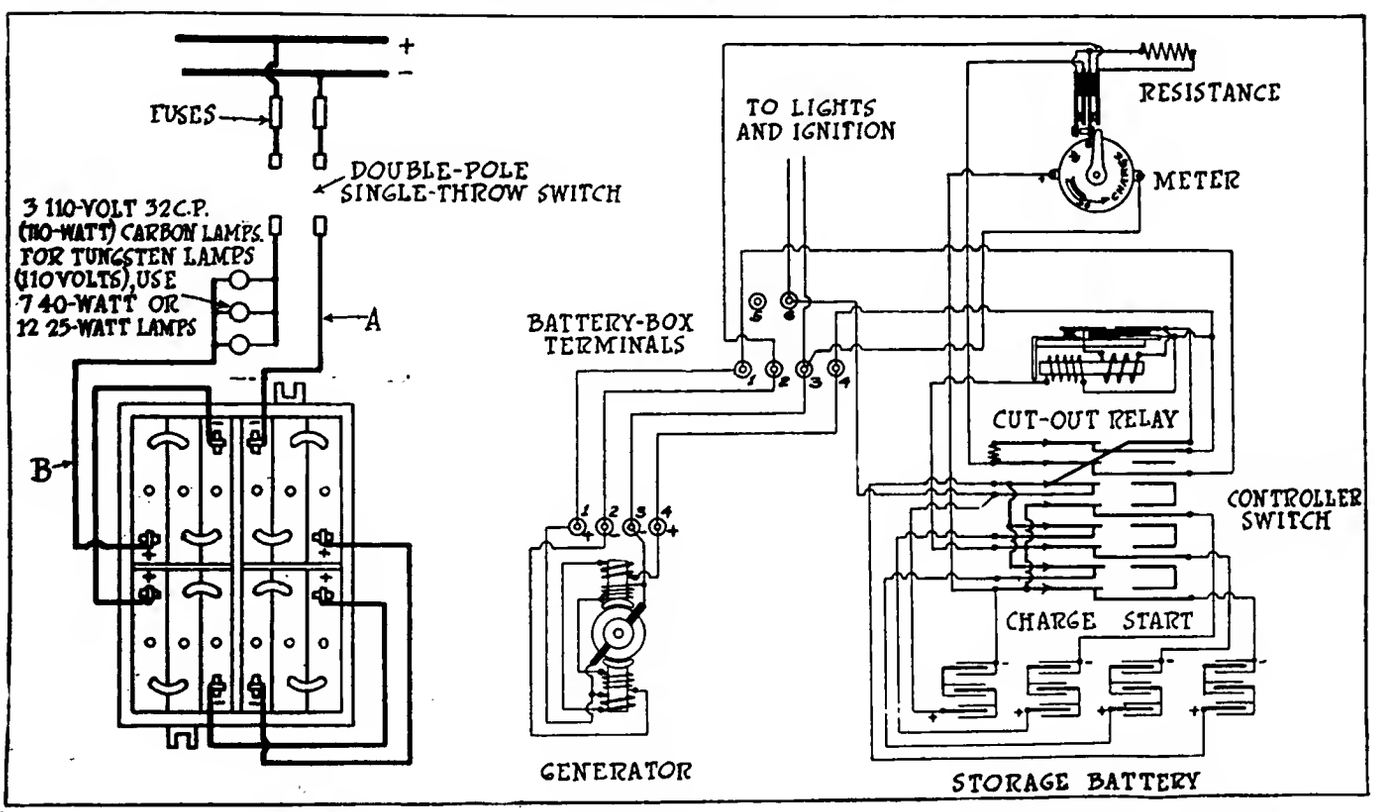


Fig. 1—Charging twelve-cell battery from 110 volt lighting circuit. Fig 2—Diagram of connections with cells in series

The History of the Pneumatic Tire—15

Operation of Device for Registering Tire Rebound—Fabrics Neglected for Years—Skidding Becomes a Factor—Various Corrugated and Other Treads To Prevent Side-Slip

The History of the American Automobile Industry—42

By David Beecroft

LAST week the Duryea machine for recording the number of bounces a tire would make when its wheel was dropped from a given height was mentioned very briefly. This device was simple in construction and was operated as follows: The wheel was placed on one end of a long axle, the other end of which was hinged to the wall so that the wheel could be lifted freely, the hinge simply guiding its fall. A prop supported the axle at the desired height, and pulling out the prop also moved a card across the path of a pencil attached to the axle. This arrangement secured a series of nearly vertical lines, separated, more or less, according to the speed with which the card was moved, and representing by their comparative heights the amount of rebound of the tire. By counting the number of rebounds and dividing 100 by this, the percentage of loss at each rebound was found. The height of the fall could be as desired by changing the length of the prop. The load was easily varied by weighting the axle. Cards were made by dropping on the flat surface, and also on obstacles, and differences of as much as 25 per cent were found between tires on the market at that time.

Fabrics a Minor Matter

With the decline of the interest in bicycles and their improvement and the coming of the motor vehicle, tire fabrics ceased to be considered. So long as the tire was thick enough to be reasonably free from puncture, the buyer was satisfied, and a little matter like fuel economy, lessened mileage, or overheated engine did not concern him. Water was plentiful and he did not go joy-riding to save fuel. It s interesting to note that tire makers and users are now beginning to study again this matter of better fabrics and more resiliency with increased mileage.

Side Slip a Factor

With the advent of the pneumatic tire with its broad, flat surface, and light load, as compared with the narrow, solid tire or even with the cushion tires, used shortly before, it was found that the bicycle would skid easily on slippery surfaces. This matter was of decided importance in a one-track machine, where each thrust on a pedal tended to slip the wheels from under, so naturally, protection against side slipping was early called to the attention of makers.

Some Corrugated Treads

This matter had not been wholly neglected by the solid tire makers. The wide, shallow Star tires already mentioned were in reality corrugated, having a high ridge in the center with shallower ridges on each side. Other makers had fitted their solid tires with grooves of V shape adapted to grip the road, but since these were solid tires, which were not largely adopted by automobile makers, we need not consider them further.

The Jeffery Tread

Jeffery seemed to catch the significance of this most early and brought out his corrugated tread advertised in January, 1894. This consisted of several parallel ridges or beads on the tread of the tire and extending lengthwise thereof. The assumption was that these would grip the ground much as the skate runner does and avoid slipping. It was quite common, in the early days, to make up these tire casings, without molds, and, while being vulcanized, to have them wrapped with muslin or even burlap, which wrapping served much as a mold. When removed, a more or less roughened surface remained, according to whether the fabric was coarse or fine. These roughnesses probably were of little value to prevent skidding, but as molds became commonly used these markings somewhat deepened were reproduced in them in various forms.

New Brunswick Braided Surface

The New Brunswick Tire Co., in January, 1897, advertised a braided surface; the Samson milled tread tire was advertised in April, 1897, while the Bailey studded tire, particularly for preventing skidding, is mentioned in September, 1897. In May, 1897, the Lovell-Diamond advertisement showed a cut having letters on the tire of the wheel, but their placing indicates that they were simply using a convenient space on the cut and not that they were actually on the tire.

The FORVM

SUMS UP DISCUSSION ON OTHER CYCLES ARTICLE AND ADVANCES THEORY OF TWO-CYCLE ENGINE — CORRECTION OF ERROR IN WHEEL ANALYSIS

A Two-Cycle Construction with Unusual Features

By James McIntosh

IF my comment on J. Edward Schipper's article in THE AUTOMOBILE for April 20, and my entry into print in THE AUTOMOBILE for May 18 has anything to do with the array of letters in the June 8 issue I do not know, as there is no direct challenge or reference made outside of a few ifs and ands and a few fears that possibly are more imaginary than real. My later letter appearing in The Forum for June 1 may set at rest the possibility that the four-cycle engine has all the virtue as a means of control, using a throttle with a homogeneous mixture to suit the initial compression for a given throttle opening and a carbureter that delivers a larger proportion of fuel for light loads and low speeds, resulting in low efficiency. This wastefulness is the direct result of the system of control used to suit a cycle that has outlived its usefulness for large powers as applied to large units for marine and stationary engines when weight and space in the former means much.

In each instance it does not appear to be due to the desire to get a simple engine nor is it the desire to eliminate valves in the head, although Sulzer, in his six-cylinder, 6000-hp. engine, has not found the defects and weak points due to heat flow or the lack of efficiency Finley Robertson Porter has experienced. Again, German submarines are not fitted with two-cycle engines simply because they are less efficient, for as to that we have reasons to believe they have been altogether too efficient.

A. L. Milbrath also has some beliefs as to future and attendant difficulty due to bearings leaking because of slight wear and resultant weak explosions in the cylinders and connecting a relatively higher compression and more difficulty to prevent leakage than with the lower pressure, as there is no connection with crankcase compression and cylinder compression nor is either a measure of the other.

F. E. Watts fears that the two-cycle is probably complicated; as an offset, Mr. Schipper states that a good four-cycle 20 per cent efficient at full throttle opening drops to 5 per cent with a one-third throttle. Further, Sulzer Brothers do not seem to worry about retained burnt gases and poor fuel economy, flexibility or control in an engine of 6000 hp. operating a lighting plant requiring close regulation directly connected and economy is not a secondary consideration for units of the size cited.

C. W. McKinley may forget about valve complications. Sulzer has overcome this inherent defect by the use of ports and uses a modification of the three-port system. As to the relative results *The Gas Engine* has this to say: "An analysis of a large number of engines using the actual developed horsepower as a basis and at normal speed shows that the piston displacement of the two-stroke engines is almost exactly 7 cu. ft. per minute per horsepower, while 11.6 cu. ft. is the average for the four-cycle engines, which is about 65 per cent larger than the two-stroke, with corresponding dimensions and speed." This analysis also showed that the piston displacement of the port-scavenging type of engine was no greater than that of the valve-scavenging type for the horsepower developed.

E. G. Gunn seems to fear complication more than he values efficiency. Complication, or lack of efficiency are not virtues nor is simplicity, when results may be had due to additions tending toward efficiency that does not in itself necessarily mean lack of virtue. E. Gruenwald considers an air pump necessary; that is not a defect surely. A four-cycle has valves, tappets, cams and gearing in addition to a piston and cylinder. What special objection can there be to eliminating some of these parts and using the piston as a valve and pump does not seem to me much like adding considerable complication and weight for an automobile engine. In my letter of June 1, I refer to a valve that seems to eliminate at least one other according to standard practice and three according to a racing engine, and I further remove the valve I do use to a place where heat will have no effect on it as it is not in the combustion chamber and controls air only. Also I use not only the air admitted but the mixture to internally cool the piston and pump interior, so that to add to the simplification of the proposition and eliminate or tend toward eliminating one inherent defect in all standard automobile engines, the piston is cooled. This feature may be one solution to Mr. Strickland's piston troubles for the lack of facilities to eliminate the limiting factor in all engines due to some highly heated spot.

Compression in any engine is limited by the heat of some surface, usually the piston head, and then it may be only evident at the center of that surface where the conductivity of the metal is not sufficient to eliminate the heat as fast as it is generated, and is usually evident on the inside in the shape of a red or charred spot the size of which is soon aggravated, due to preignition. Again, if an engine must deliver a number of impulses for a certain horsepower a four-cycle must run double the number of revolutions of a two-cycle or have twice the number of cylinders. As to the virtue of a cylinder delivering one impulse every revolution as against another resting every other stroke to cool off it seems like a joke and to add parts to accomplish this condition seems funny.

F. N. Nutt seems to have had a few unpleasant experiences sometime ago and believes that there is no possible chance for any two-cycle now because the gasoline is poor. There is no apparent real reason for such a fear. Mr. Knight did not succeed in the United States because of a fear that his design was too radical. The Chinese dread new things and as a result they stand still.

Summing up the situation, it is not through doubts and fears that progress is made. To get radical results things must be different. I have outlined a new means of control and it will take more than a few fears to refute the logic cited in my last letter appearing in The Forum for June 1.

In closing I might suggest I can handle a poorer grade of

gasoline due to the fact I can add more heat to make a gas and deliver it where it belongs and yet use pure, cool air and it never touches the mixture until it is trapped into the pumping chamber and piston interior where the cool air remains for light loads three-quarters of a revolution while the total mixture must pass the inner end of the piston, thus reducing its heated walls and head to a point where higher compression can be used than with an engine fitted with a piston where the same air may remain indefinitely, as there is no disturbing influence to change it, and the closer to the head the less it is effective as a cooling medium.

In referring to a cooling medium, it is, of course, assumed that I do not mean to force the jacket water fast enough to condense the energy of a power stroke simply to be able to handle high compressions, but I do believe that poor piston-cooling facilities are evident in every standard automobile engine. I not only cool the piston, but can improve the charge by adding heat to it first by precompression and second by added heat after the charge has been trapped. I will even venture to state that I can take in a larger volume, due to only a part of the charge being heated and that only sufficient to make and retain a mixture while the air is as cool as the atmosphere, and if drawn off, a sleeve encircling the intake pipe may be even cooler. In some carbureters the total air used to make a mixture is heated and the more it is heated the less it can be compressed and the less its volume or value in oxygen.

I believe I have stated a few facts sufficient for the present and can be more specific if occasion justifies further discussion. Of course, I am only stating things in a general way and hope critics will be specific as to comment and not treat the subject on past records but future possibilities.

Corrects Error in Analysis of Rolling Wheel Motion

By C. V.

REFERRING to the communication Analysis of the Rolling Motion of a Wheel appearing on page 192 of THE AUTOMOBILE for Aug. 3, the writer, after careful re-examination of said communication, wishes to call attention to some erroneous statements contained therein.

Being totally ignorant of analytic geometry—the realm in which the proposition belongs—I attempted to analyze *experimentally* the cycloidal curve in question. This curve is transcendental (not algebraic), therefore the equation of the ellipse is only roughly approximate.

Some of the conclusions are also erroneous. For instance, at the top of the second column, where the deduction is made that the maximum velocity of the point *A* is attained when approaching or leaving the ground: it is exactly the opposite, because, from a consideration of the composition of the linear, and the rotational velocity vectors it would seem that the maximum velocity is reached when the point is at the opposite end of a diameter leading to the point in contact with the ground.

Error in Wheel Motion Analysis

THE motion analysis of a rolling automobile wheel, by C. V. in THE AUTOMOBILE for Aug. 3 is certainly very interesting, but one conclusion reached seems to jar against the old theory that the top point of a wheel on a vehicle travels twice as fast through space as the axle, while the bottom point stands still at the instant of contact with the road.

The conclusion referred to is "*the point A* [on the circumference of the wheel] *will reach its maximum speed when approaching or leaving the ground.*"

I believe this conclusion to be erroneous, and I repeat the principal lines of C. V.'s diagram, with his lettering and some additional lines and letters of my own.

Now, while the center of the axle *O* is passing through the parallelogram *A E I G*, the point *A* on the wheel does not reach the intersection of the cycloid *A C B* with the perpendicular *G I*, but only reaches the intersection of the cycloid with the horizontal line *OO1* at *A1*. That is, the wheel will have made a quarter turn only and the original point *A* will have reached the point *A1*. In the second quarter turn the point reaches *A2;* in the third *A3*, and in the fourth, *B*. It will be seen that the point travels about two and one-half times as far while in the upper half of the circumference of the wheel as it does in the lower half. The conclusion mentioned, therefore, must be wrong.

J. W. WATSON.

Alcohol-Benzol Fuel

PARIS, July 30—According to reports reaching here via Switzerland, German army automobiles are being run on a mixture of benzol and alcohol. As soon as Germany found herself cut off from outside supplies of gasoline, a technical committee was appointed to find a substitute. Experiments were carried out with a 1914 Mercedes touring car equipped with an ordinary carbureter, when mixtures of alcohol and benzol were found to give satisfactory results. Summarized, the results obtained in these tests were as follows:

Nature of Fuel Employed		Speed Obtained, M.p.h.	Miles on 1 Liter of Fuel
Benzol	Alcohol		
1 part	1 part	42.2	4.66
1 part	2 parts	41	4.4
1 part	3 parts	39.1	4.3
1 part	4 parts	38.5	4.1
1 part	5 parts	36	3.7
Benzol only		41.6	3.79
Gasoline only		43.49	3.6

Calculating on the rates existing before the war, the benzol-alcohol mixture is the cheapest fuel obtainable. One liter of gasoline cost 9 cents, benzol 8.6 cents, and alcohol 8.2 cents. The cost per kilometer works out as follows:

	Cents		Cents
Gasoline	0.0157	Alcohol-benzol, 50%	0.0125
Benzol	0.01362	Pure alcohol	0.0167

This shows that a 50 per cent mixture of alcohol and benzol is the most economical, and it is this fuel which has been used throughout the German motor transport service. The only inconvenience experienced is the necessity of a preliminary heating of the carbureter. Starting the motor is a difficult task, and on several occasions when the army has been retreating automobiles have been abandoned on this account. This difficulty has been overcome by fitting a secondary tank containing a small quantity of gasoline or ether. A three-way cock allows the supplementary tank to be put into connection with the carbureter for starting purposes. As soon as the motor is warm the reserve fuel is shut off and the alcohol-benzol mixture supplied to the motor. In case of a breakdown near the enemy's lines, or the loss of the main fuel through a bullet or piece of shell entering the tank, the reserve supply is used. This is able to take the vehicle 10 or 12 miles, which is generally sufficient to remove it from the danger zone.

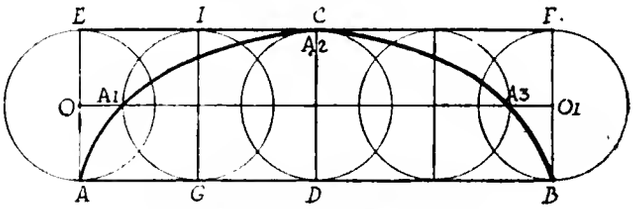


Diagram showing wheel motion

Carbonization of Oils Due to Oxidation

Bureau of Standards Paper Points Out That Polarization Consequent Upon Oxidation Is Main Cause—Cracking Gives Rise to Comparatively Little Carbon

AN interesting technologic paper has recently been issued by the Bureau of Standards of Washington, D. C. It was prepared by C. E. Waters, associate chemist of the Bureau, and deals with data on the oxidation of automobile cylinder oils. One of the points featured in the paper is that the so-called carbonization of automobile cylinder oils is due only a very limited extent, if at all, to cracking but is caused by oxidation and subsequent polarization. In order to learn whether there is any close connection between the rate of oxidation of different oils or an exposure to light and air and their carbonization values at elevated temperatures both before and after oxidation in the light, a series of tests has been made on three well-known automobile brands.

Oxidation in Sunlight

When an oil is oxidized in sunlight, water and carbon dioxide are given off, the oil becomes highly acid and an insoluble oxidation product is thrown down, sometimes after only a few hours in solution. The method of making the determinations was to place twenty-one flasks upon a window sill in the sunlight every bright day for a total of 438 hr. At first the flasks were weighed every day, but later on as the rate of oxidation became less rapid this was done only every 3 or 4 days. The average gain in weight for the three oils was in accordance with the accompanying Table I at different time periods. The fluctuations were not regular, at times, one would be ahead then drop behind and possibly again catch up in weight.

From time to time measurements in increase in acidity due to oxidation were made by chemical means. The oils became more and more strongly acid and the measurements were made by ordinates showing the number of milligrams of potassium hydroxide required to neutralize 1 gram of oil. The results of these tests are given in Table II.

Carbonization Values

The carbonization values of the oxidized oils were determined on samples taken at the same time as those used for determination of acidity. The procedure followed was the same as described in other papers published by the Bureau of Standards, but an electrically heated and controlled air bath was used instead of one heated by gas. Ten gram portions of oil were heated to 250 deg. in 150-cc. Erlenmeyer flasks for 3 hr., allowed to cool and diluted with 50 cc. of petroleum ether. The precipitate was filtered off in a Gooch crucible prepared with a disk of filter paper and covered with a thin layer of asbestos. It was washed with petroleum ether, dried at 100 deg. Cent. and weighed. The results are shown in Table III.

A number of other interesting conclusions and experiments were made in this paper and the summary states the object and results of the tests to be as follows:

In order to determine whether there is any close connection between the rate of oxidation of automobile oils when exposed to sunlight and air and their carbonization values when heated to comparatively high temperatures, a study was made of three brands of oil. The gains in weight and in acidity and the increase in the carbonization value were determined at frequent intervals. In the first two of these tests, two of the oils showed nearly identical gains, the third differing quite noticeably. In the carbonization test the values for the three oils were quite far apart.

Other Determinations

Of minor importance were determinations of the demulsibility, the iodine number, and the Maumené number. The effect of oxidation was to increase the tendency to form emulsions with water. The iodine numbers were lower and Maumené numbers higher for oxidized than for the original oils.

The changes in the carbonization values caused by heating the above three oils and eight others to 250 deg. for different lengths of time were then studied, as well as the changes caused by heating to different temperatures for 3 hr. It was found that in both cases the greater the carbonization value at first, the more rapidly did it increase as the temperature was raised or the time of heating extended. In other words, an oil which has a low carbonization value if heated to 250 deg. for 2 or 3 hr. and an oil showing a somewhat higher value under the same conditions will be farther and farther apart as the conditions become more strenuous.

The carbonization value of an oil is coming to be recognized as a valuable criterion in routine testing, and methods for its determination are finding their way into textbooks, as well as into the journals.

Table I—Average Gain in Weight of Oils Exposed to Sunlight and Air

Total Exposure Hr.	Oil No. 1 Mg.	Oil No. 2 Mg.	Oil No. 3 Mg.
9	9.1	19.3	18.2
51.5	62.6	79.7	75.5
90	88.0	107.7	104.0
130	123.5	141.7	139.2
167.5	154.0	170.9	169.6
205	172.6	188.8	188.2
249	180.7	197.4	197.0
289	195.4	212.7	212.6
327	210.5	227.2	227.2
364	220.4	237.8	237.4
402	229.9	247.4	246.7
438	236.2	252.9	252.1

Table II—Gain in Acidity of Oils Exposed to Sunlight and Air

Acidity	Oil No. 1	Oil No. 2	Oil No. 3
Initial acidity (milligrams KOH)	0.06	0.04	0.03
Acidity after 22 hr	.08	.08	.08
Acidity after 40 hr	.09	.10	.09
Acidity after 69 hr	.19	.21	.22
Acidity after 90 hr	.16	.24	.22
Acidity after 101.5 hr	.17	.25	.25
Acidity after 118 hr	.38	.51	.50
Acidity after 149 hr	.50	.71	.67
Acidity after 174 hr	.86	1.03	1.08
Acidity after 208.5 hr	1.22	1.36	1.43
Acidity after 238 hr	1.44	1.65	1.67
Acidity after 289 hr	2.32	2.74	2.68
Acidity after 333 hr	2.40	2.91	2.94
Acidity after 419 hr	3.40	3.70	3.67

Table III—Carbonization Values of Oils Oxidized in Sunlight

Exposure Hr.	Oil No. 1 Per cent	Oil No. 2 Per cent	Oil No. 3 Per cent
None	0.14	0.17	0.30
22	.23	.26	.38
40	.30	.33	.52
69	.28	.29	.47
90	.32	.35	.50
101.5	.28	.37	.54
118	.30	.35	.53
149	.38	.45	.64
174	.40	.48	.73
208.5	.45	.59	.82
238	.42	.63	.87
289	.52	.74	1.11
333	.66	.92	1.25
419	.90	1.38	1.75

ACCESSORIES

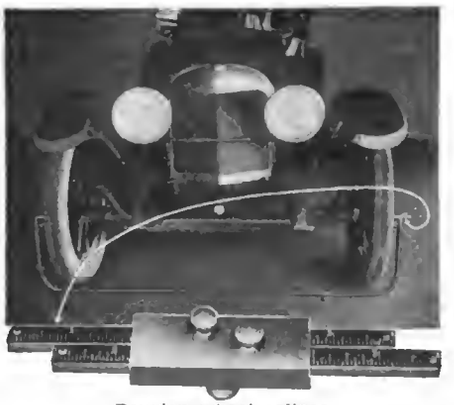
K-W Magneto

THE new Model T is an independent, high-tension magneto for automobile and aeroplane engines. It operates on the well-known inductor principle, having stationary windings and revolving rotor. It will give a spark of great intensity at speeds as low as 60 r.p.m., it is said. This type of construction does away with all moving wires, special contacts, etc. The circuit-breaker is claimed to be unusually fast, and tests have been made up to 18,000 sparks per minute without missing. This is the equivalent of operating a twelve-cylinder engine at 3000 r.p.m. This model conforms to all standard dimensions; it is entirely inclosed and is fully protected against dirt, water and oil. The Model TK is identical, except that it is equipped with an impulse starter. Prices: Model T, four-cylinder, $50; six-cylinder, $52.50; eight-cylinder, $55; twelve-cylinder, $60. Model TK, four-cylinder, $55; six-cylinder, $57.50.—K-W Ignition Co., 2833 Chester Avenue, Cleveland, Ohio.

K-W high-tension magneto

Bowden Wheel Caliper

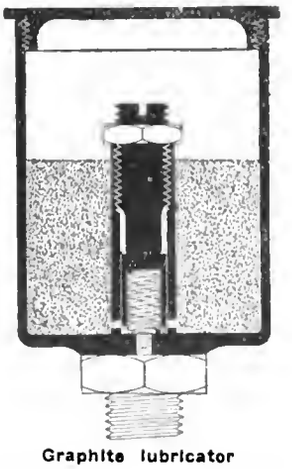
This device consists of a U-shaped member made of tubing which is hinged to the floor by two straps. At one side of the U there is a head which slides vertically, and which contains two members which may be moved horizontally and which are provided with inch scales. Each of these members may be instantly locked in place. First a measurement is taken on the front, using one of the scales, and then a measurement at the back, using the other, and the difference, after allowance is made for toe in, is the amount the wheels are out of line.—Multiform Sales Co., 431 South Dearborn Street, Chicago, Ill.



Bowden wheel caliper

Graphite Lubricator

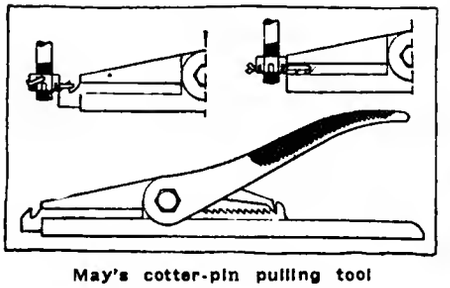
A radical departure in motor lubrication is seen in this device, which supplies dry graphite to the motor. The device is attached to the manifold and delivers the graphite in small quantities. It is a cylindrical shape, resembling an elongated grease cup, which has a valve which is influenced by the slight pulsations of pressure in the manifold, the amount of graphite delivered being in proportion to the pulsations. There is an adjustment to control the rate of feed for various conditions of service. The object of using dry graphite is to keep the cylinders and valve surfaces thoroughly lubricated in spite of the high temperatures to which they are exposed. The graphite does not burn or carbonize, it is said, but fills the irregularities of the metal, giving smoother friction surfaces, preventing leakage and the formation of carbon. The last is obtained due to the fact that the graphite forms a thin coating over the interior of the cylinder and prevents carbon and other foreign matter from accumulating. Price, $6.—Graphite Lubricator Co., 326 Diamond Street, Pittsburgh, Pa.



Graphite lubricator

May's Cotter-Pin Puller

The device pulls cotter pins of any size at any angle, regardless of how inaccessible or badly bent they may be. Pressing the handle operates a ratchet acting on a rack, the front end of which is formed into a hook engaging the eye of the cotter pin. Pressing the handle a few times draws this hook back and carries the cotter pin with it. The device is simple and powerful, and very little effort is required to operate it. Removing the pin in this way straightens it so that it may be used again, and the construction of the tool is such that it is impossible to drop the pin from the tool. Price, $1.25.—Service Shop, 112 Auburn Avenue, Atlanta, Ga.



May's cotter-pin pulling tool

Keystone Wrenches

The large line of Keystone wrenches includes square sleeve and Morse taper ratchet wrenches, reversible ratchet wrenches and adjustable wrenches with straight and S handles. The leader of the line is known as the Westcott adjustable S wrench and has a malleable iron handle with forged steel jaws. It is made in five sizes as follows:

6 in.,	opens to	¾ in.	$0.50
8 in.,	opens to	1 in.	.75
10 in.,	opens to	1⅜ in.	1.00
12 in.,	opens to	1⅝ in.	1.25
14 in.,	opens to	2 in.	1.75

—Made by Keystone Mfg. Co., Buffalo, N. Y. Distributors, Surpless, Dunn & Co., New York City and Chicago.

Nonpareil Trailers

All three models have broad, low express bodies with flareboards, high hickory wheels, Timken bearings and solid tires. The body on the 1000-lb. Model A is 6 ft. long, 46 in. wide, 10 in. deep and has 7-in. flareboards, which are removable. It weighs 360 lb. Model B has a capacity of 1500 lb., a body 8 ft. by 46 in. and weighs 430 lb. The Model C capacity is 1 ton, the body is 8 ft. long, 46 in. wide and 8 in. deep, with sides and ends re-

Keystone adjustable S wrench

Model A Nonpareil trailer

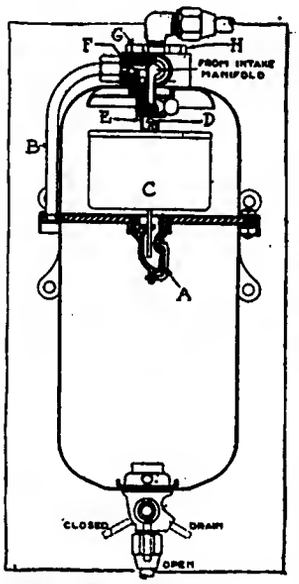
movable; its weight is 465 lb. Prices: Model A, $65; Model B, $80; Model C, $100.—Nonpareil Mfg. Co., Cochranton, Pa.

Tructor for Fords

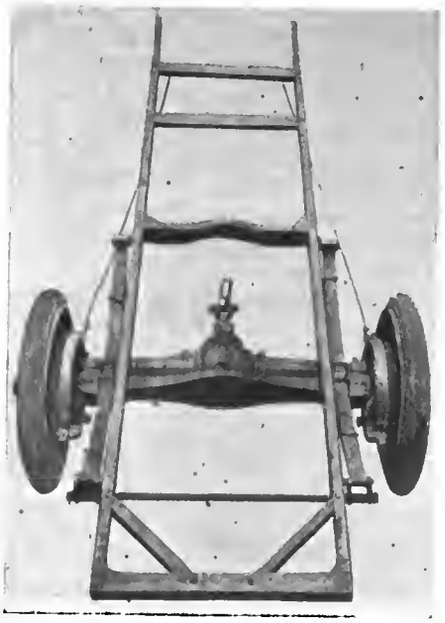
With the addition of a Tructor unit a Ford is readily converted into a 1½-ton truck. The unit consists of a heavy frame, with three cross-members and corner braces, which is slipped over the regular Ford frame, and attached to the rear are heavy springs and an internal gear drive axle. Specifications: Carrying space, 9 ft.; wheelbase, 127 in.; tires, 32 by 3½, solid; speed, 15 to 25 m.p.h.; gear ratio depends on locality; contracting rear wheel brakes, 16 by 1⅞; tread, 56 in. It is said that the change may be made in 1 hr. and it is not necessary to drill any holes. Similar units are built for all other cars. Price. for Fords, $350.—Tructor Mfg. Co., 1502 Michigan Avenue, Chicago, Ill.

Thermo Vacuum Fuel Feed

This is a small fuel tank which is auxiliary to the main tank and feeds directly to the carbureter, eliminating the need for pressure where the main tank is lower than the carbureter. It can be installed on any car, on the engine side of the dashboard. The tank consists of two compartments connected by means of a flat valve *A* and equalizing tube *B*. The upper tank compartment contains the float *C* which operates the suction valve *D* and the valve stem E. When the engine is started a vacuum is formed in the manifold and transferred through the suction pipe to the upper compartment when the valve *A* closes. Atmospheric pressure forces the fuel from the main tank to the upper compartment; the float begins to rise until the valve stem *E* touches the ball valve which is held on its seat by atmospheric pressure. The gasoline continues to enter until the float *C* becomes submerged when it rises and opens the valve and in rising still further closes the suction valve *D*. The pressure in the upper and lower compartments is immediately equalized and the flap valve *A* then opens and permits the gasoline to flow into the lower compartment. The float being held up by the suction valve cannot immediately follow until nearly all the fuel has left the upper compartment. It then drops back, opening the valve *D* and after closes the ball valve. The valve *A* is drawn to its seat and the actions repeated. The valve *F* controls the flow to the carbureter. Loosening the plug *G* permits access to both upper valves and a second plug *H* is provided for priming when necessary. Price, $7.50.—Thermo Vacuum Systems, Detroit, Mich.



Left—Thermo vacuum feed



Tructor attachment for Fords

Polson's leather boot

Polson's Hook-On Boot

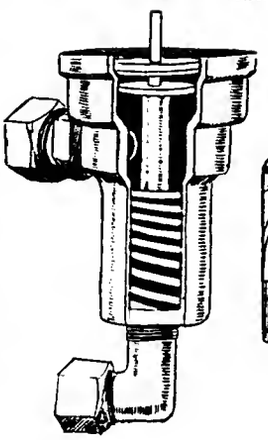
This boot may be used as a complete tread, in which case several sections are required for a tire; or it may be employed as a blow-out patch, in which case only one is required. The boot is made of heavy frictioned fabric, vulcanized over a tire form to make a perfect fit. The tread is heavy chrome leather, studded with hardened steel studs. It is attached by a set of adjustable hooks which fit in the rim of the wheel. Prices: 3 in., $1.30; 3½ in., $1.40; 4 in., $1.50; 4½ in., $1.70; 5 in., $1.90.—Polson Rubber Co., Cleveland, Ohio, and Kansas City, Mo.

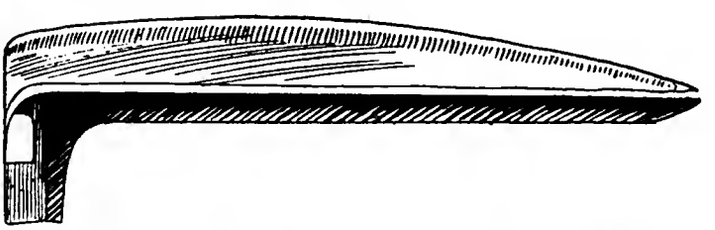
Duplex Air Valve

A plug, screwed into the intake manifold, to supply additional air. The casting houses the valve opening into the manifold, the valve being operated by a piston working in a cylinder, which is also connected to the manifold. At low speeds the valve is held closed by vacuum, but at higher speeds the reduced vacuum allows the valve to open under the action of a spring and admit additional air. Price, $5.—Duplex Vitalizer Corp., Elmira, N. Y.

S. & H. Top Covering

Complete outfits are made so that anyone may re-cover a top in a very short time. The equipment consists of roof and back curtains and with or without side curtains. Top covers for all the standard cars are carried in stock, and for others measuring blanks and instructions are furnished so that anyone may take the measurements, send them to the factory and receive a cover that will fit. Price, $5.95 to $7.96.—Split Hickory Wheel & Top Co., Hunt and Sycamore Streets, Cincinnati, Ohio.





Left—Duplex air valve. Right—H. & H. top covering—made for all cars

The Automobile

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Broadening the Base of the Sales Field

SELLING Ford cars through a vastly increased number of retailers will be beneficial to the industry.

It will benefit the manufacturer and the consumer.

There is no retail trade in the world that has not gained by the abandonment of restricted selling, and there is every reason why the automobile business should benefit also.

Hitherto, a man wanting a Ford car has had one place only where he could buy it in his locality. Now he will have a dozen or more. Instead of Ford cars for a certain territory all passing through one man's hands, they will be handled by any substantial retail trader who wants to sell them and will undertake to give proper service. They will be easier to buy, and, in a sense, easier to sell. There will be far more men trying to sell them, thousands more people making a living through handling the Ford car.

The step seems revolutionary because it is absolutely new to the automobile business. Actually, however, there is nothing so very remarkable about it, because it represents a stage in the evolution of a business which has been reached and passed by many other industries. Recently we have seen the decline of a territorially restricted form of retailing in the talking-machine business, coupled with an enormous increase in the number sold. To-day the piano trade is well on its way along the same line; and so it is with many other articles both cheap and costly.

That the Ford example will be followed by other manufacturers of inexpensive cars is certain. The change is logical, is in accord with the immense modern development of business which has made our homes so much better equipped, and has provided those innumerable refinements of life which have made it possible to maintain the pace of modern existence.

There is, of course, a limit. Articles which cost so much that they are not in everyday demand cannot be stocked by every trader. Only a few jewelry stores have $10,000 gems in their safes, only a few furriers $5,000 coats. So with automobiles we shall find that there is a stage where specialized selling will still pay all parties concerned better than generalized selling. To state the dividing line would be a dangerous prophecy. It is certainly not less than the price of a piano, not less than $500 to $750; it may very likely prove that $1,000 is not too high, or even a little more than that.

The excellent Ford principle of maintaining a fixed, low price for every spare part, and for upholding the price of the new car at the catalog figure, will not, of course, be affected by the abandonment of territorial restriction. Such schemes are a paramount essential to the automobile user.

Gear Ratios

AFTER a year of experiment with high gear ratios of nearly five to one on both low-priced and high-priced cars, manufacturers appear to be fairly well satisfied with the results. Whether this satisfaction will be maintained, however, is not yet to be decided. Twelve months ago it was pointed out that the average piston speed of the American automobiles of 1916 was far higher than anything ever attempted before, and predictions of rapid wear with excessive fuel consumption were made by all the more conservative among the engineers. The bulk of the past year's output is barely in the hands of the user, most of the deliveries have taken place since April 1, so it is too early yet to say anything about durability. On the subject of fuel consumption though, there has certainly been some complaint. It is possible to argue that the gearing ought not to affect this, but the fact remains that it does do so, probably because the internal friction of the engine increases in some proportion to the piston speed.

There is a feeling in some quarters that next year will see a change back toward the gear ratios common in 1914, an average high gear ratio of between 3.5 and 4 to 1, that is. Observation suggests that the majority of drivers never make use of the full high gear ability now provided, that is to say, they do not in practice try to run at 2 m.p.h. without shifting gears. It is certain that the limit of lowness in gearing has been reached; it will be interesting to see in another year's time whether it has not been exceeded.

V-Ray Plug Now Being Made

Stewart-Warner Corp. Starts Manufacture of Same in Its Speedometer Plant

CHICAGO, ILL., Aug. 15—The Stewart-Warner Speedometer Co., which recently purchased the V-Ray Co., Marshalltown, Iowa, maker of the V-Ray spark plug, has changed the name of this product to the Stewart V-Ray spark plug, and has started manufacture here in the speedometer factory. The plug will be distributed through the regular selling channels of the Stewart-Warner corporation. The Stewart V-Ray plug has a porcelain core made of Petriflint, the process for the manufacture of which is owned and controlled by the Stewart-Warner corporation. There are four sparking points. The plug has a universal cap which, it is said, fits practically every cable terminal in use.

A. O. Smith Insures Every Employe

MILWAUKEE, WIS., Aug. 12—The A. O. Smith Co., Milwaukee, Wis., has taken out a group insurance policy covering every employee in the service more than one year. Each employee received a life insurance policy which is accumulative with each year of service until the amount reaches $1,000. The policy costs the employee nothing, the company bearing all of the expense of premiums and other charges. A recent innovation is the installation of a motion picture outfit in the main bay of the big shop, and every Monday and Friday noon the employees gather for luncheon, during which time popular and educational reels are thrown on the screen.

Rich Tool in M. & A. M.

NEW YORK CITY, Aug. 15—The Rich Tool Co., maker of engine valves and miscellaneous metal specialties, Chicago, Ill., has been elected to membership in the Motor and Accessory Manufacturers, the national accessory organization. This organization now has a total membership of 235 and controls the majority of the accessory show space at the National shows in New York City and Chicago.

Duplex Co. Earned $41,110 in 1916

CHARLOTTE, MICH., Aug. 11—The Duplex Power Car Co., during the fiscal year 1916, earned $41,110.03, which is very much better than the previous season was, and certainly compares favorably with conditions three years ago, when there was an indebtedness of over $30,000. Stockholders present at the meeting subscribed about $20,000 of new stock and probably $30,000 worth will be offered for sale soon. The board of directors and officers which were re-elected are: F. P. Town, president; F. S. King, vice-president; Fred Murray, secretary; H. H. Bryan, treasurer. Allen White, J. H. Brown and William Cooley are the other directors.

Republic Motor Truck Expanding

ALBANY, N. Y., Aug. 15—To take care of a new policy of expansion, the Republic Motor Truck Co., has incorporated in this State with a capital of $1,312,500. There are 72,500 shares of stock, 62,500 of which have no par value, and 10,000 with a par of $100 a share. The directors are C. C. Bellows of Forest Hills, L. I.; E. C. King of Pelham Manor, and H. W. Smith of Larchmont.

Oakland Adding 800 More Men

PONTIAC, MICH., Aug. 11—The Oakland Motor Car Co. factory is to be considerably enlarged, so that 800 more men may be employed within the next few months. New buildings will include a large saw-tooth, one-story machine shop, enlargement of the warehouse and stockroom department. Recently a large basement was added to one of the present manufacturing buildings, making the latter really a two-story building. $50,000 will be spent within the next 12 months for additions.

New Name for American Jack

HICKSVILLE, OHIO, Aug. 14—The American Automatic Automobile Jack Co. has reincorporated as the Maumee Valley Mfg. Co., with capital of $100,000, and will take over the Coller show case factory.

Continental to Build Big Machine Shop

MUSKEGON, MICH., Aug. 11—About 30,000 sq. ft. of floor space will be added to the Continental Motor Co's., factory here through the erection of a large one-story, saw-tooth machine shop building and other minor additions to the plant. Fifteen hundred more men will be employed bringing the total up to 4500. At present 3000 men are employed on the day and night shifts.

Enger Motor Car Co. Incorporated

CINCINNATI, OHIO, Aug. 12—The Enger Motor Car Co. has been incorporated with a capital stock of $4,000,000 to take over the business of manufacturing the Enger car, which has been on the market for some time. The incorporators are F. J. Enger, D. L. Jones, G. W. Platt, E. E. Lincoln and Edward Ritchie.

Hassler Building Absorber Factory

INDIANAPOLIS, IND., Aug. 9—The Robert Hassler Co. is erecting a new No. 3 Austin building 300 ft. long to cost $45,000 for its shock absorber business.

54,700 Chevrolets During Year

Production Plans for Next Year Call for 100,000 to 125,000 Cars

NEW YORK CITY, Aug. 15.—The Chevrolet Motor Co. during the year ended Aug. 1 turned out 54,700 cars, including the output of the Canadian factory, thereby entering the list of the seven largest producers in the country.

The company will turn out about 10,000 cars this month, and plans for next year call for 100,000 to 125,000 cars. The maximum schedule projected for the summer months of this year has not been completely met on account of the delays in obtaining raw materials, particularly brass and copper.

The treasury position has been improving steadily. Current assets are now over $25,000,000 as against $8,000,000 at the time of the organization last fall.

Standardize Truck Controls

(*Continued from page* 257)

gineering, and Auxiliary departments of the army would be truck users with somewhat different requirements and that other users would be the Signal Corps, the Aviation Corps and the Navy. The Truck Standards division is working in conjunction with the S. A. E. Military Transport committee on this matter, and is expecting a request for special work in the near future. At the Buffalo meeting it was suggested that if possible the division should commence discussion of specifications for that size and type of truck likely to be most in demand which would be the one for the Quartermaster's department.

H. D. Church, chairman of the division, presided and there was a good representation of the membership present. General Manager C. F. Clarkson, chairman of the Military Transport committee, was also in attendance.

More Meetings Scheduled

Meetings of most of the divisions are scheduled to be held during the latter part of August and the whole of September. The next general meeting of the whole standards committee will take place on or about October 12. The Research division hopes to be able to make further recommendations for testing performance, while the Electrical Equipment division will have further lamp tests and a number of other matters to report. Important reports from the Engine and Transmission division and the Miscellaneous division are also expected. These divisions have had several matters brewing and a report is expected.

Gasoline Still Dropping in Price

Lower by 1 and 2 Cents in Important Centers—Up Slightly in Portland, Ore.

NEW YORK CITY, Aug. 15—Gasoline continues to drop in price throughout the country. Declines of from 1 to 2 cents occurred last week, and further reductions are predicted. The recent reduction in prices by the leading gasoline companies, it is stated, was caused by a threatened overproduction. It was feared that the output would overreach the demand and well-drilling was discouraged as a result.

Reports from different sections of the country show a steady decline. New York City prices again declined 1 cent, making a reduction of 2 cents a gallon within 3 days. The spot gasoline basis was nominally steady at 23 cents per gallon in steel barrels to garages and 25 cents to consumers.

Portland, Ore., prices have proved an exception to the rule. Instead of a reduction prices have been advanced 1 cent and gasoline is now retailing throughout the city at 20½ cents per gallon.

Gasoline at the present time is selling lower throughout the South and Southwest than in any other section of the country. The Standard Oil Co. is now selling gasoline in New Orleans at filling stations at 19½ cents, as against 21½ cents a month ago. A further cut is expected. Gasoline in Dallas is still selling for 19 cents, with prospects of no decrease. Although reductions of 10 cents per barrel have been made in Oklahoma and Louisiana crude oils, the price of gasoline is not expected to go much lower in this part of the Southwest. One automobile dealer in Dallas will start on Oct. 14 a novel plan for selling his customers gasoline. He will furnish them with gasoline and oil at cost. A service station will be opened at the company's plant.

Louisville, Ky., prices have declined 2 cents during the past 3 days. For several months the fuel has been retailing at 23 cents, but since Thursday it has been selling at 21 cents. The Louisville branch of the Ford company continues to sell gasoline at 20½ cents a gallon to Ford owners only.

Prices throughout the Denver, Col., territory remain unchanged, wholesaling at 23 cents to the garages and filling stations. New Jersey prices were reduced last week 1 cent and customers are now paying from 24 to 26 cents a gallon. The wholesale price is 21 cents to garages. Gasoline declines were reported yesterday by the Atlantic Refining Co. in Philadelphia from 25 cents to 24 cents, tank-wagon basis. Pittsburgh quotations by the principal oil companies have been reduced 1 cent a gallon, to 26 cents. This follows three reductions in the price of crude oil, a total of 25 cents a barrel.

Lower prices are now prevailing throughout the New England section. Last week Boston prices dropped 1 cent, from 25 to 24 cents wholesale. The dealers then announced a 1-cent drop. Some of the dealers are wondering about the retail price, which varies from the wholesale to 2, 3 or more cents above the oil company's price.

The gasoline situation in Milwaukee has caused one independent oil refiner to pit its forces against those of the Standard Oil Co. by the medium of newspaper advertising. Answering the full-page advertisements being published by Standard Oil in all Milwaukee newspapers, the Wadhams Oil Co. is using large newspaper space to explain why it chooses to sell Wadhams gasoline exclusively and why its prices are higher than the 18.6-cent price offered by the Standard Oil Co.

—

Dale Takes Over Jordan and Thianna for New York

NEW YORK CITY, Aug. 15—The Simplex Automobile Co., New Brunswick, N. J., has taken over the Metropolitan distribution of its car. John G. Dale, who has handled the car for several years, will take over the Jordan car and the Thianna, a high-priced town car.

The Simplex company, which takes over all of the unfilled orders and contracts, has rented for a term of 5 years, the store and basement of the new building at the southeast corner of Fifth Avenue and Fifty-eighth Street, and will establish there its local sales and showroom.

The Jordan car will be handled at the old location of the Simplex, 240 West Fifty-ninth Street. According to present plans the territory included under the new arrangement will include the Metropolitan district and the surrounding territory reaching as far as Bridgeport, Poughkeepsie, New Jersey and Long Island.

The first shipment of Jordan cars to be made by the Jordan company reached this city by express to-night and consisted of one carload of three touring models, consigned to Mr. Dale.

—

Ross Prices Raised $200

DETROIT, MICH., Aug. 15—The Ross Automobile Co., this city, has increased the price of its seven-passenger touring car and three-passenger roadster $200 to $1,550. This raise goes into effect Sept. 1 and was caused by the increase in the cost of raw materials and a number of refinements for the new models.

Tractor Men Debate S. A. E. Merger

Opinion Divided but Probably Owing to Misunderstanding —Gov't Favors Plan

FREMONT, NEB., Aug. 10—The Society of Tractor Engineers has decided to take definite action at its next general meeting in Minneapolis as to whether the society will combine with the Society of Automobile Engineers or remain a separate organization. This decision was voted at a meeting held here last night, when representatives of the S. A. E. and the S. T. E. attended for the purpose of considering the advisability of the tractor engineers uniting in the proposed Society of Auto-motive Engineers.

George Strite, president of the Society of Tractor Engineers, expressed a general opinion of the tractor men at present when he said all agreed that on getting results all of the tractor men have realized the work of the S. A. E. He instanced the value of the S. A. E. tread standard, stating that tractor men would find it better than the U. S. tread, and that the S. A. E. has a complete organization for the standardization of parts. He voiced the chief objections of the tractor men when he said that the latter seemed not to understand the reason for the S. A. E. urging the combination, the tractor men asking, "Does the S. A. E. want to steal our stuff?"

S. A. E. Not to Absorb

H. L. Horning of the Waukesha Motor Co. presented the subject to the tractor engineers of being a member of the S. A. E. and the S. T. E. He brought out the point that it was not the idea of the S. A. E. to absorb the other associations, but that the Society of Auto-motive Engineers would be the hand of which the different organizations would be the fingers and thumbs.

The United States Government, Mr. Horning said, had expressed a wish that these organizations be to a certain extent under one head, in order to make its negotiations and recommendations for the standardization of the allied lines more feasible, and the object of the meeting last night was to determine arrangements with the tractor men.

George W. Dunham, president-elect of the S. A. E., spoke on the advantages of the affiliation, and the plan was outlined by Coker F. Clarkson, general manager of the S. A. E. So far as the management of the combined societies is concerned, this would be in the hands of a council constituted similarly to that of the S. A. E., except that there would be an addition of four vice-presidents, one from each of the affiliating bodies. Each

of the societies would retain its identity to a certain extent, having its own meetings and being chiefly in control of the standardization of elements which entered mainly into its own industry. In the general meetings of the proposed Society of Auto-motive Engineers, which would correspond to the semi-annuals of the S. A. E., the individual societies would have as much part in the presentation of papers and in the discussion as they had material to offer.

The movement toward the affiliation of the five engineering bodies identified with the self-propelled vehicle industries which has been proposed by the Society of Automobile Engineers already has resulted in plans for concerted action by the aeronautic engineering society and the motor car engineering society, and there are strong indications that the engineering societies of the tractor, motor boat and stationary internal combustion engineers will co-operate in a general proposed society.

Texas Tractor Demonstration at Fair

DALLAS, TEX., Aug. 12—Texas' second tractor show and demonstration will be held at the Texas State Fair grounds during the 1916 fair, which opens Oct. 14, according to J. C. Duke, superintendent of this division of the state fair. It was decided to hold this demonstration, following the great success of the national demonstration conducted here in July. Indications are, said Mr. Duke, that this demonstration will be nearly as big as the national.

Forbids Use of Trailers

MILWAUKEE, WIS., Aug. 12—The city council of Escanaba, Mich., has passed an ordinance prohibiting the use of trailers on motor trucks. The same law fixes the maximum speed of motor trucks at 8 m.p.h. and the maximum load of any vehicle at 8000 lb.

A. C. A. Seals on Marmon Car

Tags in Dozen Places to Check Authenticity of Transcontinental Record

SAN FRANCISCO, CAL., Aug. 14—Authenticity was the keynote of the system used by the Marmon company in carrying out the checking work on its transcontinental car which established the record last week. The Automobile Club of America was the official medium selected by the Marmon company to do this checking. The car was sealed in a dozen places by a representative of the club in New York City and on its arrival in San Francisco the California representative checked the seals. The run was made in 5 days, 18 hr., 30 min.

Out of twelve seals put on the car at the beginning of its run, eight were intact. Of the remaining four, three were gone and the other broken and hanging on the car. Those seals that were missing were placed on the transmission case to the torque tube; on the bolt through the differential case; and on the left front spring. The seal on the torque tube to the differential housing was broken but hanging to the car.

After thoroughly investigating the original seals on the car, certain identification marks on the car were gone over. It was found that the original six wheels were gone. The rest of the parts were found intact with the exception of the socket on the torque tube end which had been moved or repaired.

Among those who observed and checked the Marmon transcontinental car were Arthur Metzler, Buffalo *Times*, Buffalo, N. Y.; Walter A. Kiedaisch, Erie, Pa.; H. H. Flook, Des Moines *Capitol*, Des Moines, Iowa; Jones H. Clark, Jr., Omaha *World-Record*, Omaha; D. O. Hodges, North Platte, Neb.; Vern Hinkley, Cedar Rapids, Iowa, and Stuart Gayness, care *Examiner*, San Francisco, Cal. Among those who reported the progress of the car were Norman E. Mack and George K. Fraley of Buffalo; Western Auto Transit Co., Rock Springs, Wyo.; A. E. Hubbard, Evanston, Wyo.; W. R. Reynolds, Eureka, Nev., and Western Union operators at Fallan, Nev., and Austin, Nev. In addition the following either acted as pilots or provided pilots: Cahill Brown Co., Syracuse, N. Y.; Flower Webster Cutter Co., Erie, Pa.; C. L. Sturtevant, Toledo, Ohio; Louis Disbrow, Cleveland; Van Riper & Engman, South Bend, Ind.; William Binz, care Marmon Chicago Co., Chicago; Lattner Bros., Cedar Rapids, Iowa; O. W. Garlock, Des Moines, Iowa; Ryan Motor Car Co., Omaha and Lincoln, Neb.; W. S. Rutherford and Carl Frickey, care B. F. Goodrich Co., Omaha, Neb.; Jack Harter, Pine Bluff, Wyo.; D. R. Gainard, Rock Springs, Wyo.; G. S. Hoad, Ely, Nev.; L. F. Rich, Salt Lake City, Utah; C. N. Crain, Cheyenne, Wyo., and H. B. Rector, San Francisco, Cal.

Milwaukee Dealers on Business Boosting Tour

MILWAUKEE, WIS., Aug. 12—Fifty-five cities and twice as many villages will be visited by the second annual booster tour of the Milwaukee Automobile Dealers' association, which starts at Milwaukee on Monday, Aug. 28, and ends at Milwaukee on Saturday, Sept. 2. Gov. E. L. Philipp and Mayor D. W. Hoan of Milwaukee, will accompany the tourists from start to finish.

The principal object of the tour is to advertise the Wisconsin State Fair at Milwaukee, Sept. 11 to 16, and the motor show to be conducted by the M. A. D. on the fair grounds. A total of sixty cars carrying 300 will be entered, it is anticipated.

Marmon transcontinental car which was sealed by the A. C. A. for checking and identification

Fifth Industry in Indiana

86,500 Automobile, Body and Parts Plants in State—7219 Wage Earners in 1914

NEW YORK CITY, Aug. 15—Eighty-six automobile, body and parts factories in Indiana employed an average of 7219 wage earners in 1914, paid a total of $5,027,000 in wages, spent $18,830,000 for materials and turned out products of a total value of $29,390,000 during that year, according to a preliminary report furnished by the Bureau of the Census to the National Automobile Chamber of Commerce.

In 1904 there were only eleven establishments, employing 816 wage earners and turning out products valued at $1,639,000. Five years later (1909) the establishments had increased to sixty-seven, employing 6797 wage earners and producing $23,764,000 worth of cars, parts and bodies.

Thus, in 1904 the average value of the product was $2000 per man and $149,000 per factory. In 1909 it had risen to about $3500 per man and $354,000 per factory. In 1914 the average output was $4071 per man and $341,770 per factory.

Only four other industries in the state ranked higher than the automobile industry in number of men employed, in wages paid and in cost of materials used, while five ranked higher in value of output. Probably the automobile business has forged still nearer the top in the year and a half elapsed since the census year.

The accompanying table shows the standing of the nine leading industries of Indiana:

Commissioner Finds Gasoline Pumps Short

BOSTON, MASS., Aug. 12—More than one-fifth of the gasoline pumps measured in Boston do not give full measure. Thure Hanson, Commissioner of Weights and Measures of Massachusetts, has started his inspectors on a State wide tour of inspection of the various gasoline pumps used in measuring the fluid out to motorists. There have been vague rumors that some of the pumps were not as accurate as they might be, and so Mr. Hanson sent for his corps and told them to start work at once.

The first places visited were the Allston section of Boston, which is the very end of the motor district. From there the inspectors will work their way in town. After the first week of tests Mr. Hanson said he found that the pumps were varying in measurement. There were 178 pumps tried out. Of that number 42.7 per cent were correct. There were 33.7 per cent giving long gallons and 23.6 per cent were not giving full measure.

The inspectors tested each pump from two to five times so that there could be no charge of hasty decisions. The largest shortage found was eight gills or 5 per cent in 5 gal., while the largest excess was 36 gills or 22.5 per cent in the same amount. The inspectors said that it appeared that the public were getting full measure.

Garage Labor Prices Higher in Wis.

MILWAUKEE, WIS., Aug. 12—Practically every garage and repair shop in Milwaukee not identified with agencies have raised prices charged for labor from 65 cents an hour to 75 cents for mechanics and from 30 cents to 40 cents for helpers' time. The increase is one of the effects of the better business policy resulting from the organization of the Wisconsin Garage Men's Association by Milwaukee garage keepers during recent months.

Nearly all agency service stations still keep in effect the old price of 65 cents an hour for labor, but it is stated that an increase may be expected at any time because the workmen are demanding increased pay and shorter hours. Some of the agency garages which have capacity to accept work on cars other than they handle, have increased prices, but continue to charge 65 cents to customers.

LEADING INDUSTRIES OF INDIANA

Industry	Establishments	Wage Earners	Value of Product	Per Cent Increase in Five Years
Iron and steel	19	11,106	$58,883,000	52.3
Slaughtering and meat packing	68	4,484	51,066,000	8
Foundry and machine shop	513	17,025	48,881,000	23.1
Flour and grist milling	512	2,281	37,488,000	—7.1
Liquor distilling	14	3,824	31,484,000	—0.4
Automobile	86	7,219	29,390,000	23.7
Carriage and wagons	193	7,306	21,569,000	—0.4
Railroad cars	10	5,800	21,570,000	127

Industry	Wages Paid	Cost of Materials	Output Per Factory	Output Per Man
Iron and steel	$9,620,000	$27,057,000	$3,099,100	$5,302
Slaughtering	2,498,000	46,295,000	750,970	11 388
Foundry	10,790,000	21,340,000	95,284	2,871
Flour milling	1,289,000	32,241,000	73,218	16,435
Liquor distilling	336,000	5,006,000	2,248,857	8,233
Automobile	5,027,000	18,830,000	341,770	4,071
Carriage and wagon	4,386,000	10,725,000	111,278	2,952
Railroad cars	3,981,000	13,711,000	2,157,000	3,719

NOTE—Decrease from 1909.

Texas Crops Promise Prosperous Year

Record-Breaking Prices for Cotton Bring $100,000,000 Increase

AUSTIN, TEX., Aug. 12—Good crops and high prices for the products of the farms and ranches mean much to the motor car trade of Texas. Money from the sale of this season's crops is beginning to circulate and the benefit that it is having on all lines of business is already apparent. Cotton-picking will have become general by the middle of August. The bales that have been marketed up to this time brought record-breaking prices, and it is expected that the market will continue its present high level during the remainder of the season. This season's prospective crop of 4,200,000 bales will bring an increase of more than $100,000,000 over the returns of the preceding year.

While the forage crop is not as large as last year, it is being utilized to much better advantage and profit by reason of the fact that there has been a great increase in the number of silos. In western Texas the maize crop will go above 75,000,000 bu., which is a considerable increase over last year's yield. It is only within the last few years that the threshing of maize has been carried on to any great extent in this State. Under the general head of maize are included Kaffir corn, feterita, milo maize, cane and other varieties of sorghums. This grain is now regarded as one of the staple crops of Texas and the demand for it has spread to remote parts of the United States and to foreign countries. It usually sells for about the same price as corn.

Garden and Orchard

In the matter of fruits, vegetables and melons, the returns from these crops have been larger this season than was ever before known. It is estimated by traffic officials of railroads that the total shipments of onions, new potatoes, sweet potatoes, tomatoes, cabbages, lettuce, cauliflower strawberries, cantaloupes, watermelons and peaches will have reached 25,000 carloads by the end of the year.

Livestock interests are unusually prosperous. Stock farming and dairying are being carried on much more than they were a year ago.

1916 Texas Crop Estimates

	1915	1916
Cotton (bales)	3,322,480	4,200,000
Cotton (price)	$225,000,000	$326,000,000
Wheat (bu.)	22,862,000	12,000,000
Corn (bu.)	175,075,000	165,000,000
Oats (bu.)	44,375,000	12,000,000
Rice (bu.)	7,113,000	10,000,000
Maize (bu.)	.....	75,000,000

Ford Salesmen Form Agencies

Some of the Large Cities Have as Many as Twelve New Ford Stores

NEW YORK CITY, Aug. 15—Salesmen in the Ford retail branches will not be cast adrift upon a cold world. Many will be better off than heretofore. Advices from leading cities state that they are forming partnerships and agencies to sell Fords and will thereby be able to profit by their previous experience. There will be eight agencies in Cleveland and in St. Louis ten. Some of the salesmen will get jobs with their former co-workers who now become dealers.

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Baltimore's Twelfth Ford Agency

BALTIMORE, MD., Aug. 15—Ford agencies are springing up all over Baltimore despite the fact that the Ford company opened a factory branch here on Aug. 1 at 10 to 20 East North Avenue.

E. T. Backus, Ford local manager, declined to make any statement on what the sub-agencies all over town meant. He refused to discuss the matter at all.

It is known that the various members of the retail sales force that was organized by the local factory branch have joined together in pairs and are establishing agencies. The Ford headquarters will no doubt be continued as a big distributing force and a force of mechanics is working hard on alterations.

Wilcox & Brown, two of the best known Ford salesmen in the city, have opened an agency at 607 West North Avenue. R. M. Stein, who has been handling the Moon agency, has opened a Ford store. Another Ford agency opened to-day at Baltimore and Eutaw Streets and will be known as the Ford Agency Co. It is expected that there will be at least a dozen retail Ford agencies in the city. About 2500 Fords were sold in Baltimore last year, and under the present plan it is estimated that the number will be doubled.

Ford to Drop Retail Sales

(*Continued from page* 255)

is available, but in all probability the minimum allotment will be ten cars.

It is thought that the new method will greatly reduce the garage and service cost to the ultimate user of the cars, although the plan is not yet old enough for any predictions of this kind to be made. Economies all along the line resulting from the new scheme might suggest ways and means of lowering the cost, but these are yet to be proven.

In the sense that any reputable concern will be able to get a supply of Fords at a Ford branch, any big users of cars, even though these machines be for his own business, can get them direct, providing he wants enough to come within the minimum wholesale requirements. In other words, if a big department store wanted ten or twenty-five cars for its own delivery system it could go direct to the Ford branch and secure them at wholesale prices without going through a dealer. If this same concern wanted less than the minimum wholesale allotment it would have to buy them through any Ford seller and pay retail prices. It could not get this less-than-minimum number through the Ford branch.

Already in all parts of the country evidences of the new Ford selling method are to be noted. In Detroit several organizations either have been formed or are in the process of formation to sell the cars with no territorial restrictions. They will give recognized Ford service and maintain a Ford garage. The branch here will eventually close its doors to the retail buyer of cars.

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Denver Ford Increases 150%

DENVER, COL., Aug. 12—During the first 6 months of 1915 the Denver plant assembled 2618 cars, while during the first 6 months of 1916 it turned out 6863 cars. In addition to this output the factory shipped 1400 cars into this territory during the 1916 period for the reason that the local branch could not get materials fast enough to supply the immediate demand.

Other leading cars show sales increases ranging from 50 per cent to as high as 300 per cent for the same comparative period, and several distributers claim that they could have done a still larger business this year if prompt deliveries had not been hindered by a serious shortage of cars.

Returns for the first half of this year show a total registration of more than 34,000 cars for Colorado alone, as against a total of not quite 22,000 for the same period last year and about 28,000 for all of 1915. This gives a registration increase of 54 per cent for the half-year period, or 21 per cent over the year.

Crow Elkhart Much Larger

New Touring Body Very Spacious—Appearance Improved —Cloverleaf Continued

ELKHART, IND., Aug. 15—A larger touring car of improved appearance is now being produced by the Crow Motor Car Co., this city. It sells for $795 and is claimed to be one of the largest cars selling for less than $1,000. The chassis is much the same as the 1916 model, the only change being in the wheelbase, which is now 114 in. instead of 112. This increase has allowed 3 in. more length in the tonneau, and the manufacturers state that there is now sufficient space to permit the fitting of two auxiliary seats in the tonneau without cramping the rear seat passengers. The rear seat is widened to 49 in., the body bulging slightly over the wheels and thereby making a very neat junction with the curves of the new domed fenders. There is also a new radiator with a neatly rounded outline and the hood tapers smoothly into the body, the side lines from tip of radiator to the back seat line being almost dead straight. The cloverleaf roadster body which the company has been building for several months is now fitted to the same chassis as the touring car, but has not been changed in any way, the slightly pointed radiator and flat fenders being retained for this model.

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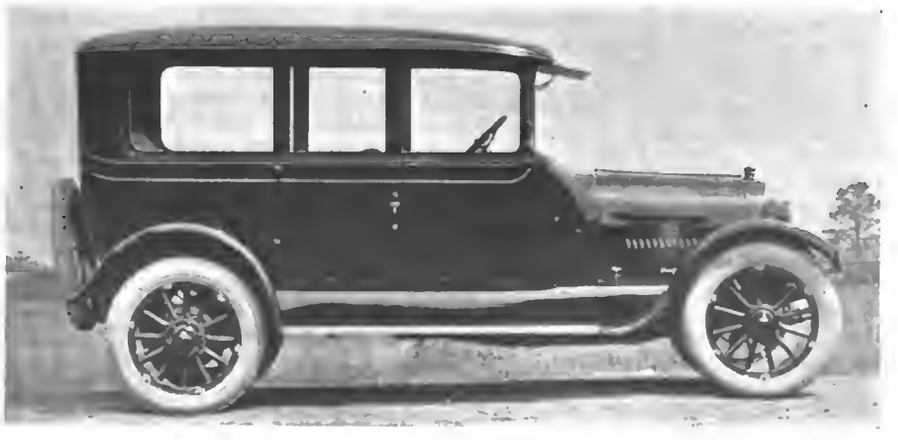
Winningham Hudson Advertising Manager

DETROIT, MICH., Aug. 14—C. C. Winningham, who is sales manager and director of advertising of the Hudson Motor Car Co., has now taken full charge of the advertising department, since W. L. Agnew, who was advertising manager, resigned. Owing to the growing importance of the advertising department, Mr. Winningham will devote considerably more time to it than heretofore.



New Reo Sedan which has been put out on the standard chassis

General view showing roadway up Pike's Peak Mountain from a point near the summit. The distance of the hillclimb was 12.5 miles, the maximum grade 10½ per cent, and the average grade 7½ per cent. The sinuous nature of the course is well indicated

Hudson, Chalmers Win at Pike's Peak

Romano Takes Penrose Free-for-All Trophy in Long Climb

COLORADO SPRINGS, COL., Aug. 12—Rae Lentz, Ralph Mulford and Fred Junk, driving respectively the Romano, Hudson Super-Six and Chalmers, divided honors in climbing Pike's Peak during the 2-day motoring festival that ended here to-day. It was predicted before the events took place that the winner's time in each of the three events would be close to 15 min.; but the prognosticators did not take into consideration several factors, among which were the weather, carbureter troubles and proper gearing.

Two events were run yesterday, one for cars of 231 cu. in. displacement and under and one for cars with a displacement ranging from 231 to 300 cu. in.

Six cars were entered in the 231 to 300 cu. in. event. These were sent away in two groups, the first including Hughes, Mulford, Parish and Oldfield, and the second Buzane and Patterson. Hughes went out in his car above timberline with motor trouble, and a faulty timing device made it necessary to recall Oldfield and Parish after they reached Glencove, as their time at the start was not registered. This left the course free for Mulford, and he covered the 12½-mile course in 18 min. 24.7 sec. The maximum grade is 10½ per cent; average 7½.

Sending two cars back put four in the second group to start, and Patterson's Hudson seemed to have second place cinched but ran off the course when about 20 ft. from the finish line and was disqualified. This left Buzane, in a Duesenberg, second and Parish, in a Mercer, third, as Oldfield's Delage did not do anything spectacular. In fact, Barney did not get his car on the course until the morning of the race.

To-day's event, which was for the Penrose trophy and $3,000 in cash, was won by Rae Lentz in a Romano special having an eight-cylinder aeroplane motor with a displacement of 402.12 cu. in. Ever since Lentz began to perform on the course he was predicted to be a likely winner, but his time to-day was not equal to that shown by Mulford in winning yesterday's event; but, of course, physical conditions were different to-day, for most of the race was run in rain, sleet and snow. Mulford finished second in to-day's race, and he, too, found climbing more difficult to-day.

Conditions were anything but auspicious for to-day's event. Most of the climb was through a driving storm of rain, hail and snow, and the spectators, who journeyed far up the mountain to watch the drivers zigzagging far below them, shivered in the cold. Goggles worn by the racing crews were so covered with rain and sleet that they had to be discarded.

Race Tabulation

PENROSE TROPHY EVENT

Car	Driver	Time	Prize
Romano	Lentz	20:55.6	*$2,000
Hudson	Mulford	21:40.5	1,000
Chalmers	Junk	22:46.7	
Hudson	Hughes	22:53	
Cadillac	Mortenson	23:30	
Grant	Jonee	25:42	
Ford	Knowles	26:20	
Chalmers	Stentz	26:28	
Ford	Peterson	26:32	
Studebaker	Morgan	28:23	
Duesenberg	Buzane	Out	
Saxon	Wetmore	Out	
Ford	Henry	Out	
Pathfinder	Hugheon	Out	
Mercer	Parish	Out	
Maxwell	Worthington	Out	

231 CUBIC INCHES AND UNDER

Car	Driver	Time	Prize
Chalmers	Junk	23:04.6	$500
Chalmers	Stantz	23:29.9	250
Grant	Jones	26:03.3	150
Ford	Peterson	28:00.3	
Saxon	Wetmore	28:43.4	
Ford	Knowles	29:25.7	
Ford	Spangler	36:58.8	
Ford	Henry	Ditch, Glencove	
Maxwell	Worthington	Out	

231 TO 300 CUBIC INCHES

Car	Driver	Time	Prize
Hudson Super Six	Mulford	18:24.7	$500
Duesenberg	Buzane	23:48.4	250
Mercer	Parish	28:31.8	150
Delage	Oldfield	31:38.6	
Duesenberg	Hughes	Out, eng. trouble	
Hudson Super Six	Patterson	Off course, disq.	

*And cup.

St. Louis A. C. Holding October Tour

ST. LOUIS, MO., Aug. 12—The Automobile Club of St. Louis will hold its three-day tour for owners early in October. The trip will embrace Keokuk with a night stop at Lousiana, Mo.

United Motors Corp. Ramifications

Big Cog in Industry Serves 10,318 Companies and Turns Out 28,323,000 Parts

NEW YORK CITY, Aug. 15—The magnitude of the automobile industry and its various ramifications has been brought out in an article appearing in the *Wall Street Journal* which takes up one of the large units, the United Motors Corp. showing the large production and the service given by this one cog in the industry.

The United Motors Corp. serves with its products 10,318 companies, and every automobile in use is equipped with one or more of its products. The output, consisting of 28,323,000 parts annually, may be classified as follows:

	Daily	Annually
Anti-friction bearings	65,000	19,500,000
Coaster brake hubs	1,800	540,000
Starting, lighting and ignition systems	1,150	345,000
Ignition systems only	1,450	435,000
Demountable rims	25,000	7,500,000

The Delco system was installed last year on 142,500 automobiles. Orders have been received thus far this year for approximately 200,000 and additional orders of 50,000 are expected before the end of the season. As of July 15 there were approximately 500,000 Delco-equipped automobiles in service.

More than 7,500,000 Hyatt bearings were supplied for automobiles in the 1916 season and over 10,000,000 bearings, it is estimated, will be required for the 1917 production. Of approximately 1,000,000 cars built this year Hyatt bearings are a part of more than 925,000.

The New Departure company had a daily production in Mya of 14,800 bearings, 1800 coaster brake hubs and 1,500,000 balls. The output has been steadily increased since that time, and by next Spring an output more than double the preceding figures is expected.

The Perlman Rim Corporation turned out daily in June 2000 sets of rims, or 10,000 individual rims. The production by Oct. 1 is scheduled at 5000 sets a day.

The fifth company in the United Motors organization is the Remy Electric Co., which is at present turning out over 950 ignition systems, composed of ignition distributers and magnetos, 400 generators and 350 starting motors. This production will be increased 30 per cent within 6 months and the output for the year will reach the record mark of 410,000 ignition systems and 125,000 starting and lighting outfits.

All of these products are manufactured in 110 buildings with an aggregate floor-space of 2,449,229 sq. ft. The number of employees is 14,000.

Six Entries for Harvest Meet

INDIANAPOLIS, IND., Aug. 12—The fourth entry for the three events in the Harvest meet at the Indianapolis Motor Speedway on Sept. 9 adds an international touch. Josef Christiaens is the first foreign driver to enter the 20-, 50- and 100-mile events on the program and he will drive the English Sunbeam in which he has made a name for himself on the various tracks of America, as well as in foreign countries.

The car is the same which raced first in New York last spring. Gil Anderson and Howard Wilcox, entered by the Speedway Team, will drive their Premier cars.

The Sunbeam brings the total to six cars entered in the Sept. 9 event. Two Peugeots, with Aitken and Merz at the wheels and the Ostewig Special with S. Ostewig driving, are the other entries received by General Manager, T. E. Myers, of the Speedway.

Speedway Company in Columbus

COLUMBUS, OHIO, Aug. 12—The Columbus Motor Speedway & Horse Racing Co., has been incorporated with an authorized capital of $200,000 for the purpose of building a speedway for both automobile and horse races. The incorporators are: T. M. Hardesty, S. B. Randall, S. D. Maddox, L. F. Laylin and Robert Pfeiffer.

Fourteen Entries for Chicago Speedway

Resta, De Palma and Other Major Lights of Racing World to Participate

CHICAGO, ILL., Aug. 15—When the elimination trials open to-morrow, fourteen cars will attempt to qualify for the American Speedway Grand Prix race to be held here next Saturday. These trials will continue Thursday and Friday, and it seems probable that from past performances of the majority of the entry list, the requisite speed of 100 m.p.h. will be attained, and that when the cars are lined up before the starter at 2 o'clock next Saturday afternoon, the total number to participate will be practically the same as the entry list.

Entries to date include two Packards, one of which has been entered by Ralph De Palma, along with his Mercedes, and it is not known at present whether Ralph will enter the race next Saturday driving a Packard, or the car which has served him both well and uncertain in various races for several years—the Mercedes. This leaves one Packard with the driver un-named.

Dario Resta's Peugeot is here, and he is expected to arrive to-day. The Hoskins Special, which Eddie O'Donnell drove at Kansas City, will be driven by George Buzane, as O'Donnell's broken arm is not healed sufficiently to allow him to participate. Ralph Mulford has wired his entry of the Peugeot and the Hudson Super Six. The latter he is bringing to Chicago from Colorado Springs, and the Peugeot is being shipped here from New York.

Among the other entries are: D'Alene's Duesenberg, Milton's Duesenberg, Christiaens' Sunbeam, and Galvin's Sunbeam, Jackson's Ben Hur, Lewis Chevrolet's Frontenac, and another Hoskins Special, to be driven by Eddie Rickenbacher, this car being a duplicate of O'Donnell's car and owned by C. C. Hoskins.

Fred Junk in the winning Chalmers at the Pike's Peak Mountain hillclimb and Mulford in the record-breaking Hudson

Security Prices Are Higher

General Motors Features with 70 Points Gain—Chevrolet Up 25 Points

NEW YORK CITY, Aug. 15—Automobile and accessory securities last week regained their prestige on the Stock Exchange and Curb Market by again becoming one of the strongest group of stocks. Most all of the stocks advanced under the stimulus of buying orders from a group of stock exchange houses. General Motors was especially strong, and rose to a new high record during the middle of last week to 583. Rumors have it that this company will soon cut another large melon. Just what effect these rumors had with the rise of this stock is not known, but the other stocks were seemingly affected by the increase and joined in with substantial gains. Chevrolet, with the aid of buying orders from the houses showed some of its old-time vigor and advanced sharply with increased strength. Rumor has it that this company will declare a large cash dividend. Stutz, United Motors, and Stromberg, were also prominent on the curb. Stutz showed a new high level of 66, a gain of 2⅝ points. United Motors was bouyant, in sympathy with the movement in Chevrolet.

Other securities to make substantial gains were Goodyear common, 10 points; Saxon, 4½ points; Studebaker common, 3¼ points; U. S. Rubber common, 2⅛; and Willys-Overland common, 2 points.

The quotations on the Detroit Exchange were also higher with General Motors featuring with a 60 point rise on its common. The rest of the gains ranged from 1 to 10 points.

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15 Per Cent Dividend for Bower Roller

DETROIT, MICH., Aug. 14—As evidence of the prosperous condition of the Bower Roller Bearing Co., manufacturer of the Bower roller bearing, the stock of the company was placed on a 60 per cent dividend basis at a recent meeting of the board of directors. In other words, a dividend of 15 per cent was declared and it was styled a quarterly disbursement.

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West Canadian Provinces Buy 8,000 Cars

WINNIPEG, Aug. 9—Eight thousand cars have been sold this year in the three provinces of Manitoba, Saskatchewan and Alberta. Of this quantity 3500 were taken by Manitoba. Local dealers assigned the improvement through the success of an exact road building campaign initiated by the government.

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Dallas Dealers Plan Fall Show

DALLAS, TEX., Aug. 9—Plans for an automobile show during the state fair, Oct. 14 to 31, were practically completed at a meeting held to-day by nearly all of the dealers of this city.

Copper Prices Are Higher

Up to 27 Cents a Lb.—Open-Hearth Steel Higher—Further Drop in Petroleum

NEW YORK CITY, Aug. 15—The rise in copper and open-hearth steel and the decline in petroleum featured in last week's market activities ih this city. Copper is again showing unusual activity and as a result prices have gone up in both lake and electrolytic to 27 cents a pound, a gain of ¼-cent. Crude oil prices have gone down 15 to 30 cents a barrel during the past two weeks. It is stated that further reductions will be made. Kansas petroleum is now quoting at $1.05 while Pennsylvania is down to $2.35. The gasoline situation in this city, despite the general reduction in crude oil prices, is steady, and competition is keen.

Lead was active and in demand, with quotations 5 cents a pound higher yesterday. Tin also was active again on the resumption of buying and rose to $39.50 per 100 lb., a net gain of $1.75 for the week. The rest of the metals were steady.

The rubber market was quiet with Up-river Para steady at 65. Ceylon grades fluctuated throughout the week, reaching 58½ cents and then declining to 57½. The Intercontinental Rubber Co., Tucson, Ariz., has started experiments to make cheaper rubber.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co. (new)	..	..	64	66	+1
J. I. Case pfd	70	79	85	89	..
Chalmers Motor Co. com	87	90	160	175	—10
Chalmers Motor Co. pfd	94	97	98	102	..
*Chandler Motor Car Co.	..	..	104	106	+2
Chevrolet Motor Co	..	..	212	215	+25
Fisk Rubber Co. com	..	..	110	150	—10
Fisk Motor Co. 1st pfd	..	..	112	120	..
Fisk Motor Co. 2d pfd	..	..	120	..	..
Firestone Tire & Rubber Co. com	510	515	915	930	..
Firestone Tire & Rubber Co. pfd	111	..	112	114	+1
*General Motors Co. com	218	220	570	580	+70
*General Motors Co. pfd	107	110	118	119	+5
*B. F. Goodrich Co. com	58	59	72	72½	+1⅞
*B. F. Goodrich pfd	107½	108	113	114	— ⅜
Goodyear Tire & Rubber com	263	270	233	238	+10
Goodyear Tire & Rubber Co. pfd	107	108½	106¼	107	— ¼
Grant Motor Car Co	..	..	7½	8½	— ½
Hall Signal	..	..	26	27	..
Hupp Motor com	..	..	6½	7	..
Hupp Motor pfd	..	..	80	100	..
International Motor Co. com	25½	26½	5	7½	..
International Motor Co. pfd	48½	49	17	22	—1
*Kelly-Springfield Tire & Rubber com.	184	185	70	70¼	..
*Kelly-Springfield Tire & Rub. 1st pfd.	86	88	96	97	..
Kelsey Wheel	..	..	100	101	..
*Lee Rubber & Tire Corp	..	..	45	45½	+2
*Maxwell Motor Co. com	40	42	81½	81¾	—4½
*Maxwell Motor Co. 1st pfd	86½	87½	85½	86½	— ¼
*Maxwell Motor Co. 2d pfd	34½	35½	55¾	56½	+1¼
Miller Rubber Co. com	..	195	225	235	..
Miller Rubber Co. pfd	107	107½	104	106	..
Packard Motor Car Co. com	..	120	165	175	—5
Packard Motor Car Co. pfd	97½	100½	100	104	..
Paige-Detroit Motor Car	..	..	45	50	..
Peerless Truck & Motor Corp	..	..	22	23	+1½
Perlman Rim Corp	..	..	..	..	..
Portage Rubber Co. com	42	..	115	118	..
Portage Rubber Co. pfd	92	94	115	118	..
Pratt & Whitney	..	..	104	106	..
Princess Motor Corp	..	..	1	1⅛	..
Regal Motor Co. pfd	..	..	17	22	..
Reo Motor Truck Co	17¼	18	35½	36½	—1
Reo Motor Car Co	33¾	34½	41¾	42¾	— ¾
Saxon Motor Car Co	..	..	71½	72	+4½
Scripps-Booth	..	..	51½	51¾	..
Springfield Body	..	..	71	72	..
Standard Motor Co	..	..	5½	6	+ ½
Stewart-Warner Speed. com	66	68	102½	103½	+1
Stewart-Warner Speed. pfd	105	107	..	..	..
Stromberg Motor	..	..	43½	43¾	+2
*Studebaker Corp. com	99	100	128½	129	+3¼
Studebaker Corp. pfd	103	104½	109	110¾	..
Stutz Motor	..	..	66¼	66½	+2⅝
Swinehart Tire & Rubber Co	85	90	100	105	..
United Motor Corp	..	..	65⅛	65⅜	+2⅛
*U. S. Rubber Co. com	47½	48	55⅜	55½	+2⅛
*U. S. Rubber Co. pfd	104	105	109½	109⅞	+1¼
White Motor Co. (new)	..	..	52	52½	+ ½
*Willys-Overland Co. com	184	186	53¾	54	+2
*Willys-Overland Co. pfd	103	105	103	..	—1

*At close Aug. 14, 1916. Listed New York Stock Exchange.
Quotations furnished by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co	..	..	36½	38	..
Chalmers Motor Co. com	87	..	..	165½	..
Chalmers Motor Co. pfd	96¼	97¼	96	103	..
Continental Motor Co. com	..	300	37	37½	..
Continental Motor Co. pfd	83	86	9½	10½	..
Ford Motor Co. of Canada	1475	..	335	350	+10
General Motors Co. com	216	220	540	600	+60
General Motors Co. pfd	108	110	115	121	+3
Maxwell Motor Co. com	35	37	80½	83½	+4½
Maxwell Motor Co. 1st pfd	40	43½	84	87	— ½
Maxwell Motor Co. 2d pfd	86½	88½	54½	57½	+1
Packard Motor Car Co. com	114	..	..	178	..
Packard Motor Car Co. pfd	99	..	101	104	..
Paige-Detroit Motor Car Co	..	..	41½	50	—3½
W. K. Prudden Co	20¼	..	42½	..	+1½
Reo Motor Car Co	33	33¾	42	42¾	+ ¼
Reo Motor Truck Co	17⅜	18	35¼	36¼	..
Studebaker Corp. com	95	98	127½	130½	+5
Studebaker Corp. pfd	103½	106	105	..	..
C. H. Hall Lamp Co	..	..	..	30	..

INACTIVE STOCKS

Atlas Drop Forge Co	28	..	30	..	..
Kelsey Wheel Co	205	..	55	60	—1
Regal Motor Car Co. pfd	..	21	17	..	..

Maxwell Common on 10% Basis

Initial Dividend Declared—Dividends of $7 and $6 on First and Second Preferred

NEW YORK CITY, Aug. 15—The Maxwell Motor Co., Detroit, Mich., to-day declared an initial quarterly dividend of $2.50 per share on the $12,778,050 in common stock, payable Oct. 2 to holders of record Sept. 11. This virtually places the issue on a 10 per cent per annum basis. The company also declared a dividend of $7 per share on the $12,816,400 first preferred and $6 a share on the $10,127,468 second preferred.

The dividend on the first preferred is payable in four equal quarterly installments of $1.75 each, as follows: Oct. 2 to holders of record Sept. 11; Jan. 2, 1917, to holders of record Dec. 11, 1916; April 2, 1917, to holders of record March 10, 1917, and July 2, 1917, to holders of record June 11, 1917.

Second Preferred Dividend

The second preferred stock dividend will also be paid in four equal quarterly installments of $1.50 each, as follows: Oct. 2, 1916, to holders of record Sept. 11, 1916; Jan. 2, 1917, to holders of record Dec. 11, 1916; April 2, 1917, to holders of record March 10, 1917, and July 2, 1917, to holders of record June 11, 1917.

President W. E. Flanders, after the meeting of the directors, stated that the company had enjoyed a most prosperous year and now has 80,000 cars of the 1917 type contracted for.

Sales of Maxwells during July were about 7000 cars, and it is expected that the output will run 8000 for August. Very likely the company will figure on a manufacturing schedule of 100,000 cars for the coming fiscal year.

Of the 60,000 cars manufactured last year, about 3000 were for export. Surplus earnings for the fiscal year ended July 31 last were over $5,000,000 after deduction of all charges of every character.

90,000 People See Ford Tractors

(*Continued from page* 255)

handling two plows; that is, plows two furrows at once. The tractor is not on the market yet and will not be ready until next year, when the factory of Henry Ford & Son, Dearborn, Mich., is expected to be under operation. The present demonstration here was apparently made with the object of trying out public sentiment and getting general criticisms. The few criticisms heard were to the effect that some changes will have to be made; but if Ford had been able to make deliveries he could have gone back to Dearborn with scores of orders and cash on deposit in his pocket.

The 3 days of demonstrations here were the greatest compliment to motor power for farm use that could be wished for. Never before has such enthusiasm been seen, and while the name of Ford naturally exerted its magnetism, yet there were thousands and tens of thousands who came to see the other threescore tractors demonstrate their superiority over fast-fading Dobbin.

The total attendance of 90,000 for 3 days, two of which were muddy, compares favorably with the attendance for a week at the Grand Central Palace motor show in New York or the Coliseum show in Chicago. With good weather and a week's show the tractor demonstration would prove itself a giant.

It is a sight to inspire the heart of man to see sixty-five motor tractors operating at the same time. The appetite for performance of these new gasoline-eating machines is nothing short of prodigious, for they plowed 160 acres of land in 2 hr. At this pace a farmer owning a whole section of land 1 mile square (640 acres in all) could have his entire block plowed between breakfast and afternoon tea, and have time for an hour at lunch.

Tractor manufacturers exhibited at Fremont to a greater extent than at the earlier demonstrations, both because there were more of them ready and because the Fremont demonstration has come to be recognized as the classic. There were forty different makes of tractors to be seen, and at least one-half of the makers had two or more models on display.

The 3 years of tractor demonstrations at Fremont has had its effect on the attitude of the farmers of that section. They do not have to be shown that the farm tractor as a piece of farm machinery is a practical and successful thing. Their neighbors have been using them, and have produced better crops by the deeper plowing made possible by the tractors. Three different farmers, one of whom lived 75 miles away from Fremont, pointed out to me a field upon which the demonstration tractors had operated the two preceding years and which this season produced a yield nearly double that of its horse-plowed neighbors. "Deeper plowing," was their explanation.

As to the fuel situation the tractor makers seem to be quite divided. Approximately one-half of the tractors in the field were operating on kerosene. To make sure that there was no false claims in this regard the technical committee tested the fuel used in the plowing demonstrations. Nevertheless some of the tractor men who favored gasoline impressed one with their doubts as to the real nature of the fuel used by the kerosene burners.

All of the tractors, in fact, were exceptionally free from stoppages due to mechanical troubles. With one or two exceptions all the machines dug in and finished up their task in a steady and businesslike way that was an eye-opener to the novice in tractordom.

Prospects

The marketing of agricultural tractors differs from the marketing of motor cars in one essential respect. If a farmer, or any other man for that matter, has sufficient of worldly goods to buy and main-

Jones Federal Brass Sales Manager

DETROIT, MICH., Aug. 16—Lloyd P. Jones has been made sales manager of the Federal Brass Works, Detroit.

For the past five years Mr. Jones has been connected with the American Bronze Company, and since 1913 has been manager of their western office.

Three Gallons Just As Dangerous

ST. LOUIS, MO., Aug. 12—Pouring 3 gal. of gasoline on the street is as dangerous as pouring any larger quantity in the opinion of Mayor Kiel, who has just vetoed a bill prohibiting the pouring of more than 3 gal. of gasoline on the street.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.57	.57	.57	.57	.57	.57	...
Antimony	.10½	.10½	.10½	.10½	.10½	.10¼	— .00¼
Beams and Channels, 100 lb.	2.77	2.77	2.77	2.77	2.77	2.77	...
Bessemer Steel, ton	43.00	43.00	43.00	43.00	43.00	43.00	...
Copper, Elec., lb.	.26¾	.26¾	.26¾	.26¾	.26¾	.27	+ .00¼
Copper, Lake, lb.	.26¾	.26¾	.26¾	.26¾	.26¾	.27	+ .00¼
Cottonseed Oil, bbl.	9.28	9.34	9.10	9.13	9.15	9.30	+ .02
Fish Oil, Menhaden, Brown	.55	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl.	.23	.23	.23	.23	.23	.23	...
Lard Oil, prime	1.05	1.05	1.05	1.05	1.05	1.05	...
Lead, 100 lb.	5.95	5.95	5.95	5.95	5.95	6.00	+ .05
Linseed Oil	.70	.70	.70	.72	.72	.73	...
Open-Hearth Steel, ton	42.00	42.00	45.00	45.00	45.00	45.00	+3.00
Petroleum, bbl., Kans., crude	1.15	1.15	1.15	1.15	1.15	1.05	— .10
Petroleum, bbl., Pa., crude	2.40	2.40	2.35	2.35	2.35	2.35	— .05
Rapeseed Oil, refined	.90	.90	.90	.90	.90	.90	...
Rubber, Fine Up-River, Para	.65	.65	.65	.65	.65	.65	...
Rubber, Ceylon, First Latex	.57	.58	.58	.58	.58½	.57½	+ .00½
Sulphuric Acid, 60 Baume	2.50	2.50	2.50	2.50	2.50	2.50	...
Tin, 100 lb.	37.75	38.00	38.12½	38.50	38.50	39.50	+1.75
Tire Scrap	.05½	.05½	.05½	.05½	.05½	.05½	...

The new Ford tractor at the Fremont, Neb., tractor demonstration. It is a four-wheel design using a four-cylinder motor 4 by 4¼, multiple-disc clutch, three-speed and reverse, constant-mesh type of gearset and worm-drive to the rear axle. It weighs less than a ton. The price has not yet been set. It pulls two plows at a speed of 2 to 2½ m.p.h., and will travel at 5 to 6 m.p.h. on the road

tain a motor car he is considered at least a possible prospect. But when it comes to buying a tractor for tilling his fields there enters another consideration, and that is, "Will it pay?"

The answer to this question involves a number of considerations, but the chiefest of these, particularly in level country, is the tillable acreage.

The Department of Agriculture has found that, in general, on level land a tractor will pay, if properly managed, when the tillable acreage is not less than 160 acres. According to Nebraska real estate men who have been in touch with conditions in this territory for years, the average size of the farms in Nebraska is double that figure. There are, of course, many farms of 160 acres or less, but there also are many in which the acreage is 1000. It is on the larger farms that the tractors have been operating for the greatest period and with the most success.

One landowner whose holdings approximate 1200 acres of corn and wheat lands has been operating two very large tractors for several years and this week purchased two smaller ones to use in addition to his larger ones. To a certain extent it is the smaller capacity and less expensive tractors that are popularizing these machines in this territory. A big, heavy, expensive machine capable of pulling eight or ten 14-in. plows represents too much capital to the owner of 240 or 360 acres, and its capacity is so great that there is not work for it on one farm a sufficient proportion of the time. It has been found, as a general rule, that to keep the machine sufficiently busy by doing custom work on other farms is not a paying proposition.

The later types of smaller, lighter and less expensive tractors capable of handling two to four plows seem, in the opinion of a large proportion of the farmers in the territory, to meet the demands of the moderate-size farm, and with many of them the purchase of a tractor depends on present prosperity and future crop prospects.

General view of tractor demonstration at Fremont, Neb., last week

The August crop report for the State of Nebraska as compiled by the federal bureau of crop estimates Aug. 1, together with the actual production last year, is given below. It should be borne in mind that last year's production was approximately 120 per cent of the normal yield for the past 5 years; also, that this estimate was made before the general rains of this week, which put hundreds of thousands of dollars in the pockets of the Nebraska farmers and, in the minds of some, meant a full corn crop instead of a partial one.

Crop	Aug. 1, 1916 (Estimate) Bushels	1915 Production Bushels
Corn	180,000,000	213,000,000
Winter wheat	61,600,000	66,618,000
Spring wheat	4,560,000	5,536,000
Oats	75,100,000	70,400,000

Fremont markets Aug. 9, 1916, quoted No. 2 wheat at $1.30, No. 3 corn at $0.75 and oats at $0.35 per bushel. On Aug. 1, 1915, wheat was 29 cents less, corn 5 cents less and oats the same. Live stock and dairy products last year put $244,000,000 in the coffers of the Nebraska farmer and this year will do as well.

There has been a great deal of discussion among tractor men as to whether the motor car dealer or the implement dealer is the logical man to handle tractor sales. A new argument was injected into the discussion to-day by the representatives of two big tractor makers who, by the way, also are large manufacturers of other farming implements. They made the point that the question is one which necessarily will solve itself, because the implement man who handles tractors will find it to his advantage to handle motor cars as well, and, on the other hand, the motor car dealer who takes on a line of tractors must perforce stock up with plows, harrows, disks and the other implements which are to be drawn by the tractor. In other words, the car-tractor dealer will become an implement man and the implement-tractor dealer will become a motor car man.

Factory Miscellany

Bell to Build—The Bell Motor Car Co., York, Pa., is planning a one-story, 108 by 240-ft. plant.

Alter Starts Building—Excavation has been begun at Grand Haven, Mich., for the new factory of the Alter Motor Car Co.

Michelin Tire to Add—The Michelin Tire Co., Milltown, N. J., has let a contract for the erection of a one-story, 25 by 46 and 23 by 780-ft. addition.

Chicago Parts Co. Builds—The Regal Model & Tool Works, 122 South Clark Street, Chicago, Ill., is building a plant for manufacturing special machinery, automobile parts and dies.

To Make Washing Device—The Keystone Device Co., Harrisburg, Pa., has established a plant for the manufacture of a patented automobile washing device composed of a brush and nozzle.

Buys Tractor Plant—The plant of the Ohio Tractor Mfg. Co., Marion, Ohio, has been purchased by W. H. Houghton and associates of Marion. It will be used for the manufacture of commercial vehicles.

Gordon Plant Ready by Sept. 1—The L. O. Gordon Mfg. Co., Muskegon, Mich., a new concern which will make camshafts and other automobile specialties, is expected to have its plant in full operation by Sept. 1.

Springfield Body Moves Ad and Sales Departments—The Springfield Body Co., Springfield, Mass., has moved its advertising and sales departments from the Springfield factory to 509 David Whitney Building, Detroit, Mich.

To Make Engines—The Field Motor Co., Grand Rapids, Mich., has practically completed negotiations for the erection of a plant for the manufacture of a new process gasoline and kerosene engine. It will be one story, 50 by 100 ft.

Dewes Plant Moved—The plant of the A. Dewes Co., maker of stampings, dies and automobile accessories, will be moved from its present location, 241 Centre Street, New York City, to 199 Lafayette Street. This change in location was made necessary by the business outgrowing the present quarters.

Wald Machine to Add—Ground was broken to-day by the Wald Machine Co., Sheboygan, Wis., a large producer of accessories and mechanical specialties, for its new shop building, 80 by 100 ft. in size. When completed, the new shop will make it possible to increase the production nearly 300 per cent.

Miller Plant Enlarged—The plant of the Harry A. Miller Manufacturing Co., Los Angeles, Cal., has been enlarged and remodeled. A large addition has been taken over, in which the pattern shop, motor and racing departments are located. In addition to turning out fifty carbureters a day for the Miller Carbureter Sales Corp., the factory is building motors, including a twelve-cylinder aviation motor for De Lloyd Thompson, which is to weigh less than 800 lb. and develop 300 hp. at 1400 r.p.m. As a great many of the racing drivers make headquarters at the Miller plant, there is now a department given over entirely to them, where their cars are kept and where they have all the machinery.

More Metal Workmen Wanted—The Western Malleables Co., Beaver Dam, Wis., which recently established a separate division for handling a large influx of business from the automobile industry, is combing the country in search of additional help. Last week a party of fifty skilled molders from Portland, Ore., arrived at the plant in response to the insistent call directed at the Pacific Coast, where labor conditions are said to be less serious than in the Middle West. The Beaver Dam Co. could use 250 to 300 more men to man its foundries, consisting of three large units in Beaver Dam.

The Milwaukee branch assembling plant of the Ford Motor Co. now has reached a daily production of 106 cars and before Sept. 1 expects to increase this number to 150. The shortage of skilled labor, which is keeping down the production of all metal working shops in Milwaukee, has affected the Ford works.

The Automobile Calendar

ASSOCIATIONS

Aug. 28-Sept. 1 — Milwaukee, Wis., Booster Tour of Milwaukee Automobile Dealers.

Sept.— Indianapolis, Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.

Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.

Oct. 13—Flint, Mich., Fall Meeting National Assn. of Automobile Accessory Jobbers.

Dec. 2-9—Electricians' Country-wide Celebration.

CONTESTS

Aug. 18-19—Elgin Road Race, Chicago Auto Club.

Aug. 26—Kalamazoo, Mich., 100-Mile Track Race.

Sept. 1-2—New York, N. Y., Sheepshead Bay Speedway, 24-Hour Race, Trade Racing Assn.

Sept. 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.

Sept. 4—Cincinnati, Ohio, Speedway, Cincinnati Speedway Co.

Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.

Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.

Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.

Sept. 9—Indianapolis Speedway Race.

Sept. 16—Providence Speedway Race.

Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.

Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.

Sept. 30 — New York City, Sheepshead Bay Speedway Race.

Oct. 7—Philadelphia Speedway Race.

Oct. 7—Omaha Speedway Race.

Oct. 14 — Chicago Speedway Race.

Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.

Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.

Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 1-9—Cincinnati, Ohio, Good Roads Exposition and Convention, Music Hall, Hamilton County Dixie Highway Council of Cincinnati.

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

SHOWS

Aug. 7-19—Atlantic City, N. J., First Show, Young's Pier.

Sept. 2-9—Cleveland, Ohio, Show, Industrial Exposition and Fair, Edgewater Park.

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.

Sept. 4 - 8 — Hartford, Conn., Show, Connecticut Fair Assn.

Sept. 4-11 — Indianapolis, Ind., Show, Indiana State Fair, Indianapolis Automobile Trade Assn.

Sept. 10-16 — Milwaukee, Wis., Show, Wisconsin State Fair, Machinery Bldg.

Sept. 25-30—Salem, Ore., State Fair, Joseph M. Rieg, manager.

Oct. 14 - 31 — Dallas, Texas, Show, State Fair.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 13 -20 — Montreal, Que., Show, Montreal Automobile Trade Assn.

Jan. 27-Feb. 3, 1917 — Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb.—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.

TRACTOR

Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.

Aug. 21-25—Bloomington, Ill., Tractor Demonstration.

Aug. 28-Sept. 1—Indiana Tractor Demonstration.

Sept. 4-8—Madison, Wis., Tractor Demonstration.

Sept. 11-16 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Week in the Industry

Southwest Items—S. S. Lindsey, sales manager of the Kansas City branch of the Buick Motor Car Co., has been promoted to manager of the branch at Oklahoma City.

The Ramsey Auto Co., Kansas City, Mo., has been organized to handle the Detroiter six. J. A. Ramsey is manager.

The Velie Motor Car Co., Kansas City, Mo., has purchased a lease on the southeast corner of Sixteenth and McGee Streets, and will erect a salesroom there.

Columbus News Items—The Peters & Heron Dash Co., located on Culbertson Street, Columbus, Ohio, has sold its dash and buggy business to the McKinnon Dash Co. of Buffalo and Troy, and will devote its attention in the future to the manufacture of automobile hood covers, robes, dimmers and other accessories, which has developed amazingly in the past few months.

R. W. Pharis, who has been connected with the Pharis Tire & Rubber Co., Newark, Ohio, in the capacity of secretary and manager of the Columbus branch, has resigned to take up the management of the International Tire Co., a new retail concern at 187 East Gay Street.

The Columbus Cadillac Co., central Ohio agents for the Cadillac, has taken a lease on the southwest corner of Broad and Sixth Streets upon which will be erected a 2-story building for sales headquarters.

Sales agents representing the Domestic Engineering Co., Dayton, Ohio, manufacturer of the Delco light systems, convened at the office of J. J. Munsell, general agent for central Ohio at the office of the agent, 11 East Rich Street, Columbus, recently. It was the first meeting of sales representatives held east of the Mississippi River. R. H. Grant, general manager of the company, was chief among the speakers. In all about forty sales representatives were in attendance. Reports of a very encouraging nature were made.

The Marion-Handley Sales Co. has been organized in Kansas City to handle the product of the company in eastern Kansas and western Missouri.

Russell H. Clark & Co., Kansas City, body and top builder, is building outing and commercial trailers, its specialty being the Russ outing trailer, convertible by removing the wire spring bed into commercial trailer. The firm is also stocking commercial bodies for touring cars; it is furnishing commercial cars complete.

S. R. Parsons, Kansas City, has established the Parsons Motor Co. for handling the Tonford unit 1-ton truck of the Detroit Truck Co. in Kansas and Jackson County, Mo. Mr. Parsons will equip a shop and salesroom shortly at 1804 Grand Avenue.

Pacific Coast News—E. A. Williams, Jr., president and general manager of the Garford and Gramm Motor Truck Co., has announced that the company will build a branch building in Seattle in the near future, which will be under the supervision of A. W. McKenzie, Pacific Northwest manager. Temporary offices and salesrooms have been opened at 1726 Broadway, which handle the business of the company in Washington, Oregon, Idaho, British Columbia and Alaska.

The North Pacific Oakland Company has been organized in Seattle to handle the agency for the Oakland car in Washington, Oregon and northern Idaho. R. K. Roberts, until recently assistant general sales manager of the Oakland Motor Car Co., with headquarters at San Francisco, will be general manager of the new company, and E. M. Mark, who has been at the head of the Northwest Oakland company, distributor of the Oakland cars for western Washington, will be secretary and treasurer.

The Pacific KisselKar Co., Pacific Coast distributor for the KisselKar and Briscoe lines, has opened a branch at 806 East Pike Street, Seattle. The company is now operating branch houses in San Diego, Pasadena, Los Angeles, San Francisco, Cal., and Portland, Ore.

B. C. Scearce has been appointed assistant manager of the northwest branch of the Metz Motor Car Co. in Seattle to succeed D. H. Hotchkin, who recently became factory representative of the company for its northwest territory.

The Northwest Buick Co., which recently took the agency for the G. M. C. trucks in the Pacific Northwest, announces the appointment of W. H. Barnes, formerly factory representative of the General Motors Truck Co., as truck sales manager. H. H. Harwood, formerly with Frederick & Nelson, has been appointed assistant sales manager of the truck department.

The Portage Tire Sales Co. has opened northwest distributing quarters at 706 East Pine Street, Seattle, to handle the agency for the Portage tire.

The Fisk Rubber Co. has moved into its new branch at the corner of Tenth Avenue and East Pike Street, Seattle.

Omaha News Tips—A direct factory branch for the Willys-Overland Co., under the firm name of Willys-Overland, Inc., has been opened here with J. R. Jamieson, president of the Overland-Omaha Co., in charge.

The old show rooms at 2047-2049 Farnam Street will be maintained, and in addition the company occupies the old quarters of the Ford Motor Sales Co. at Twentieth and Harney Streets, the latter moving to the new branch factory at Sixteenth and Cuming Streets, recently completed.

Henry Werdehoff, who has directed the mechanical department of the local house for two years past, will have charge of the service department in the new location.

The Overland Auto Co., Denver, for several years Overland distributor for Colorado and Wyoming, has given up this agency on account of the new Willys-Overland factory branch just established, and has secured the King and Saxon distributing agency for the same territory, with headquarters at 1200 Broadway. The concern will continue to operate under its established name, at least temporarily, with W. J. Carter as president and treasurer.

The Cole Motor Sales Co., Denver, is the name of a new Cole distributing agency for Colorado and Wyoming just opened at 17 East Colfax Avenue by H. P. Federspiel, formerly manager of the Colorado Motor Car Co.

The National Motor Co., Denver, National and Elgin distributor for Colorado, Wyoming and western Nebraska, has added the Weston distributing agency.

Stiermann Vehicle Co., St. Louis, has been appointed distributer in this community for the Aurora demountable truck attachment which converts a Ford chassis into a 2000-lb. truck.

Hudson Phillips Motor Car Co., St. Louis, has been named distributing agent for the Philadelphia Diamond Grid Starter batteries.

L. M. Ball has been made service manager for the Locust Motor Sales Co. of St. Louis, distributer of the Scripps-Booth car.

J. W. Angle of Wilcox, Ariz., has been appointed an agent for the Moon cars.

Monarch Auto Repair Co., St. Louis, has been appointed distributer for the compensating air plug.

The St. Louis Electrical Works, St. Louis, Mo., will shortly begin the erection of a two-story factory building at Sarah Street and Forest Park Boulevard.

The Automobile

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NEW YORK, AUGUST 24, 1916

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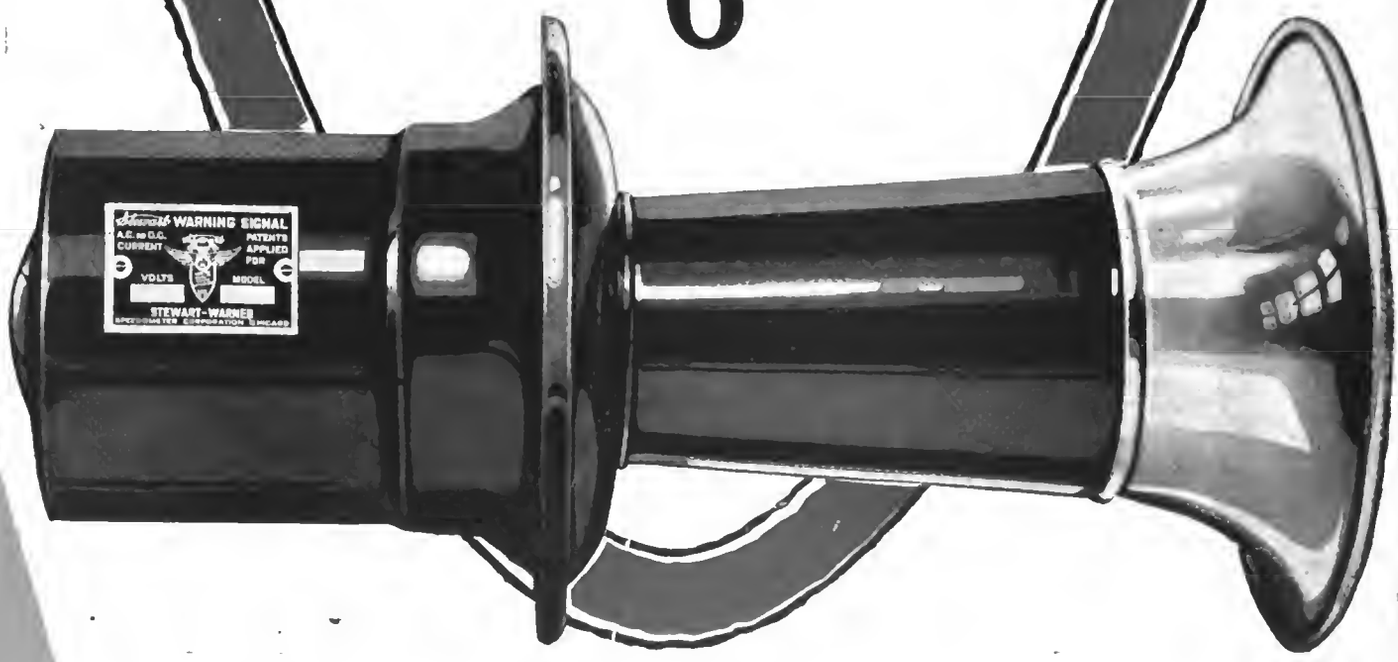
Motor Driven Warning Signal

$6



The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, AUGUST 24, 1916—CHICAGO No. 8

Consolidated Now Abbott Corp.

Moving from Detroit to Cleveland and Increasing Stock from $500,000 to $1,250,000

DETROIT, MICH., Aug. 21—The Consolidated Car Co., manufacturer of the Abbott-Detroit cars, has been reincorporated under the name of the Abbott Corporation, and the capital stock has been increased from $500,000 to $1,250,000. The larger stockholders in the concern are F. C. Hull and A. W. Gardiner of this city.

It has been definitely decided to remove the business of the Abbott Corporation to Cleveland, Ohio, where a factory has already been secured which will have ample facilities for the increasing of production over the fifteen to twenty-car-a-day output possible in the present factory here. Difficulties in getting materials and the labor situation here are given as two reasons for the change, although Messrs. Gardiner and Hull have material financial interests in Cleveland, according to M. J. Hammers, vice-president, and this move will, therefore, serve to group the holdings of those principally interested and provide the best of financial and commercial support for the Abbott concern. The personnel of the company will remain the same, with the exception that an executive officer will be appointed to succeed C. L. Lewis, who recently retired from the presidency to become affiliated with the General Engineering Co.

—

U. S. Truck Capital Now $1,000,000

CINCINNATI, OHIO, Aug. 21—The capital stock of the United States Motor Truck Co., this city, was increased from $300,000 to $1,000,000, at the recent stockholders' meeting, to take care of rapid growth of its business and to greatly increase its factory facilities.

This increase in stock was divided into both preferred and common, the preferred is cumulative 7 per cent, and participates in the earnings with the common up to 10 per cent.

The directors declared the regular annual dividend of 7 per cent on the preferred, and placed quite a large sum to the credit of surplus from the excess earnings.

—

Metcalf a Simplex Director and Vice-President

NEW BRUNSWICK, N. J., Aug. 21—Morris Metcalf was elected a director and vice-president of the Simplex Automobile Co., at a recent directors' meeting. He will be in charge of all the commercial departments, including sales, body, service and publicity.

—

Large Peerless War Truck Order

NEW YORK CITY, Aug. 18—One of the Allied governments has placed through Gaston, Williams & Wigmore an order for 2400 Peerless trucks, delivery to commence immediately. Delivery will be made at the rate of from eighty to 100 trucks a week until late in 1917.

—

Iowa Rubber Co. Formed

DAVENPORT, IOWA, Aug. 17—The Iowa Rubber Tire Co., capitalized at $1,000,000, was formed here recently, with a number of local men as incorporators. Chief among those interested are: J. W. Bettendorf, J. R. Lane and Judge J. W. Bollinger. A plant will be erected, either in Davenport or in Bettendorf, the suburb of this city, in the near future.

—

Browne Heads Anderson N. W. Division

DETROIT, MICH., Aug. 18—L. M. Browne, formerly of the eastern sales division of the Anderson Electric Car Co., this city, has been placed in charge of the northwest sales division, with headquarters in Minneapolis.

Timken Buys Out David Brown

Worm Gearing Concern Merged with Axle Company—Myers Leaves Organization

DETROIT, MICH., Aug. 21—The Timken-David Brown Co., this city, the majority of the stock in which was originally owned by the Timken-Detroit Axle Co., has been bought out entirely by the Timken-Detroit company, and the manufacturing operations will be consolidated under the management of the axle company. That portion of the Timken-David Brown stock which previously was not held by the Timken Axle Company was owned by David Brown & Sons, Huddersfield, England, and the new move divorces the two entirely. The Timken-David Brown Co. has always been regarded as a part of the Timken factories here, being under the same roof. It manufactures worm gearing for motor trucks and power transmissions, and the gear generating machinery was brought over originally from Huddersfield.

Coincident with the announcement of this merging of the Timken units comes information that Cornelius T. Myers, formerly chief engineer, and later manager in charge of engineering, manufacturing and sales of the Timken-David Brown Co. has severed his connection with the concern, disposing of his interests to the Timken-Detroit Axle Co. Mr. Myers, it is announced, will again take up consulting engineering in this city, making a specialty of motor truck, tractor and worm gearing applications to all kinds of power transmitting machinery. Myers has had an active engineering experience, having been mechanical engineer for the General Motors Co., and chief engineer of the General Motors Truck Co. He is a prominent member of the Society of Automobile Engineers.

Ford Agencies Increase Rapidly in Every City

Unrestricted Territory Plan Occasions Formation of Many Agencies—Ex-Salesmen of Ford Branches and Others Not Heretofore Connected with Ford Branches Have Become Retailers

NEW YORK CITY, Aug. 21—With the adoption of the new merchandising policy by the Ford Motor Co., hundreds of Ford salesmen have set up for themselves and in other instances have formed partnerships with their co-workers. In still other cases, they have readily obtained positions with the many new Ford agencies that are being established.

The unrestricted territory plan has occasioned the formation of many agencies even by those not heretofore connected with Ford branches and many garagemen, equipped to give service, have become Ford retailers. The change is most noticeable in those cities where there have been Ford branches. In towns where representation has been by a dealer only, new agencies as yet have not been established in any great number, and sometimes not at all.

One of the greatest changes will be in America's biggest city, New York. In Manhattan it is estimated there will be twenty-five or thirty and in Greater New York, which includes Brooklyn, Manhattan, the Bronx and Staten Island, fifty or more.

In Chicago, where there will be about thirty Ford dealers who will handle 10,000 Ford cars during the coming year; none of them will be allowed more than 500, and the minimum, according to the plan, will be ten.

In St. Louis nine new agencies are to be formed, making ten, including the Johnson Auto Co., the original Ford retailer. Several of these agencies have held openings, served lunch and entertained the public.

While additional appointments may be made, there are already in Milwaukee ten and in the suburbs two. In Wisconsin and upper Michigan, the business in the immediate future will be handled by 254 dealers of whom 238 are in Wisconsin and sixteen in upper Michigan. Many of these have been handling the Ford. The branch had thirty salesmen, most of whom have already made new connections.

In Louisville, Ky., four dealers have already been appointed, and in Lowell, Mass., the agency has been given up by Stephen L. Rochett of the Lowell Motor Mart, and has been taken over by Harry Pitts of the Pitts Auto Supply Co.

In Connecticut the number of dealers has been increased from twenty-two to thirty-eight. The Elmer Automobile Co. has controlled the territory and states that it plans to operate much as in the past. It has headquarters in Hartford with branches in Manchester, New Britain, Willimantic, Torrington and Winsted. John M. Butler, manager of the Elmer company said he expected to dispose of 28,000 cars during the next 12 months. Dealers, who heretofore have had more than one town, will concentrate on one town, which means an increase of 73 per cent in the number of dealers. It is stated that in Columbus, Ohio, the Ford branch, has, where possible, given preference to its former sales force. In fact, oustide of one dealer who formerly handled the county, every Ford agency in Columbus will be controlled by former Ford salesmen. There will be eight in all in the city and quite a few in the county, although it is said that most of the country dealers will be unchanged.

Ten of the fourteen Philadelphia salesmen have left the branch to open agencies.

Conditions similar to these exist throughout the United States, and while the unrestricted territory plan will vitally affect some dealers and distributers, there are instances in which the actual operation of the plan will be less revolutionary than its theory indicates. This belief seems to hold true especially with regard to country districts where agencies equipped to give service are not as numerous as in the cities.

Richmond, Va., will have at least four firms acting as Ford retailers. The factory representative will only sell the Ford automobiles, trucks and tractors at wholesale. It is stated that at least four agencies will be opened in Norfolk.

The Ford company in Pittsburgh has been besieged with applications for new agencies. The company has so far established nine agencies covering all parts of the city. It is expected that at least three or more agencies will be placed there.

Up to the present time about eight agencies will handle Ford cars in Washington, D. C. Applications for five other prospective agents are being considered. The fact that any dealer who wants to handle Ford cars will be limited in territory to the District of Columbia has come as a district surprise, as it was generally understood that under the new selling plan there would be no restrictions as to territory.

Five sales shops will be opened in Dallas, Tex. Three branches have been established in Baltimore, Md. Several of the Baltimore newspapers have been carrying blind advertisements asking prospective Ford buyers, who desire some special consideration to communicate. It is thought among the trade in that city that these cars will be sold on the payment of $100 deposit and $25 monthly. It is expected that there will be about twelve agencies in Baltimore. At present there is a little hesitancy on the part of prospective agents in the matter of forming companies on account of the guarantee to sell a car for every working day in the year. There is little doubt that the Ford company will dispose of about 5000 cars during the fiscal year to Aug. 1, 1917.

Twelve agencies are lined up in Minneapolis for Ford cars to replace the branch selling agency. Nine of these are closed and three are in abeyance. In some instances as high as three salesmen have gone with an agency. Contracts in the country remain as territory line-ups and are unchanged. In the city the minimum for cars is twelve.

Conditions will be somewhat similar in St. Paul. There will be eight to ten agencies, possibly more.

Parent Company Abandons Repair Business

DETROIT, MICH., Aug. 22—Supplementing the exclusive publication in last week's issue of the details of the new Ford selling plan, which is revolutionary in the automobile industry, complete information as to the workings of the new method of marketing Fords has now been secured.

The plan is really very simple in its workings, and requires only that the prospective dealer have financial responsibility and a garage at which he can take care of service for the car. The dealer can interpret the word service in any way he sees fit. Possibly Ford will continue to give service for some months yet at the various branches and assembly plants throughout the country, but when a man comes for service he will be told that that time is the last from the Ford company direct.

The number of cars that a dealer may secure for the year is based upon an estimate of his possibilities of selling them. There is a regular discount per car, and if the dealer meets the estimated number of cars he has arranged for per

month he will get a bonus on each car at the end of the fiscal year. If, for instance, a dealer contracts for twenty-five cars a month for the year and takes this number, his discount per car is increased by a bonus payment.

The number of agencies in any city or locality will be based upon the population and experience in that locality. In Detroit the maximum number is to be twenty-five agencies, and this will vary for other points. Already some eighteen dealers are either selling or getting ready to take contracts.

The contract limits the dealers to selling cars in Detroit, Highland Park and Grosse Point, which are really all a part of Greater Detroit. Thus, in any locality the dealers will have to confine themselves to certain selling fields as per their contracts. Dealers must do their own advertising.

American Vanadium Co. Sold for $7,000,000

PITTSBURGH, PA., Aug. 23—The American Vanadium Co., this city, which owns 92 per cent of the known deposits of vanadium and which sells very largely to the makers of high-speed tools and automobiles, has been taken over by eastern capitalists for $7,000,000. J. L. Replogle, Kuhn, Loeb & Co., Harrison Williams and others, are at the head of the syndicate.

Mr. Replogle, now vice-president and general manager of the company, will be made president after the conclusion of the sale. J. J. Flannery, head of the present company, will become chairman of the board.

A year ago American Vanadium stock was considered to be worth $152 a share. The last sale reported was made at about $600. The syndicate is offering $1,000 a share, of which $650 will be paid in cash and $350 in 6 per cent notes, or in the stock of the company. The new company, which will retain the name of the old, will have a capital of $13,500,000, made up of $5,000,000 of 7 per cent preferred stock, $6,000,000 of common, and $2,500,000 of 6 per cent short-term notes.

426,892,673 Barrels Petroleum in 1915

WASHINGTON, D. C., Aug. 19—Petroleum production in 1915 amounted to 426,892,673 barrels, exceeding the 1914 production by 28,194,307 barrels, or 7 per cent. Nineteen-fifteen was the most successful year of production in the history of the petroleum industry. The bulk of the increase in 1915 came from the United States and Mexico, though Russia, Argentina and Japan recorded significant gains.

The marketed production of crude petroleum in the United States in 1915 was 281,104,104 barrels of 42 gal. each.

20-Cent Gasoline Predicted

Fuel Continues Recession Throughout Country—Middle West Prices Lowest

NEW YORK CITY, Aug. 22—Gasoline continues its rapid drop in price. No logical reason is given for the sudden shift. All that is definitely known about it is that the investigation of the Federal Trade Commission had nothing to do with the reduction. Some authorities state that the recession is the outcome of the digging of new wells.

It is believed that gasoline prices will reach the low level of 20 cents a gal. in practically every section of the country within 2 weeks. Prices have been falling steadily throughout the West and Middle West during the past week. Figures collected from all parts of the country show that automobile owners of the Middle West, from Chicago to Denver, are paying the lowest price at present for gasoline. Chicago and Des Moines quoted the lowest price, 17½ cents, and the average is 18 to 19 cents. These prices average 2 cents below the rest of the country. The Standard Oil Co. has reduced prices in St. Louis to 17.9 to 16.9 at filling stations. The independents in that city also commenced quoting the same price. The first drop in gasoline prices in the Rocky Mountain section occurred on Aug. 15, when a cut of 1 cent was made. Oil companies there are wholesaling to garage and filling stations at 22 cents a gal. Columbus prices have been cut a cent to 22 by the Standard Oil Co.

A reduction of 1 cent per gal. for the lower tests of gasoline was made effective in Milwaukee and throughout Wisconsin and Upper Michigan this week. The Standard Oil Co. and the independents authorized the drops at the same time. Present quotation at filling stations or delivered in Milwaukee, is 17.6 cents per gal. on the Red Crown grade. The independents' lowest test, marked 59 deg., is now 17.6 cents, tank-wagon basis, or 18.6 cents, filling stations. Higher tests, or grades running from 65 to 74 deg., are not affected by the reduction. Practically all retailing of gasoline in Milwaukee is now done directly by the Standard and independent companies through filling stations. Garages which sell gasoline for the most part do so on commission for the big wholesalers and thus are designated as filling stations for these companies. Garages connected with agencies for cars do not want gasoline trade because it is wholly unprofitable.

The Texas Co. to-day announces reductions of 1 cent a gal. tank-wagon basis, to conform with cuts by competitors in the territories named, as follows: Illinois, to 17½ cents; Minnesota to 18½ cents; Missouri to 16.9 cents minimum, 17½ maximum; Florida to 22 cents minimum, 22½ cents maximum; Georgia, 22 cents minimum, 25 cents maximum; Louisiana, 18½ cents minimum, 20½ cents maximum; Mississippi, 20½ cents minimum and 22½ cents maximum; Alabama, 22½ cents minimum, 26 cents maximum; and Ohio, 21 cents.

The Eastern section of the country has also been favorably affected the shift in prices, though the average price being paid is somewhat higher than in the West. Pittsburgh prices, retail, have been cut 2 cents a gal. within the last 4 days, quotations prevailing at from 22 to 23 cents. Detroit prices, tank wagon basis, have been reduced 1 cent to 18 cents. Buffalo owners are paying 23 cents and in Albany prices are ranging around 25 cents per gal. New Yorkers are paying 23 cents a gal. in 1000 gal. lots. Gasoline in New York City may now be had at the Socony stations at 23 cents a gal., though, representing a drop of 3 cents since the beginning of last week. Louisville prices have received a further cut of 1 cent to 20 cents wholesale.

Gasoline Report Expected Soon

WASHINGTON, D. C., Aug. 19—The Federal Trade Commission met again to-day to consider the gasoline phase of its oil investigation that has been in progress for several months. It announced that the report on gasoline would be issued shortly, but those in close touch with the commission say the report will not be submitted before the adjournment of Congress. That the commission was co-operating closely with the Department of Justice also was learned When the investigation was first inaugurated, such co-operation was planned; any specific complaints in regard to gasoline prices were to be turned over to the trade commission and anything of interest to the Department of Justice was to be noted.

G. C. Todd, assistant attorney general in charge of anti-trust prosecutions, met with the commission to-day and listened to some of the information it has collected to report to Congress on the causes for the rise in the price of gasoline. The Department of Justice has kept an eye on the companies into which the old Standard Oil Co. was dissolved under the supreme court decree several years ago, but never has discovered evidence to show that decree has been violated. Mr. Todd declined to discuss the value of the evidence collected by the trade commission, but it was understood that so far the Department of Justice had not determined whether there was new information in government hands to warrant proceedings.

ACCESSORIES In South America

No. I

With 30,000 U. S. A. Cars in Argentina There Is No Doubt As to the Great Value of Field

By David Beecroft

"IT is hard to do business with the accessory manufacturers in the United States of America. I carry a stock of accessories here worth $50,000 United States gold. I sell the majority of my accessories to be paid for in 60 and 90 days. I cannot sell for cash. If I try to the buyer goes to three of four other places in the city."

Antonia Prado, owning and conducting one of the largest supply houses in San Paulo, Brazil, so summed up his attitude with regard to our accessory makers. Señor Prado only said what several other supply houses in different parts of Brazil and Argentina told me at different times. There was a startling unanimity of criticisms from many different cities within the course of a few weeks. They all told the same story:

"It is hard to do business with United States of America accessory firms."

There is literally no reason for such a verdict being lodged against us. These South American accessory dealers and supply house people want our accessories. They want our accessories because in many instances they cannot get any from France, England, Germany, Belgium, Italy and the other European countries they have been in the habit of buying from.

Again: They want our accessories because to-day there is a lot of U. S. A. cars through these South American countries, and it is imperative that owners of these cars secure necessary accessories.

Speedometer Shortage

Take a few examples: The majority of Ford cars sold in Argentina, Uruguay, Chile and Brazil are sold without speedometers. A car owner on the Argentine pampas is just as anxious to know how far he goes in a day as a motorist in New Jersey or Connecticut. You have more need for an odometer in Argentina and Brazil than you have in New York State or Pennsylvania. In Argentina, through the country or camp, you travel uncharted roads and have every need for the speedometer and the odometer. The same is true in other countries such as Chile, Uruguay and Brazil.

Try to buy U. S. A. speedometers and you cannot buy them in many places; in fact, it is the exception if you can buy them. We tried in four different cities outside of Buenos Aires in Argentina and could not. These supply houses generally buy from the three or four large houses in Buenos Aires, but complain that they are not able to get supplies in quantities. They may be able to get three or four or perhaps a dozen speedometers, but that does not in any sense meet the requirements. Two of the supply houses in Buenos Aires showed quite a don't-care attitude toward our cars and accessories. One house has strong German sympathies and the other leans strongly to the French. The third and perhaps the largest is very favorable to U. S. A. goods and is eager for information on the accessory field in U. S. A.

¶ *This is the first of three articles outlining what accessories there is a good market for and what business principles should be followed in the business.*

Delays on Shipments

This speedometer example can be applied to other lines of our accessories. Here is example No. 2:

While in Rosario, a city of 400,000, and 6 hr. by train from Buenos Aires, the following information was given before I had an opportunity of getting properly seated in the office:

"On Jan. 16 I placed an order for U. S. A. accessories through a New York shipping house. Under date of March 22, I got an acknowledgment stating the goods were being shipped by same steamer and would arrive by the end of April. To-day it is June 5 and I have not heard of the goods. I am out of stock and cannot get any in Buenos Aires. I am sending a second order to this same firm. I do not know when my first order will arrive, but I must have goods and am placing a second order and I may have to place a third order before I get the first order of goods. The U. S. A. cars are selling around here and I need these accessories."

This is a story you will get in seven or eight different cities in Argentina. It is a story I got in Uruguay, and it is similar to stories I got at two cities in Brazil.

Before trying to answer why it is hard for the supply house men and accessory men in Argentina and Brazil to do business with us, let us see if the possible field in Argentina is worth while. We take Argentina first because it is the greatest field for U. S. A. cars, trucks, tractors and accessories in South America.

There are many accessories which we manufacture that will prove popular there, and are proving good sellers to-day. In perhaps twenty supply houses in ten or twelve different cities in three different countries we went over a good percentage of the accessory stock on hand to see what U. S. A. goods were being carried and also to ascertain what lines were proving good sellers. We found a fair repre-

sentation of U. S. A. goods and saw many articles that are big sellers. We found many lines of French and German goods and also many English, Italian and Belgian lines.

Thirty Thousand Cars in Argentina

From a careful canvas of all sources there are approximately 30,000 automobiles in Argentina. Here are some figures on automobile imports that very nearly give this total:

Argentine Total Automobile Imp.	U. S. A. Automobiles Imported
Prev. to 1905..3,517 cars imported	1905 to 1909..... 333 cars
1905 to 1909... 244 cars imported	1910..... 217 cars
1910...1,581 cars imported	1911..... 489 cars
1911...2,461 cars imported	1912..... 708 cars
1912..4,281 cars imported	1913.....1,296 cars
1913..5,515 cars imported	1914.....2,100 cars
1914..3,004 cars imported	1915.....1,400 cars
1915..1,838 cars imported	1916.....4,444 cars
1916..4,444 cars imported	

These 30,000 cars, of which 8000 are U. S. A. cars, require many lines of accessories that call for frequent renewal. They call for certain supplies not falling in the line of accessories that can only be supplied by U. S. A. to-day. These 30,000 cars call for certain garage supplies that can really only be obtained from this country at present. The accessory market for these 30,000 cars exists, thanks to no special efforts we have taken, but due to the misfortunes of others. These 30,000 cars are literally asking for our accessories and yet we are not even making it easy for the supply house people there to do business with us. This is their outspoken verdict.

What does 30,000 cars mean as a possible accessory field?

Hand Horns in Demand

Some of the best U. S. A. sellers are hand horns, soaps, body polishes, spark plugs, speedometers, batteries, vulcanizers and dry cells.

Hand horns are very good sellers, but we rarely saw more than one or two different makes. Each of the 30,000 cars in Argentina is a prospective market for a hand horn. The field is large enough to warrant our large horn makers starting after. They should at least get their feet firmly on the ground. Very often when you asked where the dealer bought the goods he remarked, "From a New York exporting house." As to why he did this the answer came that so many of the accessory houses were hard to do business with. They had not Spanish stenographers, they did not know how to properly pack goods for ocean shipment and there were other excuses. These dealers were willing to pay an exporting house 2.5 per cent more for the goods solely because it was easier to do business in that way than with the manufacturer.

If our accessory manufacturers are asking themselves if it is worth while going after export business or not, let them not forget that during the fiscal year ending June 30, 1916, practically 8.5 per cent of our entire automobiles manufactured were exported. Where these exported cars go our accessories should follow. We are to-day becoming an exporting nation of such proportions that our makers must seriously consider this export question. We have a big export business to Europe, Canada, Australia, South America, West Indies, Africa and Asia. We can scarcely afford to close our eyes to the magnetism that our cars exert in these countries, and it is poor business if our accessory makers do not at least try to follow in the wake of our car builders in the export field.

Requests for Polishes

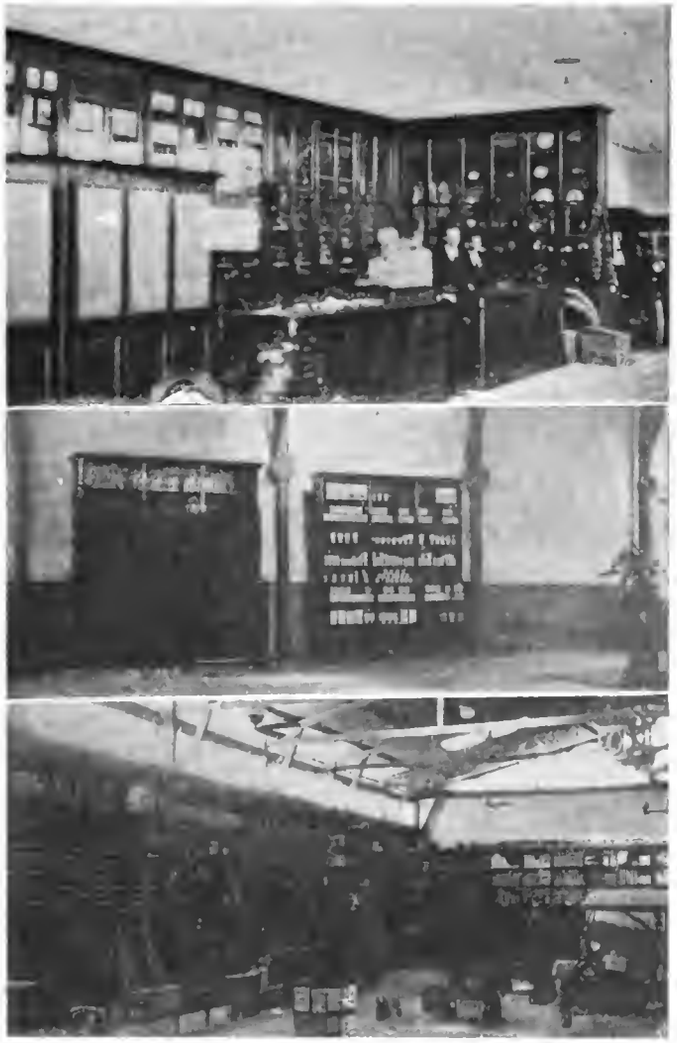
Metal and body polishes are good sellers in South America, where many of the chauffeurs are required to wash and polish their own cars. It is very common to do this, particularly where the cars are kept in individual stalls under lock and key. The driver is entirely responsible, and if a single scratch appears he is looked to. This means a very wide market for polishes. One or two supply house men wanted such in litre cans to retail at 75 cents, United States gold.

There is a brisk market for soaps and hand cleaners. Where each chauffeur becomes a body polisher it is essential that he have plenty of soap. More soap is needed per car per month than with our system of washing where four or five men in one garage wash 100 cars. We need soap for four men, whereas South America needs it for 100.

Spark Plugs Very Strong

Spark plugs are fine sellers. In nearly every supply house you see three or four makes of U. S. A. plugs, three or four French makes, one or two German, a couple of English and perhaps one Italian. You meet with Champion, A-c, Bethlehem, Mosler, Grossman, Splitdorf and some others. One criticism applies to nearly all of our plugs sent to

Goodyear tire establishment in Buenos Aires, Argentine Republic. This is typical of the high-grade accessory quarters and also illustrates the Spanish tendency of the South American architecture. The wide street should be noted. This is also typical of Buenos Aires



Top—Cadillac agency supply department in Cordoba, Argentine. Center—Valentine varnish display in Cordoba accessory store. Lower—U. S. A. accessories on shelves in a Cordoba shop

Argentina and Brazil, namely, that prices are marked on the cases. The same pasteboard boxes seen in Chicago or Kansas City supply houses are seen in Buenos Aires, Rio, Sao Paulo. This is bad. If a spark plug sells for $1 in New York it is a certainty that it cannot sell for $1 in Buenos Aires. The sign $ is the same in Buenos Aires that it is in New York, but the $ in Buenos Aires stands for only 44 cents of United States gold. In Buenos Aires that plug may sell for $4. You readily see the difficulty of a dealer trying to convince the buyer to pay $4 when the sign in plain figures on the pasteboard box is $1.

Our spark plug people who do business direct with Argentina should leave all prices off their goods. You should get special boxes with all reading in Spanish and leave the price off. Germany learned to do this some years ago and very often when you see German plugs they are in neat pasteboard boxes with the reading in Spanish. The Argentines like such. It makes sales easier. For Brazilian trade have the prices left off and print the reading in Portuguese.

The South American dealer has his troubles getting spark plugs into the country. Here is what a large supply dealer in Cordoba, Argentina, told me, and substantiated it by documents. Cordoba is a city of 140,000 located in the central part of Argentina and a night's ride by train from Buenos Aires.

The dealer has constant troubles with the custom authorities: He buys them in cases of a dozen, and out of each case there is stolen in the customs two plugs. He pays $5 United States gold in New York for the dozen and has to get his profit out of the ten reaching him. He has to add $3.52 for freights, customs, insurance, etc., so that the plugs cost him practically 85 cents United States gold each. He sells them for $1.32 United States gold each in order to break even.

This custom house trouble is not new in many of the South American countries. Very often several of such small articles are missing and the custom officials seem so strongly entrenched in their positions that nothing remains but to accept the inevitable. While in Rio de Janeiro a U. S. A. citizen had a 3-lb. box of chocolates forwarded from a friend in New York. It took nearly a week to get the box through the customs. Three different custom authorities were engaged in the job, and when the chocolates finally arrived the entire top layer was missing. There was no use complaining. The trouble is not local to automobile accessory concerns, but unfortunately is a serious one in South America, and one that must be settled sooner or later.

Need Tire Vulcanizers

Reverting to the accessory field, there are many other U. S. A. lines that you already see in South America, but which have been purchased through New York exporting houses and the makers may yet be ignorant of the fact that their goods are on sale in South America. You ask every supply manager where he buys his goods and he generally replies that it is through an exporting house. It astounds you to think that some of our largest accessory houses are not selling direct to these large South American dealers. Selling direct would give their goods better representation and the maker would be much closer to the market.

Our tire vulcanizers are not well represented. Every one of the 30,000 cars in Argentina has tire troubles, and they are just as careful of their tires as we are, in fact, more so. There is a good market for small vulcanizers, such as chauffeurs can use. There is also a good market for shop vulcanizers, for nearly every garage is well prepared to look after tire repairs. We saw in Cordoba one of the most up-to-date vulcanizing departments that could be found, the goods all coming from a U. S. A. house.

Weed chains are strong sellers in every part of South America where U. S. A. cars are sold. Many Ford dealers sell the chains as a part of the car equipment. The same is true with several of the other makes. Our cars are generally going into the camp or country where roads are not good in many places, but where the cars must go nevertheless. Chains are an essential. Oversize tires are generally sold. Every Ford dealer is stocked with Weed chains, but in many places their stocks were running low in June.

Ford slip covers are popular and good sellers. All South American countries are favorably disposed toward slip covers for seats. They are universal in the cities and the demand for them in the country gives good promise.

Gear Blanks Needed

Forge companies can do a fairly good trade in gear blanks of all sizes. Many of the large dealers in Argentina and Brazil are well equipped with gear cutting machines. You will see some of the finest German, Swiss and French machines, but too few of ours. These gear cutters will handle any size of spur or bevel used in an automobile. The dealers found it good business to fit up with such machinery.

There is a good market for steel stock in all bar sizes. The large accessory supply houses handle it.

In every supply house you will see spring clips of all sizes and similar forgings for cars. It is impossible to mention what accessories are not needed in South America. The same accessories that we use they will have to use. There did seem to be a dearth of shock absorbers, particularly the cheaper types that are in such general use on Ford cars in

U. S. A. With bad roads the rule in Brazil and Argentina it is certain that the shock absorber business will have a good field.

Paint and varnish concerns have a relatively strong field. There is a great deal of car repainting in the cities, but not so much in the camp. One supply house dealer had a large stock of Valentine goods, and had them well displayed in a special show case.

Brake Lining Needed

There is a good market for various makes of U. S. A. asbestos-copper brake facing and facings of other compositions. You meet with one or two makes, but frequently find that a supply house is short of many sizes. Keeping an adequate stock is a problem. The supply house man orders only fair-sized lots because he pays cash or sometimes cash against document in New York. In order not to keep his money tied up too long his purchases are not so large as they should be. Selling on 90 days' time will solve that difficulty and result in larger sales. The U. S. A. maker can charge, perhaps, 8 per cent extra for the time, and in addition will find his sales increasing.

We found very general requests for priming cups and grease cups. Solely because you have to cross the equator to get to Argentina is no reason to imagine that it is always hot there. Argentina has its seasons just as we have. It has its winters, and they are cold. We were there in May and June during their fall, for their seasons are directly opposite to ours, and although we wore our New York winter overcoat we were colder than in New York in February. It gets very cold in Argentina, and you feel it more so because the buildings are not heated. Garages are not heated, and naturally a car gets very cold, making priming cups an essential. There was a shortage of them in one or two places.

Grease cups of all sizes are needed. For European cars the metric thread is best, but for U. S. A. cars our standard threads will do. It would be beneficial to us if we used the metric threads on all of such parts, as it would simplify our export trade.

Big Bearing Field

Our bearing concerns are not so well represented as they should be. One of the surprises that meet you when looking through large accessory supply houses and in many garages is the large stock of bearings carried. I have seen two shelves over 12 ft. long each piled nearly 1 ft. high from end to end and for nearly a foot in width with various sizes of French, English, German, Swiss, Italian and Belgian ball bearings. You soon see the reason. Argentina is 3 weeks from Europe, and it is necessary to keep very large stocks. We found New Departures in one or two places; we found Hyatts stocked in a few places, but looked for several other makes that should have been represented, because of U. S. A. cars being sold, but could not find them. Our ball and roller bearing makers should get into the South American field. They will have to supply bearings for the U. S. A. cars, but there is no reason why our ball-bearing makers should not be supplying for a percentage of the European cars. The field is there. We must get after it.

Demand for Lamps

A brisk demand was noted for hand electric repair lamps. So many of the European cars use acetylene lighting that the electric repair lamps are good sellers. There is in this connection a good possible market for the individual electric searchlight which we fit to the frame of the windshield and operate by hand. The Argentines are fond of attachments, and their poor roads would make such a lamp very attractive. Lamps are heavily stocked in all supply houses.

Several requests were made for top-covering materials which are cut and ready to be used in recovering such standard models as the Overland, Ford, Buick and others. Tops are not given good attention in Argentina; in fact, all of our cars going into the camp get rough usage. Sometimes they are never under cover for months. To make a speedy top-recovering job these tops, cut ready to be applied, are much in demand. The life of a top in Argentina is considerably less than the life of one in our own West.

Ford Dealers Good Sellers

Nearly all Ford dealers carry a large stock of accessories, including two or three tire lines. The Ford dealer in Cordoba, Argentina, has the whole side of his shop occupied with one large showcase with glass front. It is filled with Ford spare parts and all of the accessories he can get. He was short of Ford accessories in June. He can sell 200 Fords per year if he can get them, and as all cars arrive without speedometers he was particularly anxious to get such lines. He does not want speedometers that read in miles per hour, but they must read in kilometers per hour.

(To be continued next week)

Studebaker agency along a South American automobile row. In a great many instances in South America the dealer in cars will also carry a wide range of supplies both for automobiles and other purposes. The illustration herewith shows an agency which is devoted to the sale of Studebaker cars and which is typical of the case where an American maker has secured a firm foot-hold

British Idea of Inexpensive Car Vastly Different from American

Suggested Chassis for Quantity Production in England After War Has Many Novel Points—Elimination of Moving Parts Studied with Exceptional Thoroughness

OUR British contemporary, *The Automobile Engineer*, has in its July issue a suggested specification for a car which the author considers could be produced in England after the war to sell for $800. In the light of American manufacturing experience there are many points which are highly debatable: for instance, it is stated that if a four passenger car could be sold for $800, the two-passenger roadster ought not to cost more than $750, which suggests a misconception as to the relative cost of bodywork made in a modern fashion. However, the article is not concerned so much with the details of cost as to show the general way in which cost can be cut and to "convey some impression of the *kind* of chassis that is required, as it is feared that the average British manufacturer starting on the production of a quantity car will inevitably end up by producing something of a quality in excess of what is required for the market and the purpose for which the chassis is intended."

As such it certainly creates thought. The authorship is not stated, but it is easy to see that American practice has been studied carefully, has even been taken to greater lengths than any engineer in America has yet dared to carry it. Another striking point, wherein the chassis differs from American practice, is its lightness of detail. The enormous overhang on the front axle and the almost flimsy construction of the rear axle would be suitable to the smooth highways of the old world, no doubt, but hardly in a rougher country.

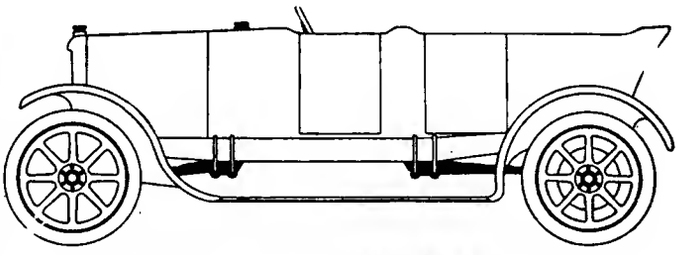
Doubt About Spring Suspension

The author himself is obviously doubtful about the spring suspension. With the points of attachment so close together the "spring base" of the car becomes so small that rolling and plunging would seem almost certain faults. It is rather surprising that this suspension should even be considered as practicable in a country where high speed is the rule. There would seem to be possible advantages in shortening the wheelbase somewhat and reversing the rear springs so that they are attached to the rear end of the frame and point forward to the axle, as was done with marked success on the baby Peugeot, which has the same type of shackleless springs. Even a cross spring at the rear would seem better than the type suggested.

However, it is not fair to criticise without quoting the author's own description of his ideas which follows:

"The main points that have been borne in mind in the chassis lay-out given are economy in detail manufacturing costs, economy from the point of view of erecting shop costs, and economy of attention when in use. The last-named objective is a most important one, and to carry out this scheme all possible 'attention-requiring' points must be eliminated. No greaser or oilcan hole must occur in the chassis. On this account fixed cantilever springs fore and aft are adopted. These are rigidly clipped to both axles and frame, so that the use of shackles, spring bolts, etc., is avoided, and the suspension thus embodies no moving parts.

"For steering connections the O.S. bearings or bearings of this type are suggested. The O.S. bearings are American productions, and are of a nature that is different from ordinary British practice. The wearing or bearing surfaces consist of compressed graphite impregnated material that needs no attention in use. In this way steering or other likely parts are made self-lubricated, or lubricated statically instead of dynamically.



Exterior appearance of British idea of an $800 quantity production car

"The engine, clutch, gear, and steering formed an integrally oiled unit in the original lay-out, but from the viewpoint of production economy it was deemed advisable to separate the steering gear, the advantage of self-lubrication of this unit scarcely warranting the extra complexity involved in the casting. This is a debatable point, and it may still be found advisable to combine the parts in the manner suggested. Both foot and hand brake actuation is by cable—an arrangement that gives at once compensation and freedom from pin joint and other 'attention-needing' spots.

"By reference to the general arrangement of the chassis it will be seen that, for side members, two straight channel pressings are proposed. They are of good deep section at the center, tapering away at either end, and are set up at the rear to allow for back axle movement. Being without curves or formed dumb-irons, economy is effected in die costs, and also in production prices, as the shaping of the dumb-iron bend on a side member adds considerably to its cost; moreover, even when the channel has been bent and completed, the actual dumb-iron brackets, either castings or stampings, must be provided.

"Four cross members are used, the rear cross member being strongly reinforced by angle plates to insure stability endways. At the front of the chassis the two engine arms, by being made of particular strength, might be employed to serve as a cross member, so that the extreme front cross channel might conceivably be eliminated altogether. This cross member, instead of carrying the starting handle, has a starting handle bracket that is blanked off by a cap fitted in front, as is usual where a starting motor is installed. In the event of the front cross channel being eliminated, an extension of the timing gear cover casting could be arranged to form the starting handle bracket. If this scheme were adopted, it would be as well to carry the engine feet as far forward as possible on the crankcase. The steering box is attached by the engine foot bolt, an arm on the box clamping between the engine arm and the frame block. This enables the steering column angle to be readily set for two or four-seaters. A steering column bracket on the dash insures rigidity.

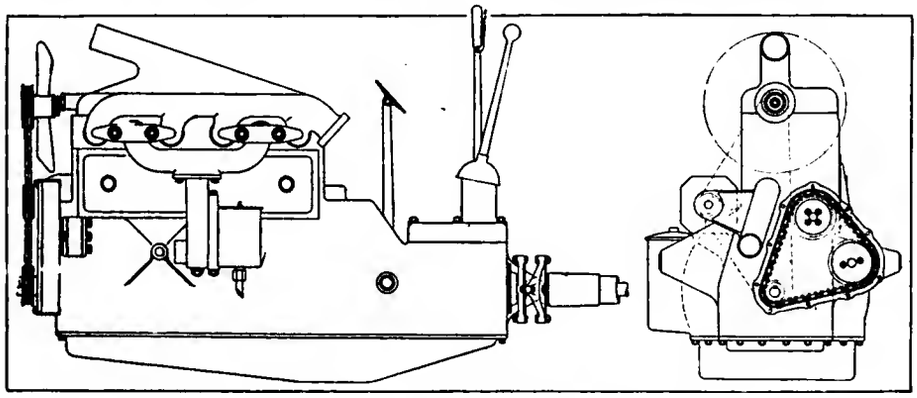
"The springs—fixed cantilevers front and rear—are bolted direct to the underneath of the channel section by clips circling completely round the side members and springs. The extremities of the springs are, as previously mentioned, clipped rigidly to both axles, half the spring end being turned down and a corresponding turn up on the spring seating being used to form a natural register in both directions to avoid any necessity for doweling or machining of spring seatings in order to obtain location.

"This system of suspension offers many advantages from the viewpoint that has been adopted in this particular lay-out, as not only does it give extremely low cost in manufacture and erection, but it is also in line with the minimum of attention and trouble ideal upon which this, and for that matter most future cars, will be laid out. There being no spring pins, spring bolts, shackles, greasers, etc., the suspension should last indefinitely, provided the springs themselves are wrapped up. While considering this system, it is as well not to overlook the fact that it possesses one or two rather obvious disadvantages. If the system is adopted without tie or radius rods, as shown in the drawings, it will evidently be necessary to have as light an engine as possible. The lateral stability of such a system is poor, and too much mass directly over springs of the type shown is inadvisable, and would inevitably make the front of the car roll. A further point is that, having one coupling point only to the frame, breakage of a spring might prove more disastrous than in the ordinary semi-elliptic lay-out. Much depends upon quality of material and design, and with care such an arrangement should be safe enough; it has been employed on one or two chassis of light build, and is apparently satisfactory.

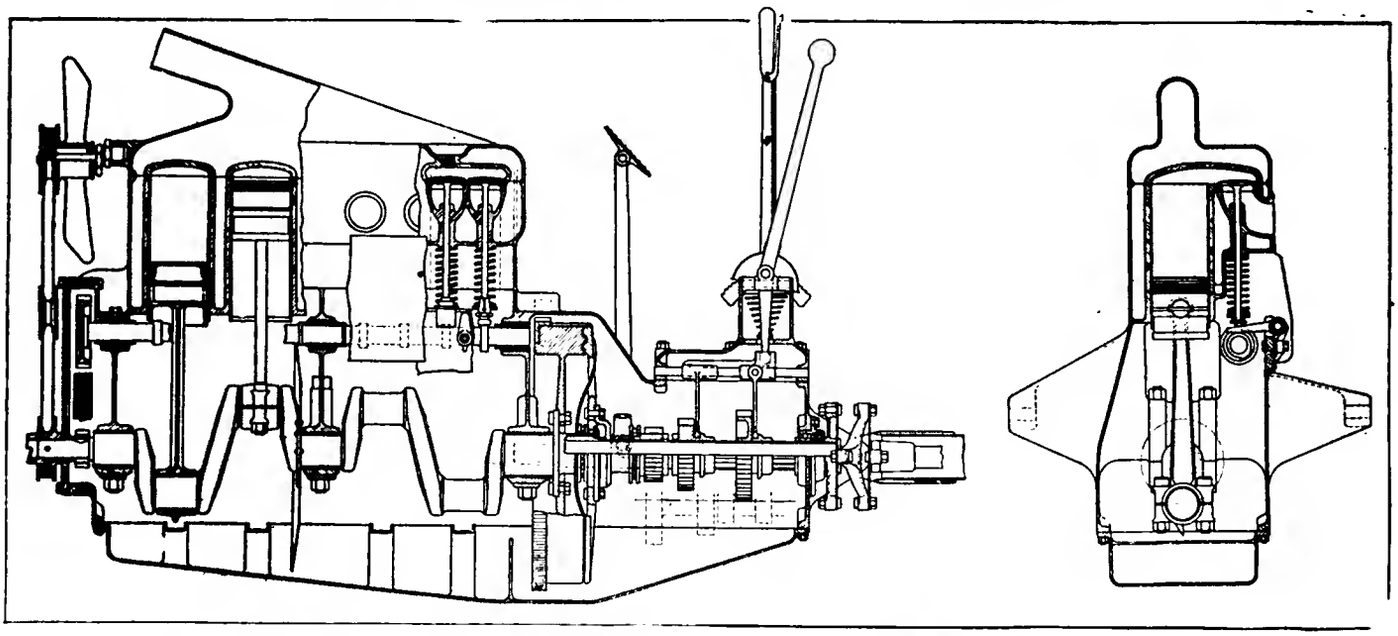
"The lay-out in these pages is for a 3⅛ in. by 4¾ in. engine, but evidently the general scheme is applicable to an engine of anything about this size; 3½ in. by 4¾ in. would probably be better, but it seems, however, that 3⅛ by 4¾ in. certainly under present and possible future persecution will be all that any ordinary human being will be able to pay for; moreover, fuel prices and probable shortage even after the war will make small capacity engines essential. The engine body and cylinders are a one piece aluminum casting with the gear box also. Separate cylinder linings and valve seats will, of course, be necessary with the material proposed, but aluminum gives so many advantages in other ways that it will probably not be found an unpractical arrangement, assuming normal material prices. This proposal, particularly with the large size casting outlined, is admittedly an optimistic one; whether or not we have a firm of founders in this country capable of tackling such a job is an open question. The proposal, however, is not an impossible one, and with a large output would be worth while. In any case, slight modification of the casting—such as the provision of a vertical joint somewhere in the flywheel or clutch region—would make the casting problem much simpler. This arrangement, nevertheless, would add to machining and erecting costs, and on that score would be best avoided.

"Aluminum pistons would be used, the gudgeon pin being probably fixed in the connecting-rod and turning in the piston.

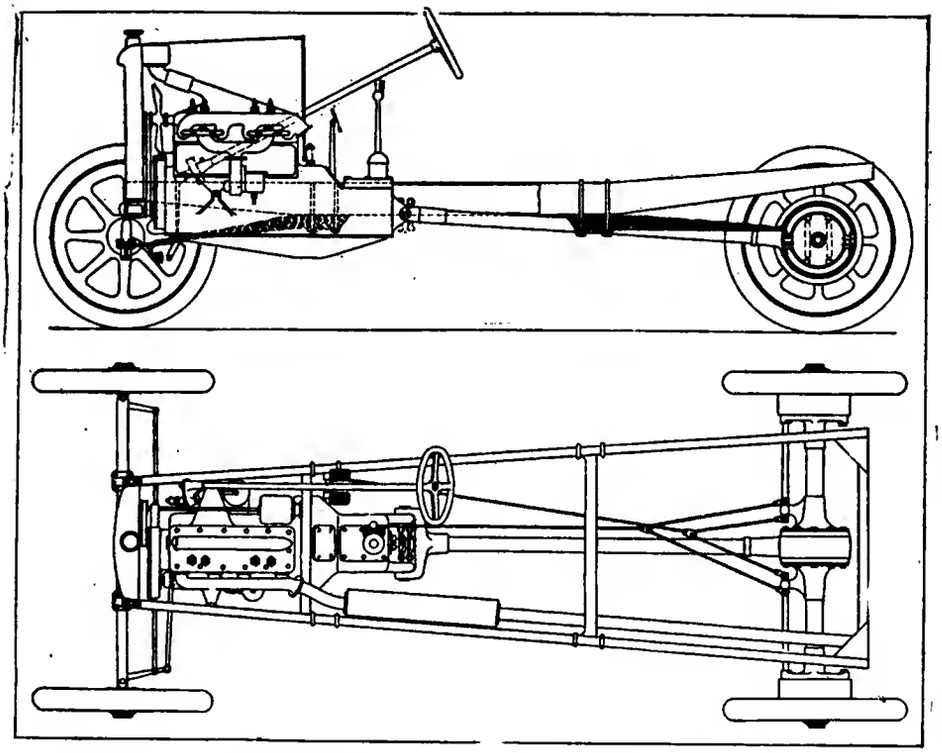
A detachable head with integral water outlet that can also be of aluminum is suggested. A chain-driven camshaft is proposed, the chain extending in triangular form, as seen in the front end view, to drive also the distributer. For chain adjustment the distributer, and its driving wheel, slide in the timing gear case, the joint face on the outside of the casing being covered by the flange on the distributer bearing. Slots in this flanged bearing permit of the necessary sideway movement.



Exterior of unit power plant to be used in a British low priced large production automobile



Section through motor suggested as suitable for a low priced car to be manufactured in British shops



Elevational and plan views of a low priced chassis, suggested for British production

"The water inlet pipe to the cylinders from the bottom of the radiator is incorporated in the main casting, and will be seen alongside the timing gear in the end view of the engine. On the side of the inlet water pipe the dynamotor driving spindle bracket is shown—also cast on—an arrangement that would probably make more for complexity than simplicity. The better plan would probably be to bolt this on as a separate part. The water pipe butts against the pipe on the bottom of the radiator, a rubber ring being employed, making a joint against the faces or ends of the pipes in place of the usual hose pipe type of connection.

"Obviously the main casting is sufficiently complex as it stands, and for this reason the inlet and exhaust branches are separate, being attached to the cylinder by dogs and clamping set-screws.

"With an aluminum cylinder block there is not much option as to the matter of making the exhaust branch separate or otherwise, as aluminum is scarcely suited to be the first receiver of hot and unexpanded exhaust gases.

"With a view to economy, it is suggested that the usual valve pressers and guides be done away with and a rocking lever system of presser be substituted, an adjustable end to the valve being used in place of the usual method of valve adjustment. This arrangement lends itself to economical construction, as all the rocking levers can be threaded on a tube with tube distance pieces, the whole assembly being then clamped against the front of the casting.

"With the general lay-out of gear and clutch shown it is evidently of vital importance to reduce to a minimum the length of the mainshaft. It is quite possible that the length of the unsupported mainshaft in the arrangement shown will produce a noisy box. On the other hand, with a view to economy, it is important to keep the number of bearings to a minimum, and on these accounts a compact narrow clutch is imperative; further, all increase in clutch length and movement means increase of shaft length, so that the reasons for the arrangement shown are fairly evident. It is difficult to arrange an economical design of the ordinary single plate clutch, the actuation for clutches of this type being usually fairly costly.

"The splitting up of the cone surfaces into steps will increase the speed of engagement in direct proportion to the number of steps, a clutch with a large number of steps giving practically instantaneous clutching if arranged with the cone usual angle. On this account the angle of the clutch cone becomes much greater than usual, the angle in the clutch illustrated to transmit the necessary power coming out at about 60 deg. to the horizontal with the leverages adopted, and using a spring requiring reasonably light pressure at the pedal pad for disengagement.

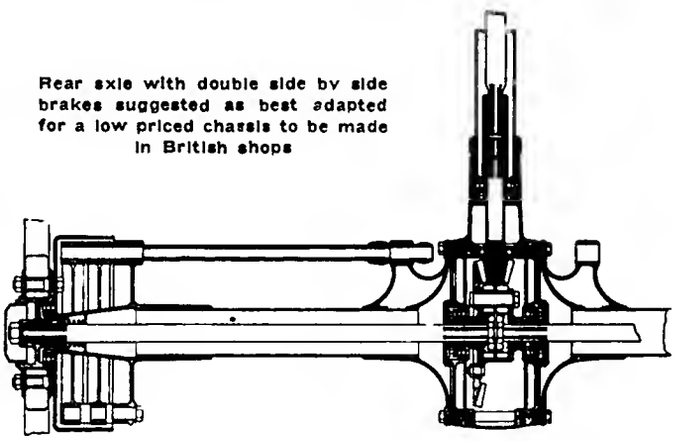
"Three speeds and reverse are suggested for the gearbox, with all sliding wheels arranged on the mainshaft. The selector, or striking lever, gate and selector mechanism, are all in a single casting that forms the gearbox cover.

"With regard to oiling details, considerable economy over the usual systems must be effected, and it is suggested that for the purpose of oil delivery a large pressing or spinning should be attached to the crankshaft center to form an oil thrower. Oil is lifted from the central portion of the sump, and thrown up into the delivery well or collector, seen on the off side of the engine body. This pot or collector forms also the oil filler, and has been arranged so that oil delivered into it is filtered, and feeds the four troughs under the big ends. Oil will inevitably be delivered by the thrower faster than it can run to the troughs, and a higher level overflow from the collector delivers to the gearbox, whence the oil flows back to the sump over the central dividing web into the crankcase, maintaining a constant level in the gearbox, and circulation to all parts of the system without much expense, complexity, or the use of an oil pump. The usual oil wells would be provided for the camshaft and crankshaft bearings to hold the splashed oil.

"With regard to arrangements at the rear, it is suggested that a torque tube be employed sliding in a T-piece of broad base that fulcrums on pins through brackets on the gearbox.

"The rear axle lay-out, as shown, is necessarily very tentative; that is to say, in certain particulars it depends so much on what is obtainable in the way of large-sized pressings. On this account the outer casing construction is extremely difficult to settle. That shown in the drawing is a large diameter tube with castings at each end, the one being the differential box end or cover and the other the axle tube end and spring seating. Both brakes are on the rear wheels,

Rear axle with double side by side brakes suggested as best adapted for a low priced chassis to be made in British shops



Measuring gasoline and on the road on the King test

King Economy Test Over the Road

From Pittsburgh to Milwaukee Under Touring Conditions Average Over 14.6 m.p.g.

CHICAGO, ILL., Aug. 19—A fuel economy test under actual touring conditions over the roads from Pittsburgh to Milwaukee has just been concluded by a King eight-cylinder, seven-passenger, stock touring car. The average was 14.658 miles per gallon of gasoline and 962.4 miles per gallon of oil. The run was in charge of F. E. Edwards of the Technical Committee of the American Automobile Association accompanied by A. A. A. observers.

In his application for a sanction Artemus Ward, Jr., president of the King company specified a car owner fuel test to be run under touring conditions. The association was asked to conduct the test in such a way as to determine the mileage that an owner would secure in touring and not a maximum economy record. No change in the equipment of the car was made.

The car left Pittsburgh at 8 a. m., Aug. 15 and travelled to Milwaukee by way of Youngstown, Cleveland, Toledo, South Bend and Chicago, covering all sorts of roads during the 616.4 miles. An average speed of 19.44 m.p.h. was made including stops and 22.67 m.p.h. excluding stops. Gasoline was measured to the fraction of an ounce. The car was the regular eight-cylinder King, 3-in. bore, 5-in. stroke, Ball & Ball carbureter, nozzle size 70, Atwater Kent ignition, Ward-Leonard electric units, Carter gravity feed, Champion plugs and Firestone tires. Mobiloil B was used and a Boyce Moto-Meter and a spot light were fitted. The car weighed 4250 lb. with full passenger load.

Summary of Stock King On-the-Road Fuel Test

From Pittsburgh, Pa., to Milwaukee, Wis.
Miles traveled, 616.4.
Gasoline consumed, 42 gal. 7 oz.
Oil consumed, 2.5 quarts.
Water consumed, 1 gal.
Miles per gallon of fuel, 14.658.
Miles per gallon of oil, 962.4.
Miles per gallon of water, 616.4.
Tires—finished on Pittsburgh air.
Miles per hour, including all stops, 19.44.
Miles per hour, excluding all stops, 22.67.
Number of stops at controls, 6; duration, 2 hr. 50 min.
Number of stops between controls, 7; duration, 1 hr. 41 min.

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a necessity from the point of view of economy in detail and erection, and wire cable is employed for the actuation of both brakes, as this gives a ready and inexpensive compensation, and eliminates the brake cross-shafts, brackets, etc., etc., with advantages both from the viewpoints of production economy and minimum of lubrication attention in use. Arrangement could be made to conduct a portion of the rear axle lubricant to the brake actuation shafts and fulcrum pins, so that no outside attention was required.

"It was originally intended to include among the published drawings an axle scheme without a differential. In the low-priced chassis the differential does not really justify itself, it having been repeatedly proved that tire wear on an axle without a differential is little, if any, in excess of that which obtains with a rear axle of the usual type. It is suggested that this is due to the fact that with a differential gear scraping of the tires results from wheel spin when one wheel only bumps, a happening that is avoided with a solid axle.

"If the 'differentialless' axle were adopted it would be necessary to arrange a clutching system to enable one wheel to revolve free if required, a small hand lever, similar to the gear change lever, and located in front or at the rear of the brake and hand levers, and actuating a dog clutch, being a likely arrangement. Thus, when the car was moved by hand, as in garage maneuvering, the one wheel would be released. It could also be freed even in the smaller maneuverings under power, such as backing into awkward corners, etc., etc. The saving in unsprung weight, resulting from an arrangement such as is outlined in the foregoing, is a strongly favorable point, apart from great saving in cost.

"The axle lay-out illustrated is still rather complex, and little in advance of the usual schemes, although a certain economy in fitting and erecting costs has probably been effected by arranging the differential box with separate sides, so that the bevels and differential gear may be erected and adjusted before the axle tubes are bolted up. In any case it seems impossible to effect sufficient economy, if the usual scheme with differential is followed at all, so that the rear axle without differential, or even a substitute, appears to be the correct arrangement in the circumstances. With a dog clutch, as already outlined, a practical working scheme should be evolved."

Some Comments

Regarding the combined casting for engine and transmission, it has not been the experience of either European or American engineers that the one-piece transmission and en-

Galvin in Sunbeam winning second heat after close race

gine is as cheap as the divided units with a bell housing attachment. The large castings are much more difficult to make, more troublesome to handle, and more costly to machine than the separate parts. The extra labor in assembly consists merely of doing up a dozen nuts, and the greater ease of putting in the gear and clutch parts separately from the engine assembly much more than offsets the saving in coupling the two portions.

One of the most interesting points is the suggestion for a torque tube as this would certainly cost more than would a Hotchkiss drive with half elliptic springs. The half elliptic springs, being lighter, would be intrinsically less costly.

Aluminum Powerplant

Another thing which is well worthy of note is the use of aluminum for the power plant, cylinder, crankcase and gearbox. This is absolutely new to British practice and is quite foreign to American cheap car convention. It means that the lower cost of upkeep obtained by lighter weight is thought so valuable as to offset the great saving possible by using cast iron instead of aluminum.

However, the most interesting thing of all is that this idea of what an $800 car should be contrasts so strongly with the sort of car an American manufacturer could put on the British market at this figure. Any manufacturer who in America is making a car selling for $650, could start a British factory on a 20,000 output, and reproduce his American model for $800 or less, quite easily. Putting it another way American production men and American engineers could show a British factory how to make something far less unconventional for the same money.

The author constantly mentions the fact that the car should not be finished too highly, that it must have no needless money lavished upon it, which means that he does not intend to give a better finish than that customary on the $650 class of American car. If this is so, then the cost ought to be less than the amount stated, if proper methods of production are employed.

Resta Easily Wins Speedway Grand Prize

Ralph De Palma Out Early in Race—Struggle for Second Place in Finals on Chicago Track

CHICAGO SPEEDWAY, Aug. 19—Dario Resta had a walkaway in the American Speedway Grand Prize Race held here to-day. With Ralph De Palma in his Mercedes out of the race early in the day, no competition remained to push Resta to anything like a close contest. The race was run in heats of 20 miles, the winners participating in the 50-mile final. Resta drove against a field that he apparently did not fear and after taking the first heat of 20 miles in 11 min. 42.6 sec., he easily won the 50 mile final at an even 100 m.p.h. The afternoon netted him $5,000 of the $10,000 prize money.

It was a close contest in the first heat for three laps between De Palma and the Peugeot of Resta. Then a cylinder head on De Palma's Mercedes blew out and after that it was all Resta. The fight for second place in the first heat was between Galvin in the Sunbeam and D'Alene in a Duesenberg who finished respectively second and third. Resta's average for the 20 miles was 102 m.p.h.

One of the best battles of the afternoon was found in the second heat, which Galvin took in the Sunbeam in 11 min. and 37.72 sec., or about 5 sec. faster than the heat won by Resta. Galvin's speed was 103 m.p.h. Lewis in the Hoskins made Galvin give his mount all it had in it and there was a margin of less than a car length between Galvin and Lewis at the finish. Galvin, Lewis and D'Alene ran one, two, three all through the second heat.

Lewis took the third heat in 12 min., 7.3 sec., his average being 99 m.p.h. D'Alene and Buzane, both driving Duesenbergs, were second and third, respectively all through the third heat. The fourth heat went to Buzane in 12 min. and 27.68 sec., his speed being 96.5 m.p.h. D'Alene crowded the little Greek hard, but could not head him. Milton brought his Duesenberg to the pits at the end of 14 miles in the fourth heat and Christiaens docked his Sunbeam at the end of 10 miles. The Belgian was having considerable trouble to

(*Continued on page* 335)

A close brush on the banked turns of the Chicago board track

Four-Wheel Drive for Heavy Tractors

By W. F. Bradley

Special Representative of the Automobile on the French and English Front

Renault tractor near the front pulling a heavy field piece up a steep incline

PARIS, July 29—From the time guns were invented until the opening of the present war, the only known means of hauling artillery was by horse traction. In the various small wars prior to the present war use had been made of armored cars, carrying machine guns or very light artillery, but there does not appear to have been a single instance of the use of the internal combustion motor for the haulage of heavy artillery. So far as the French army is concerned, it was only on the eve of the war that the military authorities had finally decided on the adoption of the four-wheel-drive tractor for hauling big guns. Although the type was well developed when war broke out, it is certain that the number of tractors in existence was small, and the number of officers and men trained to the use of mechanically hauled artillery was very restricted.

It is not necessary to state in what proportions horses have been replaced by tractors in the present war. This much is certain, however; all the more difficult artillery work can be done by gasoline tractors better than it can be performed by horses, and there are no positions accessible to horse teams which cannot be reached by mechanical means.

Notwithstanding this, military experts are of the opinion that the horse will always be retained for certain classes of artillery work, notably for the haulage of the lighter guns. It must be remembered, too, that it is easier to convert material than to change officers and men. Long training makes it possible for men to get better results out of old-fashioned material than it would be possible for them to secure for a certain length of time with a more modern and efficient material.

There is no secret about the types of tractors used in the French army. They were all described in detail early in 1914—before the war clouds had begun to form—and they have only been changed in detail since then. To the four French makes, Panhard, Renault, Latil and Schneider have been added the Jeffery quad and some Holt caterpillars. It is not possible to make close comparisons between the Jeffery quad and the three leading French makes, Panhard, Renault and Latil. The Jeffery is a light tractor without a winch not primarily designed for war conditions, and only capable of being adapted to the haulage of light artillery over made roads or moderately easy country. There are many conditions such that the most powerful tractors can only reach commanding positions by hauling themselves up the hillside by means of the winch and then hauling their guns or trailers up in the same way. The Jeffery type has its own field of usefulness, but is not built for this class of work.

Jeffery Quad on a 30 per cent gradient

Expert opinion tends toward the belief that the final type will be the four-wheel-drive tractor similar to the Panhard, Latil and Renault. Owing to its lower pressure per unit of area the caterpillar can travel over soft ground inaccessible to the four-wheel

Conquering Heavy Roads in France

Above — Rough going at the front with heavy load and heavy road

Left—Jeffery Quad near firing line subduing inclines and mud

Right — Ammunition trailer being hauled up steep gradient by tractor

Below — Renault tractors and Troy trailers ready for severe service

Workshops of a Portable Nature

Left—French artillery officer and Mr. Bradley on cross-country service

Above — An Italian tractor used by the French artillery. Note wheels

Right — Folies Bergeres artist now storekeeper at French tractor school

Lower—A wayside workshop, where emergency jobs are handled as they arise

French Artillery and Gasoline

1—*Renault putting a heavy field gun into position under difficulties*

2—*Hoisting the gun up an incline to put it in a suitable position*

3—*Latil tractor at the front crossing where no road exists*

4—*Renault tractor working along the firing line under difficulties*

driver, but this advantage is offset by its destructiveness of made-road surfaces, and officers who have had charge of both types for hauling artillery boast that with their four-wheel drivers they can do anything possible with a caterpillar.

Another type of tractor is represented by the Knox, Fiat and Isotta-Fraschini in Italy, and the Daimler-Forster in England. All these have been used in the war and important data exists regarding them. They are all, however, rear-wheel drivers, and as such incapable of doing some of the work possible with the four-wheel driver, or, as the French term them, total-adherence tractors.

All the four-wheel drivers mentioned above drive and steer at both ends. For a given wheelbase they have a turning radius considerably smaller than that of any rear-drive truck. There are, however, disadvantages in steering at both ends, for it sometimes happens that on very difficult hills the front wheels will get in one track and the rear wheels in another, making it a very difficult matter to move the vehicle. Such a condition only arises with the combination of a very steep hill, rough surface, and no width to turn. Because of this, one firm has produced a four-wheel-driver steering at the front only.

Training Tractor Crews

An interesting feature in connection with the four-wheel-drive tractor development is the training of crews to handle these vehicles. Quite independently of its truck and touring car schools, the French army has a special organization for the training of sub-officers and men in the driving and handling of tractors attached to heavy batteries. While it is comparatively easy to train men to handle ordinary trucks on made roads, and not exceptionally difficult to transform an intelligent soldier into a first-class chauffeur, it is a somewhat elaborate process to produce men capable of getting the best results out of tractors.

It is the conviction of the officers in charge of this school that a four-wheel-drive tractor can go anywhere, providing the surface is sufficiently resistant to carry the weight of the vehicle. But to pass through a forest, to climb over clumps of trees, to get up a 30 per cent gradient of natural earth, to slide a gun down a 60-deg. embankment and haul it out again calls for considerably more experience than the turning of a steering wheel and the moving of a couple of levers.

While many of the men received at the tractor school have had previous automobile experience, every profession and every grade of life is represented. A glance over the dockets of the men received for training revealed a comic artiste from the Folies Bergere music hall (incidentally he contributed to the gaiety of the army), an opera singer, a professional photographer, a working tailor, a solicitor, a footman, a taxicab driver, and a man of independent means. Naturally their ability is varied, but the material being of good quality and a spirit of emulation existing among the men, it is possible to make them all fit for artillery tractor service.

If the pupil has never previously driven an automobile, it is found that 15 days' instruction on an ordinary truck are sufficient to make him a passably good driver. After this he goes to the tractor section, and at the end of 3 weeks, on an average, is fit to be sent out to the armies in the field. In addition to his personal record card, each pupil entering the school is given a progress card divided into thirty-one numbered squares representing the days of the month. At the end of each day the number of points accorded by the instructor is recorded on the card, thus forming a permanent record of the progress made by the man during his stay in the school.

The driving instruction is of an intensely practical nature. In the neighborhood of the school is a large amount of very hilly forest land with a clay soil difficult to operate on after rain. The tractors distribute themselves in this forest, each vehicle having a dozen pupils aboard and being in command of a couple of sub-officers. The superior officers move about from group to group, supervising the general work and giving instructions as necessity arises.

When I was introduced to this school two Renault tractors were coming along a mud track by the side of a lake. Although weather conditions this day were fairly good, there was about 8 in. to 1 ft. of mud before solid earth was reached. A sharp right-hand turn brought the tractor into the forest, on a narrow, steep track just wide enough for one vehicle. The gradient being only about 10 per cent, the tractor worked its way along slowly, with a trailer in tow, without any difficulty.

After the 10 per cent gradient came a level portion, then a 32 per cent gradient for a distance of 150 yd., the track being rough earth with either high banks on each side, or thick forest growth. The trailer was unhitched and left at the bottom of this hill, the tractor advancing alone and paying out cable as it proceeded. The differential was locked, the sprag was dropped and two of the crew placed behind with big blocks of wood to scotch the wheels. On the most difficult portion a partially choked gasoline feed pipe caused a stoppage of the motor and necessitated quick work on the part of the men with the blocks of wood. When the full length of cable had been paid out the brakes were set, the wheels blocked and the winding drum put into engagement. Slowly the trailer was hauled up, the instructors meanwhile giving attention to the men who were handling the cable on the capstan and the winding drum, and also to the crew of the two men aboard the trailer. With only a few yards to go, and while on the steepest portion of the hill, the cable snapped. Quick work with the brakes prevented a mishap and the incident was taken advantage of to give a lesson in making knots.

The climb was accomplished with locked differential and chains on all four wheels. The previous day, after heavy rain, it had only been possible to climb this hill by the use of block and tackle attached to a stout tree, and when the first tractor reached the summit, it had to help haul up the second one.

Owing to the narrow width available, it is doubtful if horses could have got any load up this hill by direct haulage. In any case, animal traction would have been much longer and would have required a greater force of men than mechanical traction.

Rough Work in Training

After some work under easier conditions, but all over forest dirt roads, the crew was taken to a hollow resembling a huge shell hole. Here a Jeffery was found at work with a number of sub-officers who were being given a superior training to fit them for the handling of tractor crews. Here an officer gave a demonstration of how to take advantage of the nature of the ground. Sliding the tractor down the steep bank until it looked as if the tractor would stand on its nose, he attempted to come up the steepest portion of the bank. The first three attempts failed, the tractor attaining an inclination between 40 and 45 deg. and the motor then stalling. The causes of the failures were pointed out for the benefit of the pupils and other attempts made until after considerable difficulty the Jeffery reached the top of the bank. The private soldiers then went through the same tests with a Renault and a Latil tractor.

To get as near to actual war conditions as possible, a heavy gun was taken into a hollow assumed to be a suitable emplacement for firing on a distant enemy and the pupils instructed how to get it up a 60-deg. banking with soft surface and only just sufficient room to pass between the trees. This maneuver could only be accomplished with the use of a couple of tractors, both using their winches, and a considerable

Sometimes it is necessary to haul the vehicles over mere wagon trails

amount of block and tackle. It was explained to the men how to place the tractors and the tackle so as to use the available power to the best possible advantage. While some of the easier driving tests are being carried out, those members of the crew not required aboard are left at some convenient point and given a lesson in making knots, in splicing, and in fitting up block and tackle, for it is recognized that much of the value of a tractor lies in the ability of the men to use the machine intelligently.

Sub-officers, who will later command tractor teams, are given an entirely separate training. It is required that these men shall be really skilled drivers capable of taking a tractor over the wildest kinds of country, and capable of giving an example to the men of both skilled and daring driving. Great attention is also paid to their theoretical instruction, lectures being given them on the application of tractors to the haulage of artillery, and they are also made to spend a few weeks as apprentices in the factories manufacturing the army tractors. It is thus certain that they will possess a complete mechanical knowledge of the vehicles which will later be placed in their charge.

When an artillery battery is motorized it becomes entirely dependent on gasoline for its ammunition and other supplies. Thus during the period of training it is not necessary to haul a gun on every occasion; cases of sand can represent shells, food, gasoline, chains and other equipment which, under actual war conditions, must be taken to the gun with unfailing regularity.

Conferring Life Through Care of Finish

By M. C. Hillick

MORE care of the finish and longer life for the car is a shibboleth that may well be observed in an attempt to keep it from going prematurely to the scrap heap. This is the day of the metal car body, principally sheet steel, and it requires no chemist to tell us that rust and corrosion, once developed upon the surface, gnaw remorselessly at it until the metal collapses and buckles under the strain. To prevent this result is the chief concern of the car owner and the car maker, for in the last analysis the manufacturer profits best by making his products to wear to the utmost.

Grant that the brand new car comes from the manufacturer well painted and finished, and in other respects is a credit to his skill and reliability. It is bought by some one who takes pride in keeping the car in fine condition, and he starts out with that purpose in view. Lack of information of a practical nature leads him to neglect some of the vital points in care taking, with the result that rust starts at some of the exposed parts of the surface. The methods of prevention are simple but indispensable. The cure, if any, is correspondingly difficult. First, constant attention to the needs of the surface. The sheet steel, even when buried under the weight of much paint and varnish, requires constant watching, for here a little and there a little, the waspish sting of the rust nips at the metal, finds a niche to cling to and keeps on nibbling.

To begin, scrape the rust clean from the surface, using for the work a hook scraper and some emery paper, cleaning off all the corrosion and preparing a foot-hold for the rust-inhibitive metal primer. Touch the afflicted part with this material, and let it dry thoroughly. In due time fill the cleaned-out spot with enough hard drying putty to make the depression level with the surrounding surface. When this putty, applied smooth to lessen the labor of sandpapering, is dry, bring it down smooth and fine with sandpaper, and then coat with some of the body color, making the first coat to dry "dead"—that is, without gloss of any sort. Apply a second coat into which is stirred enough varnish to develop the necessary luster. Then when this coat has dried cuff the gloss off to match that of the finish, using for the work a piece of plush moistened in water and flicked across a bit of pumice stone flour to increase its erosive effect.

The above class of work may be performed by the car owner or the chauffeur, none of the details being too technical for the lay mind to master, nor the processes too intricate to accomplish. By keeping a close check upon the appearance and wear of the car, and taking any outbreak of the surface at its initial stage, the wear of the surface may be greatly prolonged, with the best feature of the finish consistently maintained throughout the life of the vehicle.

Rust May Develop

Perhaps the question may be raised as to the tendency of the cars with the oven baked finish to show rust development, etc. At the edge of panels, about the moldings, and where laps occur, there one needs to look sharply for corrosive manifestations, for here dampness finds a foot-hold and rust appears. Therefore, in addition to the prevention here indicated, take advantage of other precautionary measures, chief among which are the following: Light, ventilation, washing and renovation, and storage quarters.

The newly varnished car may safely be washed with clean, cool water which will serve to harden the varnish and increase its brilliancy, and keep it from spotting when used over muddy or dusty highways. When it is deemed desirable to use a feeder for the varnish—in a word, to renew its diminishing powers for service—then resort may be had to some of the reliable renovators and polishes now available. Use these mediums with judgment, and as often as the requirements of the service suggest, bearing in mind, meanwhile, that no renovator or polish is qualified to take the place or do the work for which the varnish of efficient and capable composition is designed.

Secret of Aluminum Piston Success

Errors in Design More Serious with Alloy than with Iron—Service Depends on Correct Proportions and Correct Alloy—Modified Theory of Side Pressure Distribution

By A. Ludlow Clayden

THE aluminum alloy piston has just completed its first year of usage as a stock part of an automobile. Thousands have been made both by the sand-cast and the permanent mold processes; tons of aluminum are to-day reciprocating within the cylinders of American automobiles. That the aluminum piston has been an absolutely unqualified success is only true in the cases where all the conditions have been correct. There have been troubles due to many different causes, but these troubles have been of a character which has allowed engineers to perceive the reason and to avoid it in future. Some manufacturers have had no trouble, others have had a good deal, but the average experience has been quite satisfactory. Considering how new a thing it was a year ago, the aluminum alloy piston has established itself with much less difficulty than most novelties, the set-backs have been comparatively few and their causes readily traceable.

Importance of Right Alloy

Among the many alloys used for casting pistons there are all sorts of mixtures of metals. Most alloys are kept a secret by the foundry firm which owns them, and most firms have now discovered the best alloy for piston purposes. It is a metallurgical question, complicated by the desire to cast as thin as possible so as to avoid wasting the precious metal in machining, and it is not yet possible to say that just such and such a mixture is the best for all purposes. It would be absurd to deny that wrong alloys have been used in the past year in some cases. A good many pistons did get out with too soft a metal, and these pistons have worn rapidly, too rapidly to make them commercially satisfactory. The bulk, however, have been of better material, harder and much more durable, and it is safe to say that hardly a casting firm in the business but knows more about the proper alloy and the proper method of casting than it did a year ago.

It is particularly noteworthy that the troubles due to wrong alloy have been almost all shown up by rapid wear and not by failure. Absolute fracture has been an uncommon fault. This means that engineers and aluminum experts do know the proper proportions for strength, that they knew them a year ago in fact; what remains to be settled finally is the best metal for surface durability and not the best metal for strength. If we can get the surface hardness the strength will be satisfactory with normal design for the parts exposed to stress.

Engineers are perhaps a little apt to forget that an automobile piston has two functions to perform. It has to transmit the driving force of the expansion and it has also to act as a crosshead. In a steam engine the piston is purely a piston, the crosshead which takes the side thrust of the connecting-rod is a separate part, better suited for its work than the piston itself. Light weight and limitations of possible height, together with the desire for simplicity, make a crosshead for an automobile engine altogether out of the question; it would be an absurdity, but having thus discarded the crosshead it must not be forgotten that the functions of this part have merely been transferred to the piston and the latter must therefore be designed once as a piston and once as a connecting-rod guide.

Gas engines of the stationary type have always had long, heavy pistons with a very large surface in proportion to the expansion thrust on their heads, so large a surface that the unit side pressure due to connecting-rod angularity is very small and durability correspondingly great. The early automobiles followed the gas engine and their pistons were designed in accordance with gas engine rules, but it was soon discovered that the length and weight of the piston could be cut down without trouble; the factor of safety of the gas engine was unneccessarily high for an automobile motor. Simultaneously a desire to reduce the bulk of the whole engine led to a general shortening of connecting rods, thus increasing the side pressure due to the angularity, and at the time of the introduction of the aluminum piston we had practically reached the limit of small piston surface and great connecting-rod angularity possible for iron pistons.

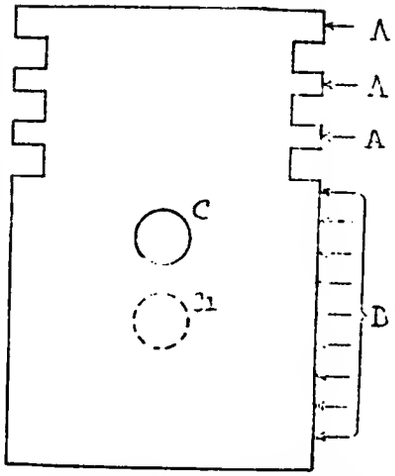
This being the case it was manifestly impossible simply to substitute a softer metal for the already very highly stressed iron; such a procedure was to court failure, yet many engineers took a chance at it. Those who did so and had no trouble really proved that their iron piston was larger surfaced than it need have been. The absolutely correct proportion for iron cannot be also the correct proportion for aluminum alloy.

Equalizing Side Pressure

In the design of pistons it has been a rule in gas engine practice to take moments about the piston pin, and to arrange the pin so that it is at the center of balance; *not* the center of the piston. The rings are neglected and the piston is regarded as touching the cylinder on the lands between the rings and over the skirt. A calculation on this basis will then enable us to locate the piston pin so that the unit side pressure between piston and cylinder wall, due to connecting-rod angularity, is the same at every point of contact. Neglecting the spaces occupied by the rings this will make the correct position for the piston pin a little below the center of the piston length. This is partly offset by the effect of friction which causes the proper position to be above the center, so, following gas engine practice, the pin position commonly is very little removed from the middle of the piston length, with the short automobile type of piston.

Now this assumes that the piston touches the cylinder on the lands between rings, and there is very grave doubt if this is ever the case in automobile practice. Firstly, the expansion of the head has to be allowed for to an extent which makes it impossible for the first land above the top ring ever to touch the wall. The case of the second and third lands is little better, in fact the clearances recommended for modern high speed engines are such as to prevent these narrow bands of metal from coming in contact with the cylinder. Thus, instead of neglecting only the spaces occupied by the rings, we have to neglect the whole

part of the piston which carries the rings. If there are three rings ¼ in. wide and ¼ in. apart, and the top ring is ¼ in. below the top of the piston head, there will be six ¼ in. which do not touch instead of three ¼ in. allowed for by the old formula. This means that when we begin to figure the piston as a crosshead we should imagine it cut off at the bottom of the lowest ring groove. Then we are left with the skirt, then add on top of it such rings and ring grooves as pin comes out at just a trifle above the middle of the skirt. In other words, we design a crosshead consisting of piston skirt, then add on top of it such rings and ring grooves as we think are necessary.



This shows the two ways of figuring the piston pin position. Including the arrows A (that is including the patches between the rings) the pin position to give equal unit pressure is the upper position shown. Neglecting all the ring-carrying part of the piston the position of the pin works out as shown in the lower place. Of course this is just a diagram and not in strict proportion

It is instantly obvious that the effect of this method of treatment is to increase the distance between the piston pin center and the top of the piston, which means that the height of the whole engine is increased a little unless we allow the bottom of the skirt to come well out of the cylinder at the bottom of the stroke. There is no harm in doing this, as the piston has little guiding to do when nearing the bottom.

If this new way of attacking the problem is the correct one, and there seems every reason to think that it is, then we must abandon the idea that the length of a piston should bear any definite proportion to its total length. Rather it may be suggested that the part of the piston below the rings should bear a proportion to the bore. For example, it is possible that a length of skirt or contact portion of piston should be provided equal to the bore. Possibly a little less than this is sufficient, but in a general way it is probable that length-bore is about right. With ¼-in. rings this means that the total length should be equal to the bore plus about 1½ in. for the ring carrying portion. Another possibility is that we may be able to place the rings closer together, having given up all idea that the lands between the rings have any function as a guide. For example, with ¼-in. rings it may be enough to allow 1/16 in. between each ring and ⅛ in. at the top. This adds up to 1 3/16 in. as against 1½ in. Experiments along this line are expected, so it may be found that it is possible to get sufficient guiding surface without a piston of *much* greater length overall than the present practice.

Effect of Expansion

Another matter that is affected by the precise alloy used is the clearance required. Some alloys have a much greater rate of expansion than others, and this means they require a correspondingly greater clearance. Luckily it appears to be the harder and better wearing alloys that have the smallest rate of expansion. Here again the dual function of the automobile is the thing which is causing the trouble. If the lower part of the piston which is really only a crosshead could be kept at a constant temperature it could be made a close fit in the cylinder and there would be no slap. Thus attempts have been made to so separate the head part carrying the rings, and the skirt part acting as the crosshead in such a way as to prevent the conduction of much heat from the head to the skirt. The earliest example of this sort of construction is, of course, the Zephyr steel piston which had a head and a skirt connected by a small diameter column in the middle.

Summing up the present situation regarding the aluminum alloy piston it may be said that every one wants to use it, but we are not yet able to state exactly how it should be designed to give long wearing qualities. In a year of use the question of the right alloy has been fairly well settled, and there are several alloys which are entirely satisfactory. We now want to find some means for reducing the unit side pressure, and some means whereby the clearance can be reduced a little more. Possibly the long piston is the answer, possibly some special form may arise that will be still better, but present appearances are strongly in favor of the long piston as the most probable answer.

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A Chance for Invention

ONE conspicuous blemish on nearly every seven passenger car is the two slots in the tonneau carpet which occur where the support of the folding seats goes through into the floor. However neatly the seats themselves may stow away into the back of the front seats, and many do now disappear completely, their presence remains obvious as long as the carpet has to be cut. In fact, the slits in the carpet are made all the more prominent by reason of the complete disappearance of the seat itself.

If the "leg" of the seat came away from the floor altogether and stood in a socket, this would not be such a disfigurement to a fine car as the present carpet slits.

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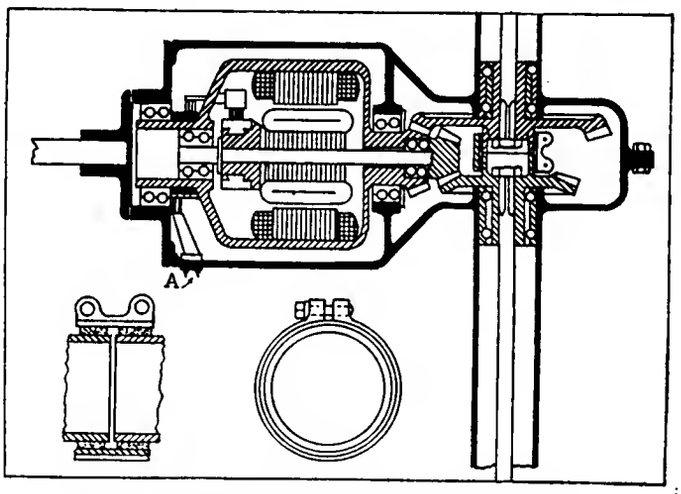
A Novel Drive for Electric Car Axles

A NOVEL rear axle drive for either electric cars or gasoline-electric has been invented by L. J. Monahan, mechanical engineer, Oshkosh, Wis. The apparatus comprises an electric motor mounted on the rear axle, the armature connecting one axle section by bevel gear and the reversely revolving field element connecting the other axle section so that the combination forms virtually an electrical differential.

A feature of importance is the frictional device which is located between the axle sections. This is shown in Figs. 2 and 3 and is for the purpose of preventing too easy a differential action which would take place with this free operating drive. The frictional bands allow slippage for corner turning but place a burden upon one wheel which prevents it from slipping too easily, thus providing internal differential friction.

The current is fed to the motor through the collector rings *A* and reversing action is given by a reverse current switch.



Section through axle with electric motor differential

Kissel All-Year Town—Victoria Body

Sedan and Coupe Types Continued and Now Mounted on the Smaller Six—Elm, Ash and Steel in Bodies and Tops

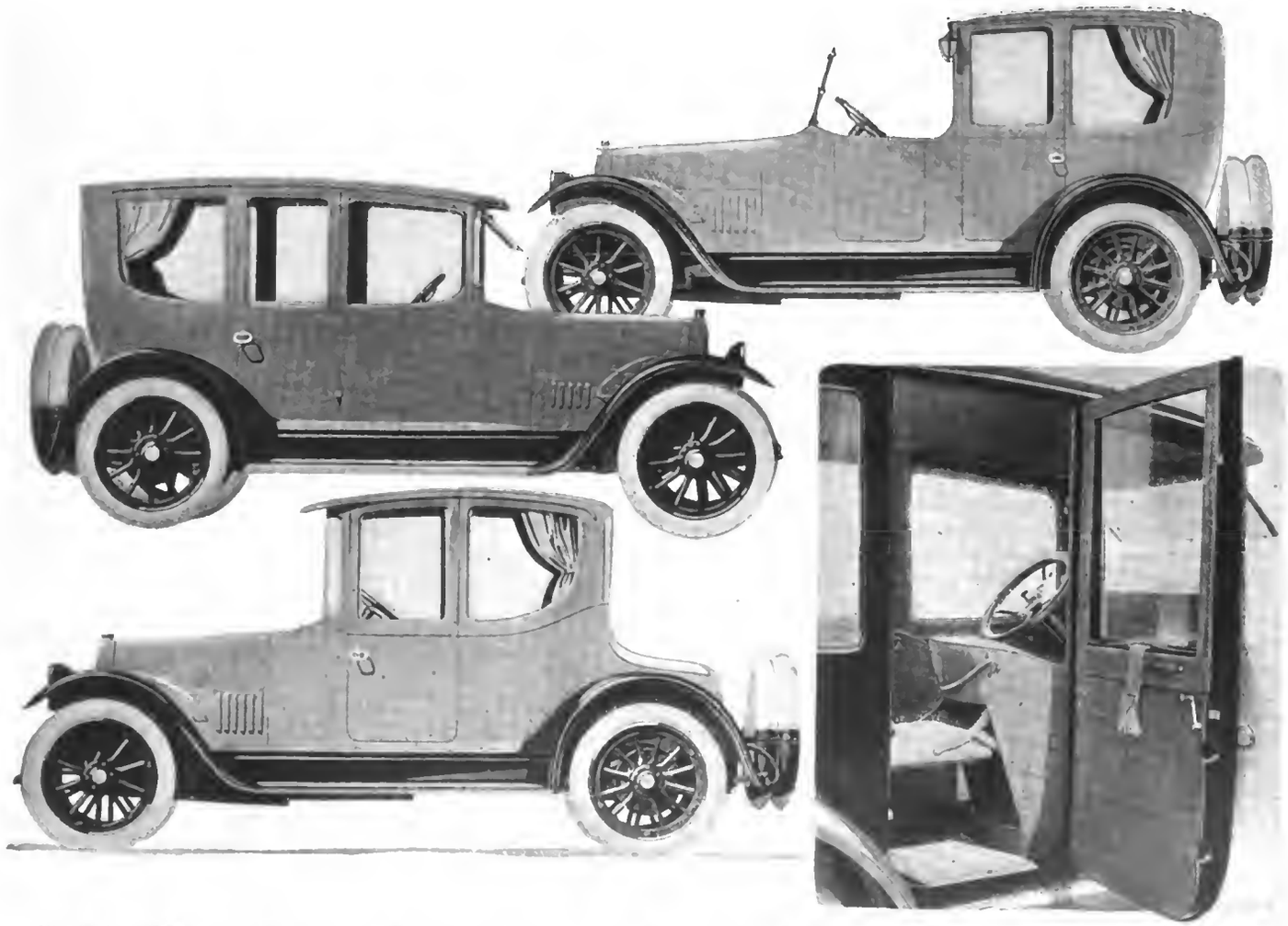
FOR the winter of 1916-1917 the Kissel company has brought out a number of its improved All-Year bodies for the chassis model marketed under the title of Hundred Point-Six. This is the smaller of the two Kissel sixes and the larger one will also be equipped with the All-Year tops as before.

The new top line includes the sedan and coupé designs which were marketed last year and in addition a town car top mounted on a victoria body. The price of the sedan and coupé bodies is $1,520, while the victoria town car lists at $1,850. These bodies are about the same in construction as those of last year. They are featured by their easy convertibility from the open to the closed type, thus allowing the owner to have all the benefits of two cars for practically the price of one.

Selected white ash and elm is used for the main and door frames of the detachable top with a covering of sheet steel. The roof is three-ply paneled white wood under heavy duck canvas laminations. French plate glass is used for the windows, and these are set solidly into hard rubber to prevent leaks and to eliminate rattles. The standard tops are leather lined and special cloth lining can be secured at additional cost.

The body and the top are connected at ten points by means of rectangular bolts fitted into sockets which are arranged to prevent any projections from marring the appearance. Between the body and the top there is inserted a layer of felt anti-squeak material. In attaching the top the electric wiring is connected automatically by spring plungers. The winter bodies are all equipped with dome lights operated by push buttons.

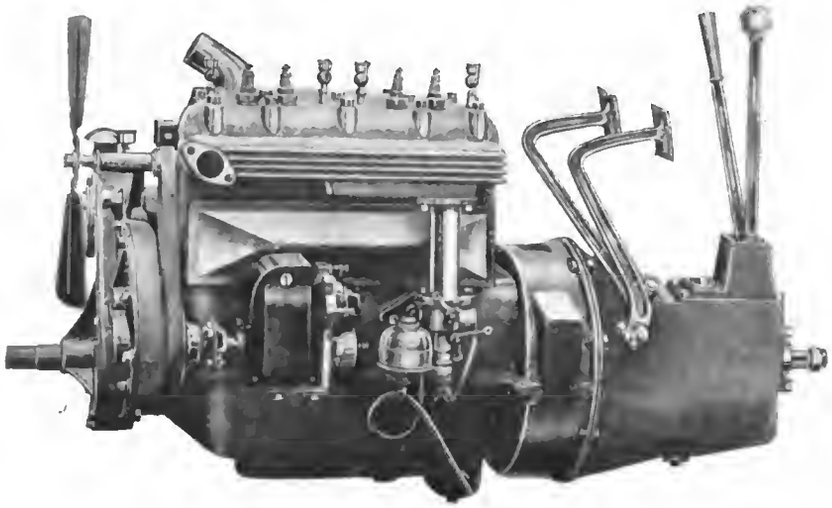
All the Kissel bodies are fitted with divided front seats, a wide corridor being provided, allowing for easy passage. Seventeen coats of paint are used, requiring twenty-two finishing operations. The hinges are pressed steel and are concealed. Ventilation is secured by dropping the windows into the lower halves of the doors.



Illustrating the all-year bodies which will be mounted by the Kissel company on the small six known as the Hundred Point model. This is the same line of bodies as was marketed last year with the addition of the Town-Victoria body shown in the upper right. The center body is a sedan-touring and the lower a coupe-roadster. All of these are convertible types, changing the car from a summer to a winter job in a short time

Rainier Delivery Car Ready Soon

Passenger Car Maker Enters Truck Field With 1000-lb. Wagon to Sell for $850. Chassis Assembled from Standard Units



Unit power plant used on the Rainier 1000-lb. delivery wagon

JOHN T. RAINIER, who used to make passenger cars is now associated with P. N. Lineberger, in the manufacture of a 1000 lb. delivery wagon to sell for $850. Production will start in October on this car car which is to be known as the Rainier. This is the first time this name has been linked with a motor vehicle since the absorption of the Rainier interests by the General Motors.

While of conventional design in the main, there are points in general appearance which are distinctive. The radiator, is a reproduction of the Rolls-Royce form. It is high, as is the square, blocky hood, which gives a good head of water above the motor for the thermo-syphon cooling system. The hood is of the three-part type with top and sides separate, snap fasteners being located at the eaves, such as found in big trucks.

The frame has been carried very low and all of the way back to the tailboard, to eliminate any body overhang. The cab floor hugs the frame closely and with the foot-board and dash is a single steel stamping. Fenders are wide and follow the curvature of the wheels in the approved style. Running-boards extend the full length and are covered with aluminum. The tubular bumper at the front is secured to brackets integral with the front spring horns.

Load Space 74 in.

Tires are 33 by 4-in. all around, and mounted on demountable rims. The 115-in. wheelbase permits of the use of larger bodies than is customary on ½-ton cars and this has been taken advantage of by the design of a number of distinctive body features as for instance, the length of 74 in. of load space back of the driver's seat.

The engine is a block-cast unit of the high-speed type. It has two bearings and is very compact due to integral casting of the cylinders, crankcase and both manifolds. The cylinder heads are in a separate casting.

With a bore and stroke of 3¼ by 4½ in., it rates 16.92 hp. by formula but at 2000 r.p.m. it develops according to the makers, 28 hp. The crankshaft bearings are 2¼ and 2½ in. long, respectively, and the connecting-rods are drop-forged I-beams 9½ in. between centers with 2-in. crank-pin bearings. Mild steel against cast iron teeth helically cut serve to quiet the timing gears, their face width being ⅞ in.

Valves are to the left, their mechanisms covered by a single pressed-steel plate. They are 1⅝ in. diameter.

The Carter multiple-jet carbureter of 1⅛ in. size, bolts to the inlet pipe on the left side, just behind the Dixie magneto and has an air control on the dash. The magneto is driven from the timing gear-case by a leather coupling from the fan-belt pulley. It is fitted with a dash spark control.

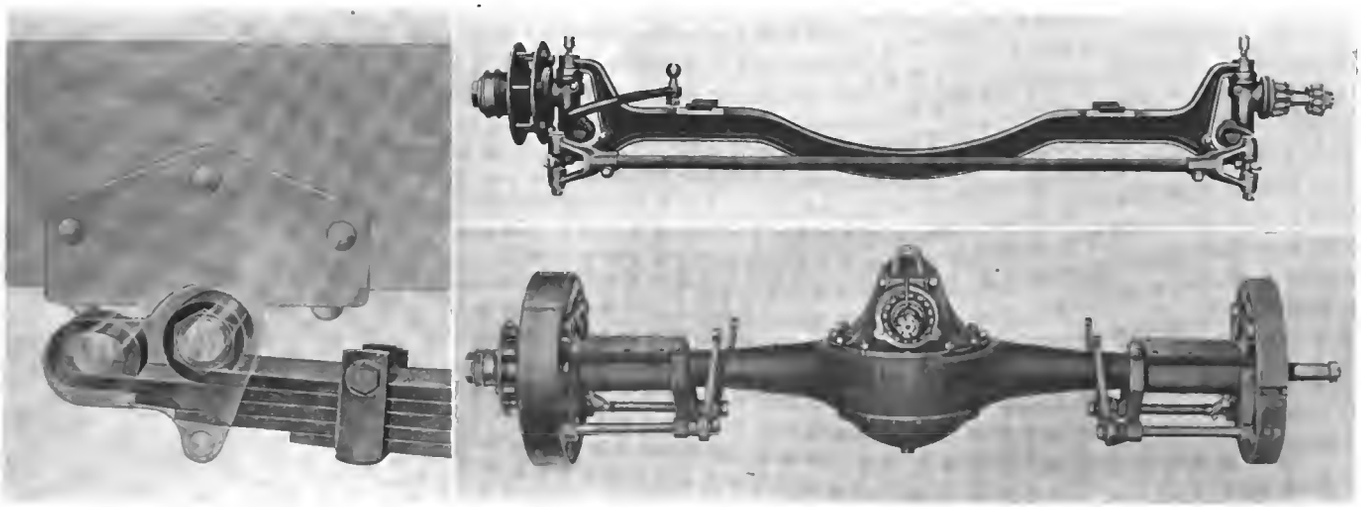
Splash Lubrication

Circulating-splash lubrication is employed, the oil being strained and pumped from the reservoir by a plunger pump eccentric-driven from the camshaft. This delivers the oil to troughs beneath the cranks. Overflow is fed by a pipe to a groove cut in the inner face of the camshaft gear, communicating with the gear teeth by holes drilled between them. Pockets also collect the splashed oil and direct it to the main and camshaft bearings. Excess oil splashed on the cylinders is prevented from causing smoking by holes drilled in each piston below the scraper ring. There is an oil gage on the dash and a level indicator at the side of the crankcase.

A Borg & Beck three-plate dry clutch drives the Grant-Less three-speed selective gearset. This clutch is adjusted by shifting two bolts. The gears are of nickel steel.

Final drive is through a shaft with two universals to the Timken pressed-steel worm-driven axle, Hotchkiss drive eliminating all radius rods or torque arms. The spring construction consists of a double-eye arrangement at the fixed front ends of the rear springs. The top leaf is provided with the usual bronze-bushed eye. The second leaf, instead of ending just below this eye extends beyond it and is bent to form a secondary elliptical eye which normally floats about an auxiliary pin. The third leaf extends out as far as the first leaf, so that 50 per cent more strength is said to be provided at this, the weakest part of a spring. In the event of the breakage of the top leaf, which ordinarily would make the operation of the truck impossible, the second pin and eye come into play, being otherwise out of action.

Typical body standard on the Rainier 1000-lb. commercial vehicle chassis



Some of the Standard units used in the assembled Rainier chassis which will be ready for delivery in October, according to the present plans of the manufacturers

Safety at this point is still further provided for by a side plate and a pin below the bracket. The rear springs are 50 in. long, extending back nearly to the end of the frame, and 2¼ in. wide. They have eight leaves. The front springs are 38 in. long, 2 in. wide and have seven leaves.

The frame is of unusual size, being 4½ in. deep, of 5/32-in. gage pressed steel, and properly necked in at the front to provide a short turning radius. This is a clear inch deeper than on some trucks of the same rated capacity.

The front axle is of Timken make, I-beam type, of 2½-in. section, having nickel steel steering knuckles. The steering gear is at the left, of Gemmer make, with an 18-in. hand wheel. The throttle lever is below the wheel, of the same type as applied to Renault cars. The throttle is principally controlled by a foot throttle. The levers are in the center of the cab.

Standard equipment consists of one extra rim, three oil lamps, the front lamps being attached to the rear of the dash, with their lenses flush, a Long horn, a tire pump, jack and full set of tools. Electric lighting and starting will be applied for $85 additional.

Several standard bodies are offered, modeled upon the designs used by leading New York department stores. The open express type, 74 in. long and 44 in. wide, known as Model E sells for $100.

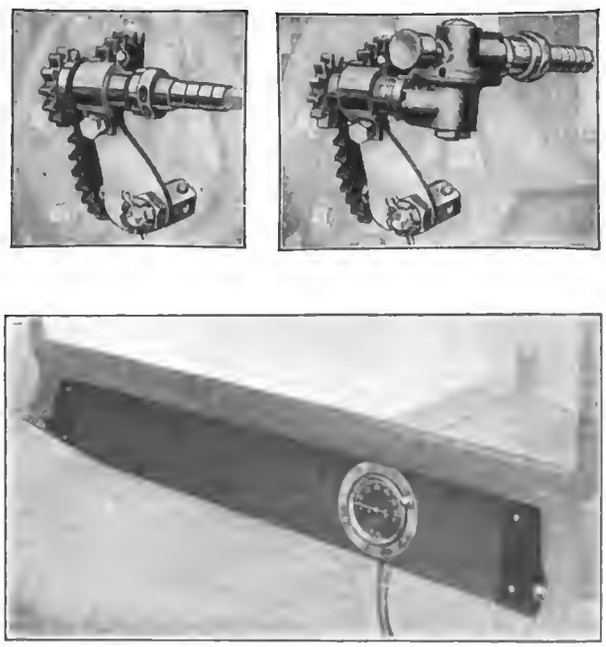
Standard painting is in contrasting colors, special painting being charged for extra. Regularly, Model E, the express body type has a green body with red crest panels, red wheels and black chassis, selling for $100, so painted. Model S, panel type, has middle and lower panels of blue, upper panels of black, red wheels and a black chassis, selling for $110.

New Ford Speedometer Easily Attached

THE Standard Thermometer Co. of Boston, Mass., has just brought out a new Ford speedometer combination consisting of an instrument board to fit in the cowl, flush mounted speedometer and flexible shaft mechanism.

The instrument board is covered with imitation leather and is cut out for the installation of the speedometer. It may be installed on the Ford car by removing one nut on each side of the dash cowl, slipping the metal and pieces of the instrument board over the bolts, and then replacing the nuts.

The installation of instrument board and speedometer can be made by any Ford owner without drilling any holes. The driving sprocket for the Standard speedometer is bored to fit the hub flange of the Ford car; the instrument board fits the Ford cowl and the speedometer head fits the instrument board.



Flexible shaft connections on wheels and new instrument board sold with Standard Ford speedometer

Two outfits of this type are at present being furnished for the Ford cars: Outfit No. F-330 consists of instrument board, flush type speedometer, 66-in. flexible shaft and case, and the Standard Thermometer Co.'s regular Ford drive with the new support which permits installation on any Ford car whether or not the steering arm may be drilled for speedometer installation. This outfit lists at $14.

Outfit No. F-355 is similar to the above with the exception that the drive is the Standard Thermometer Co.'s patented swivel type, which is particularly advisable for use on cars equipped with shock absorbers, as it removes the driving shaft from every possibility of collision with and damage by the shock absorber case. This outfit lists at $15.

The Rostrum

Speedometers Should Be Easy to Read

EDITOR THE AUTOMOBILE:—On page 179 of THE AUTOMOBILE for Aug. 3 appeared an item entitled Efficiency vs. Neatness.

There are 5280 ft. in 1 mile. If a car is moving at 60 m.p.h. it advances 5280 ft. in 1 min., or 88 ft. per sec. Roughly speaking, one and one-half times the mile speed per hour is the foot speed per second.

It is not when going slowly that the driver is most apt to be interested, but when speeding. Even at 20 to 30 m.p.h., he is moving at 30 to 45 ft. per sec.; if at 40 to 50 m.p.h., at 60 to 75 ft. per sec. What driver at such times dares take his eyes off the roadbed for ½ or even ¼ sec. to study the figures? If he desires to know the time of day, a quick glance at the clock is sufficient—the position of the hands tells him; the figures on the dial are of no consequence. It should be so with the speedometer.

There are speedometers made with black dials and white hands, but the designers could not resist the temptation to make them pretty; so they are delicate scroll work. Drop the pretty, and consider only utility—make the hands solid, straight bars, ⅛ in. wide, and charge them with phosphorus so that they will shine at night. With such an indicator, a furtive glance is all that the driver will ever need.

It would cost no more to have speedometers so built as to be easily read, if the manufacturers of automobiles would insist upon it when placing their orders.

This brings up another point. Every indicator on the dash should, regardless of appearance, squarely face the driver's line of vision.

Utility First is the elder of its twin brother, Safety First.

Boston, Mass. W. G. R.

Retiming a 1905 Mercedes Car

Editor THE AUTOMOBILE:—I have a 1905 Mercedes which originally had a make-and-break ignition, which I changed to a high-tension. I would like to know what is the correct valve timing for maximum speed.

2.—What is the correct valve timing for ordinary running?

3.—Correct timing for the magneto in each case?

W. L. W.

Port Chester, N. Y.

—The changing of the ignition system from low-tension to high-tension should not affect the valve timing. In regard to ignition timing, it may make a difference. THE AUTOMOBILE has no record of how the 1905 Mercedes was timed when it left the factory, and if there are no marks on the flywheel or other parts of the engine gear showing how the engine was timed, it will have to be done experimentally. In doing this, it is well to work with the opening of the intake and the closing of the exhaust, allowing the closing of the intake and the opening of the exhaust to fall where it will with the shape of the cam contour.

First try letting the intake valve open at as near 10 deg. after upper dead center as possible. The exact number of degrees will depend on the timing gear and you will have to take the nearest tooth mesh to 10 deg. making what difference there is on the low rather than on the high side of 10. Then set the exhaust camshaft so that it will close the exhaust valve at about 5 deg. after upper dead center. With this as a starting point you can work the engine back and fourth a tooth at a time on both the intake and exhaust valves. It may be that the timing stated will be perfectly satisfactory.

2—The timing given under question 1 will be correct for ordinary running and up to as high speeds as you will be able to secure from this car. In general the rule for timing motors for racing is to push everything ahead. That is, both intake and exhaust valve openings and closings as well as the spark timing.

3—For ordinary running the magneto should be so placed that on full retard the spark occurs exactly at upper dead center. For racing the magneto is generally advanced one or two teeth.

Found Click in New Engine

Editor THE AUTOMOBILE:—What would be the most likely reason for a click in the engine of a 1916 six? This click

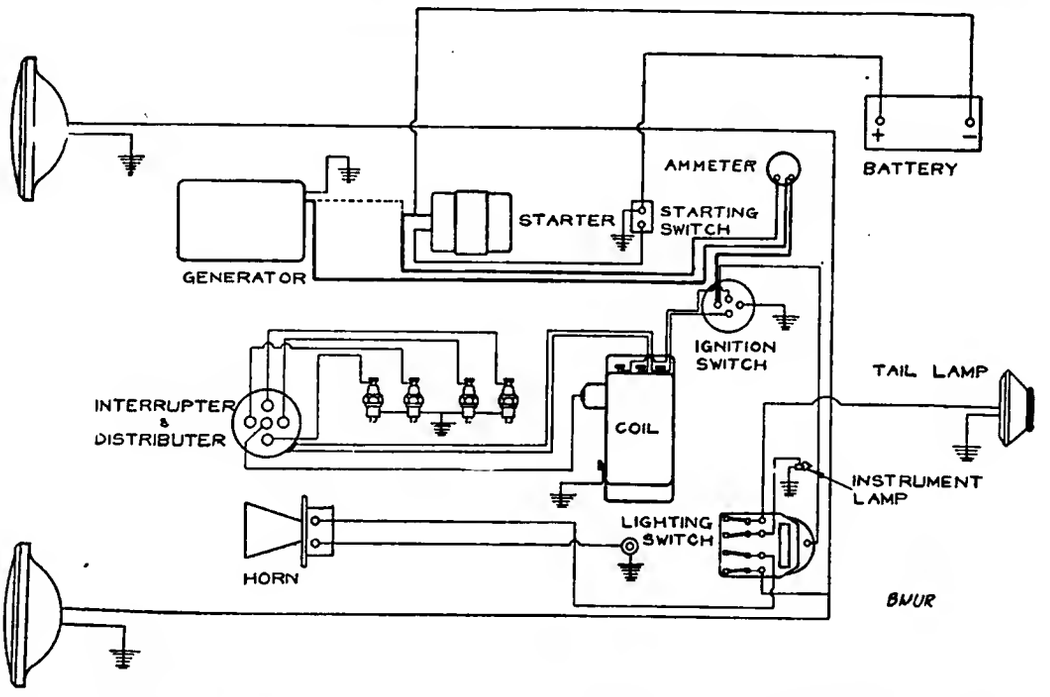


Fig. 1—Wiring diagram showing the installation of an ammeter on Hupmobile with the Bijur system

sounded like a valve tappet. The car was returned to the factory but they were unable to locate it so put in a new motor. Could it be that the camshaft was a little out of true?

2—Has the Buick company announced its 1917 sixes yet?

3—What is the bore and stroke of the Grant six, the Buick little six and the new Overland little six which was just announced?

4—Kindly give the names and prices of all three-passenger roadsters under $1,000 and state whether or not they are the clover-leaf type.

Waltham, Mass. C. H. B.

—It is quite difficult to state with any likelihood of hitting the truth which of the many moving parts of a motor would be most likely to make this clicking sound. An undercut cam, a valve stem which is too short, a loose piston, misaligned crankshaft bearings or faulty rod bearings are all possible causes.

2—So far, for the coming season the Buick company has announced the continuation of its present small six and in addition a four-cylinder car.

3—The bore and stroke of the Grant six for 1916 is 3 by 4¼. The Buick little six is 3¼ by 4½ and the Overland model 85 six is 3¼ by 4½.

4—For a complete list of body types and prices you are referred to THE AUTOMOBILE for Dec. 30, 1915, in which the price list of these cars was given. No lists have as yet been made up of 1917 cars as these are being announced by the manufacturers every day.

Needle Valve Probably Misadjusted

Editor THE AUTOMOBILE:—I have a 1915 model 37 Oakland touring car equipped with Maxwell carbureter. This spring I had the engine overhauled, put in new pistons, scraped out the carbon and ground the valves. The air valve broke off its hinge just before I put the car up for the winter, so this spring I sent that to the factory to have it overhauled and put same on after overhauling.

Now the engine runs smoothly at anything less than full opening of throttle and pulls well also, but when the throttle is opened first it pulls all right, too, but on a long pull holding it open all the way it will die down suddenly and commence to backfire through the carbureter. On a long pull in second it will do the same thing. This seems to be at speeds in excess of 25 m.p.h. in high and in excess of 18 m.p.h. in second. When it starts to spit like that and I release the throttle it will run smoothly, but, of course, the car will slow until I have to throw it in low, as it does not get the gas to push it. Have tried closing off air almost completely, also opening very wide, but am still puzzled. Can you help me?

A. T. McG.

Liberty, N. Y.

—Most probably your trouble is incorrect adjustment of the needle valve which controls the size of the nozzle. If this is wrong it cannot be compensated for by air valve adjustment. The gasoline nozzle setting is controlled by the thumb screw at the bottom of the carbureter directly under the flange where it attaches to the manifold. Try slacking this back a quarter turn at a time. The symptoms you describe are also occasionally caused by faulty spark plugs.

Putting Ammeter on 1916 Hupmobile

Editor THE AUTOMOBILE:—Kindly advise me how to install an ammeter on a 1916 Hupmobile roadster. If possible, I would like wiring diagram showing where to put the ammeter in.

Keene, N. H. G. P.

—The method of installing an ammeter on the 1916 series N Hupmobile will vary according to whether the electrical equipment is Westinghouse or Bijur. The accompanying illustrations, Figs. 1 and 2 show the installation for both these systems.

Changing National to Racing Car

Editor THE AUTOMOBILE:—I have a 1914 improved series V model National. It is now a seven-passenger and I would like to make a racer out of this car. Would like you to give me an illustration or two and some advice through your columns. I do not want to use the bucket seats but cut down the regular front seat and use it so that there will be some comfort to it.

Cutting the seat down, building the cowl and rear end is the parts I want advice on, also on lowering the steering gear.

I am in a position to do this work myself, also the metal work, cowl and stern. Where could I obtain fenders that could be fitted. I am counting on cutting the running-boards about half in two.

Helena, Ark. W. N. B.

—In building the cowl and tail, the point which must be had in mind is that the car presents no surfaces which would increase the wind resistance. Therefore, the cowl should be a continuation of the line of the hood, whether this line is curved or as it should be preferably, straight. The tail does not make such a material difference unless you are traveling at speeds above 80 m.p.h. Probably one of the best worked out streamline racing bodies in this country is that used on the Packard aeroplane racer shown in THE AUTOMOBILE for May 4, 1916.

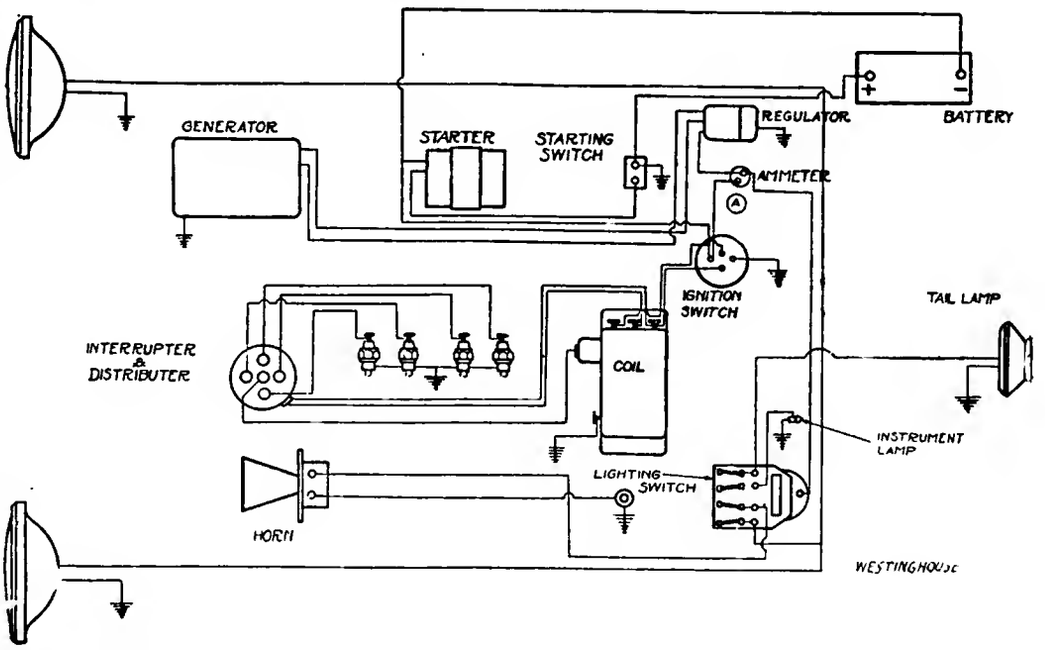


Fig. 2—Wiring diagram showing the installation of an ammeter on a Hupmobile with the Westinghouse system

The FORVM

ECONOMY OF THE SEMI-FLOATING AXLE DUE TO PRINCIPLES—MEETING THE DIFFICULTIES WHICH ARE TO BE FOUND IN THE TWO-CYCLE ENGINE

Semi-Floating Spells Economy

By A. M. Laycock

DURING the last few years the semi-floating axle has become very popular, not only in the passenger car field but in motor truck service as well, even up to 5 tons capacity.

However, there are still people who have very decided views as to the relative merits of the semi, three-quarter and full-floating rear axle. Perhaps it has never occurred to most readers that *the tonnage* of the world is carried on semi-floating axles.

All railway rolling stock, including locomotive, freight car and passenger coaches are operating on semi-floating axles. If we should subsitute the term—"fixed hub"—for semi-floating, as one of the axle manufacturers has lately announced, it might be better understood applied to railroad work, as all heavy rolling stock has the wheels keyed or fixed to the axle. In all railroad designs, the dead weight of the vehicle is carried on the axle itself, and the torsion as well; while every one can realize at a glance that the dead weight is carried on the axle, it is not so easy to grasp that there is a considerable torsion also.

On large European railroad engines, using inside and outside cylinders, it is quite easy to realize that torsion is present in the driving axle, and even with the conventional engine, using two outside cylinders; but with the passenger and freight cars, it is difficult to appreciate that considerable twisting takes place on the axle, but on rounding sharp curves when the outer wheel is running on a larger radius than the inner, the twisting moment in the axle is equal to the total weight carried multiplied by the radius of the wheel and the coefficient of friction on the rails which, when figured, amounts to a considerable torsional stress in the axle—in fact, absolutely in the same proportion to the twisting moment in the semi-floating 5-ton worm drive axle, as this is figured in the same way, particularly when propeller shaft brakes are used.

Advantage in Widely Spaced Bearings

Taking for granted that we have the combined bending and torsion in the axle with a fixed hub, the outstanding feature in favor of this construction for real heavy duty, lies in the fact that bearings are spread so very far apart—in fact, on most passenger and freight cars the bearings are on the outside of the wheel, and in European locomotive practice, with inside cranks, the bearings are always on the outside, while on the tender of the engine they are generally spread as far apart as possible. This, of course, greatly enhances the life of the bearings, as the unit pressures are so much lower, particularly when rounding curves when bearing pressures are maximum. It would be interesting to note what would happen to a full-floating axle taking curves regularly at 35 m.p.h. under these extremely heavy loads. We prophesy that the train officials would have an anxious time between hot boxes and time schedules.

Contrasting this heavy design with the full-floating type, where the bearings are spaced 4 in. to 6 in. apart as against 64 in. in freight car service, considering that the wheels are approximately 33 in. diameter, as against 36 in. to 40 in. on the motor truck and that the freight car is operating on a perfectly smooth road bed, whereas the automobile is subjected to direct violent blows on the tires due to rough roads but suffers very much more from the side blows delivered at the rim of the wheel when swaying back and forth in deep ruts over country roads, and always having in mind that the designer's chief aim in motor truck axle design is to take care of these tremendous reactions from side skidding, curb work, etc., it is difficult to appreciate the reasons for the automobile truck designer following the full-floating construction, where the centers on which the reactions are taken are so very close together, contrasting so widely with the semi-floating design—in fact, the difference in these designs is so radical, that it is hard to conceive of both of them being on right principles. Even forgetting principles for the moment, there is such a weight of precedent in favor of the semi-floating, that the writer can only come to the conclusion that the full-floating is only used on account of the accessibility of the driveshafts. If the full-floating construction had been adopted by railroad engineers for the same reasons, people who knew these facts would have a very creepy feeling when taking any long journey by rail.

We prophesy before very long that advertising men in the automobile field will not boost the full-floating axle on account of its accessibility, when driveshaft failures take place. It is infinitely better to put a driveshaft in there that will not break. This is the least that one can expect with our present knowledge of alloy steels and their proper heat treatment.

Full-Floating Impossible on Locomotive

Imagine locomotive designers starting out to design a full-floating axle for the locomotive itself, particularly on the main drivers. It would be considered by railroad engineers a practical impossibility. The bearings would be so large that there would be no spoke left in order to take care of the reactions when rounding curves, always having in mind that a choice of bearings is made from the side pressures at the rim of the wheel and not the straight static loads on the axle.

The illustration as shown in Fig. 1 is quite well known but clearly outlines the relative merits of each. The one with outstretched arms representing locomotive or semi-floating axle construction while the other represents full-floating or wagon practice.

Taking for granted that the locomotive, passenger and freight cars are all of the semi-floating or fixed hub construction and that the full-floating is horse-drawn practice (so far as its capacity for taking curves is concerned)

should the motor truck builder follow locomotive practice or revert to horse-drawn design? This is no reflection on the carriage axle—the present form of axle serves its purpose well for horse-drawn work, but this design would never do for real heavy haulage where speed is a consideration.

Again, on locomotive design the unsprung weight is really not a consideration on account of the very slight spring deflection due to the excellent condition of the road bed, but where such large unsprung weights have to be used as in modern worm drive axles, it is very much more essential that the semi-floating axles be used on trucks than in locomotive practice, as one of the principal items in the maintenance cost of heavy motor trucks is the tires consumed.

One of the most wonderful designs in the pleasure car world, noted for its exceptional gasoline economy and big tire mileage, attributes some of its success very largely to the semi-floating axle, full-elliptic springs and the Hotchkiss drive, particular attention being paid to reduction of weight at the wheel hubs themselves, even carrying this out as far as the rim and dispensing with the conventional demountable rim in favor of the fixed one in order to save weight where it is most detrimental.

Motor truck users who have had experience or even know of the above machine will expect the same relative tire mileages from their trucks and will certainly demand the lightest possible weight at the wheels on any axle equipment, even going so far as to condemn heavy cast malleable brake shoes and their attendant two-point contact, necessitating much heavier flanged and reinforced brake drums than are required with the self-intensifying band type of brake.

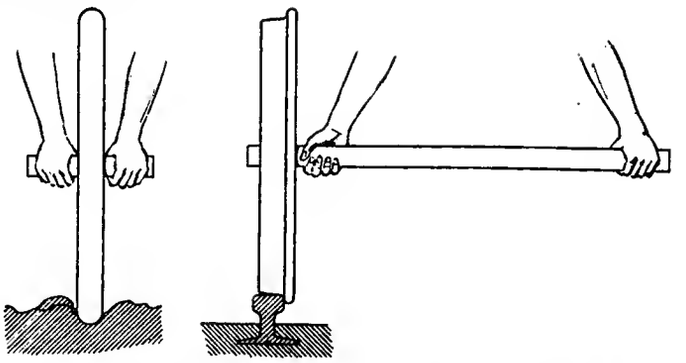


Fig. 1—Illustrating full and semi-floating axle arrangement

If all these considerations are being made in the pleasure car field, we prophesy that before long motor truck users will demand the same attention to details *for economy* of operation which has characterized the endeavor behind this design for the last nine years.

Solving Two-Cycle Problems

By Harmon J. Kline

THE recent articles appearing in the Forum of THE AUTOMOBILE seem to cover the pros and cons of the two-cylce motor situation pretty well. Some engineers are open to conviction while the majority seem to think the game isn't worth while.

The experience of most of these men appears to have been a matter of disappointment. My own experience was of about the same nature but still there is always a hope that luck will change. Theoretically the two-cylcle should begin to appear at this time since the performance of the multiple cylinder four-cycle motor may be had in the two-cycle type having only half as many cylinders and at a lower manufacturing cost. However, the hope seems a long way off if the opinions of the majority are to hold.

It is true that a motor using crankcase compression is troublesome, particularly with the low grade of fuel we are now getting. Oil leaks are also a bad feature and stuffing boxes a nuisance.

Probably a still greater disadvantage is the fact that a fresh charge from the crankcase must be forced into the cylinders at each cycle. I say "forced" because it must of necessity displace a sufficient quantity of dead gases in order that ignition may take place at all. However, this forcing process does not give good results in the ordinary type of two-cycle motor because the fresh charge always enters the lower end of the cylinders and part of it makes a bee-line for the exhaust ports. If the ports are carried around the cylinder walls far enough to allow a free escape of the dead gases, a greater proportion of the fresh charge is wasted for the sake of speed. So it is that in practice there seems to be a strata of inert gas at the top of the cylinder and one of fresh mixture at the lower end. The combination must be rich enough to allow ignition to take place, and it is obvious that trouble will ensue. At light loads the motor will four-cycle, back-fire or stop. At full loads the operation is better, but more fuel is wasted by passing out at the exhaust ports, due to the forcing process.

Is it any wonder that with raw fuel in the crankcase and a contaminated mixture in the combustion chamber, that the majority of engineers have hopelessly lost faith in any two-cycle type of motor?

If the cylinder action could be reversed properly without too much complication, I think the past reputation of the two-cycle motor would be better.

By forcing air into the upper end of the combustion chamber to scavenge the cylinder before forcing the fresh charge in, the motor will two-cycle under all conditions of load and speed. The motor may be flooded when using the overhead vaporizer so that dense clouds of smoke come out with the exhaust and yet it will two-cycle almost entirely.

When operating on gasoline with a carbureter I found out, under actual operating conditions, that back-firing would occur occasionally, due perhaps to a complete circuit of explosive mixture from the crankcase to the combustion chamber. However, the motor would not stall because the back-firing always occurred in one crankcase and the other would immediately fill the storage chamber with a fresh charge.

The motor was never known to back-fire when using the overhead vaporizer except when a valve cage in the piston came loose or a valve broke below the head.

As for starting on gasoline with a carbureter to the crankcase, starting is a bit difficult by hand but if a belt is run to the flywheel to give the same speed as an electric starter would give very little trouble was experienced. Perhaps the ordinary two-cylcle would start better now, even on our low grade gasolines with a starter but the two-cycle died before this day of extensive equipment.

Need for Cool Crankcase

As to running with hot crankcases. I think it would not be feasible to do so, particularly as means of lubrication cannot be so advantageously used in the two-cycle as the four and yet the four-cycle operates at too high a temperature to give absolutely reliable operation in the hands of the public. If some sort of cooling could be used to keep the bearings and oil at a comparatively low temperature it would be a good thing, especially with the two-cycle motor where a copious supply of oil is not advisable.

There is another point in favor of the two-cycle motor as applied to air cooling. That is the positively operated valve action. It is unnecessary to compensate for the difference in expansion of the cylinders and the push rods, valve tappets or valve stems as in the four-cycle motor.

The History of the Pneumatic Tire—16

Early Use of Pneumatic Tires on Automobiles and Other Vehicles—Motorcycles First Motor Vehicles To Use Them—Michelin's First Automobile Pneumatics

The History of the American Automobile Industry—43

By David Beecroft

PROBABLY suggested by The Lovell-Diamond advertisement of May, 1897, containing a cut showing letters on the tire of the wheel, an article appeared in one of the bicycle publications about this time, describing an advertising device, consisting of a bicycle wheel having the legend to be printed on the road formed in raised type on the tire tread. In April, 1898, the National Herringbone tire was advertised.

First Use on Automobiles

The first use on automobiles seems to have been the corrugated tread tires used on the Mark 111 Columbia in 1898. This vehicle was introduced in 1897 and may have used corrugated tires earlier than the date above mentioned.

For Horse-Drawn Vehicles

The increasing use of pneumatic tires very naturally suggested their application to other road vehicles than bicycles, and the application to sulkies by Elliott, Bidwell and Sercombe-Bolte has been mentioned. In the Winter of 1891-1892 A. H. Overman of the Victor Co. had his buggy fitted with ball bearings and the Victor arch or cushion tire which he was strongly advocating, and with which he was trying to stem the tide of favor sweeping toward the pneumatic. In the Spring of 1892, Bidwell fitted pneumatic tires to two Stivers runabouts and drove one of these himself about the city. This use seems to be the first use of pneumatic tires on horse-drawn vehicles in this country, if we omit the reported use of a carriage with Thompson tires in 1847.

First Use on Motorcycles

Since the motor vehicle developed so naturally from the bicycle which required better machine shops than did the carriage, it is to the motorcycles that we must look to see the first use of the pneumatic tires or motor vehicles. Most of these earlier motor attempts, however, were made on cushion or solid tires because the maker felt that the bicycle tires were not able to carry the heavier load. The first use on motorcycles seems to have been that of Pennington about 1894, who employed small wheels and having a very slow-running motor, with no flywheel, used quite large tires specially built for him to absorb as many as possible of the jolts. Pennington claimed earlier date than this, and this date is believed to be conservative. The *Blacksmith and Wheelwright* of September, 1894, describes an English four-wheeled car propelled by electricity having ball bearings, 24-in. wheels and pneumatic tires. Whether this use was earlier than Pennington's, is not known, but, being a four-wheeler, it more nearly approached automobile construction.

Early Use of Single-Tube Pneumatics

The first use of pneumatic tires on an automobile of accepted gage, wheel size and general road vehicle characteristics, as distinguished from cycle construction, seems to have been on the Duryea Chicago winner, which was fitted with single-tube pneumatics, 44 by 2 in. front, and 48 by 2 rear, about May, 1895. These single tubes were duplicates of others used by the Pope company on its horse-drawn delivery truck, carrying bicycles to the pay-station for some months before. Early in the same year, a New York hospital ambulance, weighing 1850 lb., had been fitted with Dunlop 3-in. tires; so these pneumatics were not chosen by Duryea until such tires had been proved capable of performing the work required.

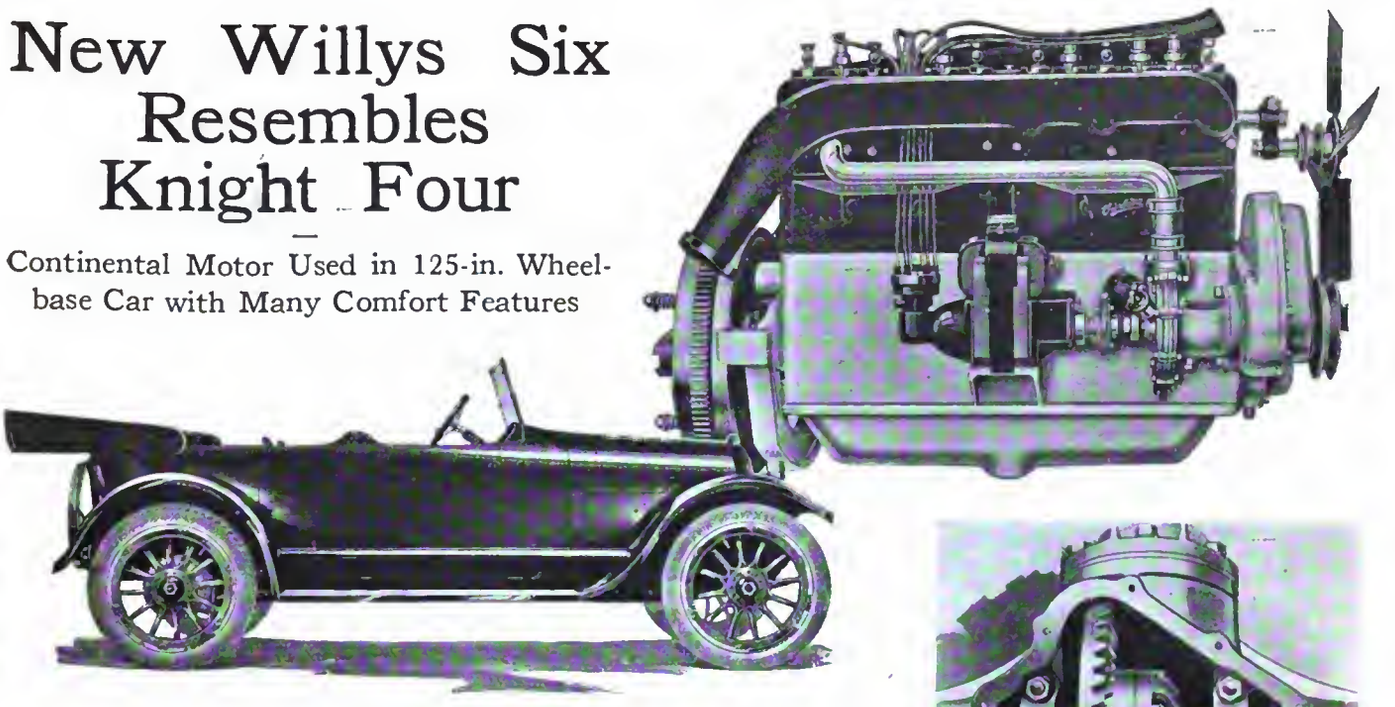
In an Early Contest

Morris & Salon built for the Chicago contest a skeleton bat which was fitted with wire wheels and pneumatic tires and is probably the second use of these tires in the United States. It is, however, hardly fair to compare this skeleton with a full-fledged automobile, for it was built for contest purposes only and was a cycle rather than an automobile.

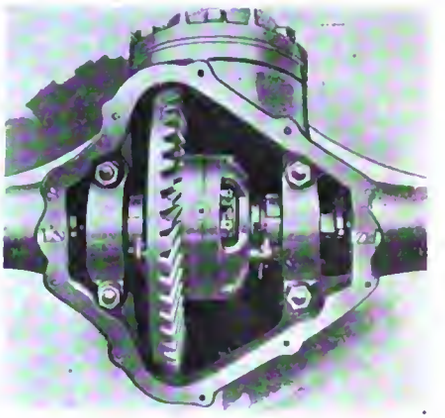
In the Summer or early Fall of 1895, Michelin, the well-known French tire maker, began to supply pneumatics for automobile use. It seems certain, therefore, that America led the world in the use of pneumatic tires, both on motorcycles and automobiles. More than a dozen Duryea cars were made during the winter of 1895-1896 and fitted with 34 by 2½ and 38 by 2½ single tube tires. The sale of several of these vehicles in June, 1896, and later constituted the first commercial transactions in pneumatic-tire automobiles.

New Willys Six Resembles Knight Four

Continental Motor Used in 125-in. Wheelbase Car with Many Comfort Features



Touring car and power plant on Willys 88 six chassis



Final drive in Willys axle, showing differential

WITH the exception of a longer hood, the new Willys seven-passenger 88-Six at $1,325 is identical in appearance with the Willys-Knight four recently described. Cantilever springs have been substituted for three-quarter elliptics, battery ignition made by Connecticut has taken the place of the magneto, the gearbox used on the 1916 Willys-Knight has been adopted, and the gasoline tank has been moved to the rear from under the seat, the change bringing with it the installation of a Stewart vacuum system. Continental motor, Auto-Lite starting and lighting, and the Tillotson carbureter are the same as heretofore.

Comfort and beauty are the features of the new car. The lines are unbroken from front to rear. The radiator edges are rounded, and the radiator is slightly higher, the top edge of the body is rolled in, and there is a double cowl and a tilted windshield. All these details combine to give a very attractive car.

Dark Blue with Nickle Trim

The body is dark blue, with gray wheels. Metal fittings are nickel and polished aluminum, and fenders and trimmings are black enameled.

The car is comfortable. The upholstery is unusually soft, due to the use of smaller springs, and because each one is in a canvas casing, which acts as an air chamber, giving a pneumatic-cushion effect. The body is roomier. There is plenty of knee room when the auxiliary seats are up. Cantilever springs, 48 x 2½ in., make this the easiest riding Overland, since it also has the longest wheelbase, 125 in. Larger tires than usual, 35 x 4½, contribute to the easy riding. The springs have been attached to the axle in such a way that the tendency is for the axle to roll backward slightly, thus reducing the force of the shocks.

The new motor will throttle down as low as 4 m.p.h. on high gear, and still run smoothly, and will pick up quickly from this speed without any difficulty. The ability of the car may be judged from the fact that the motor is rated at 45 hp., has a gear ratio of 4 to 1, and weighs 3515 lb. with all tanks full and a spare non-skid tire and rim.

The bore and stroke are 3½ x 5¼, giving an S. A. E. rating of 29.14 hp. and a piston displacement of 303 cu. in.

The motor is a standard Continental mode, with L-head cylinders cast in a block and mounted on a two-piece aluminum crank case, the lower part serving as an oil reservoir and the upper carrying the three-bearing crankshaft.

Accessibility is fostered by placing the ignition distributer and the generator and the water pump in a straight line on the right side. These units do not interfere with reaching the valves. Each is mounted on a bracket on the motor, and may be removed without disturbing the other.

This leaves the left side of the motor clear for the installation of the steering gear and the starting motor, access to both being easy. The oil-filler opening is at the front, on this side, and the oil gage is plainly visible from its position at the center near the bottom of the crankcase.

Electrical equipment consists of an Auto-Lite two-unit, six-volt system, with head, tail, and dash lamp, and headlight dimmers, as well as an ammeter.

The starting motor is mounted high in order to keep it away from dust and dirt, as well as to make it accessible, drive being by Bendix pinion, which meshes with teeth in the flywheel.

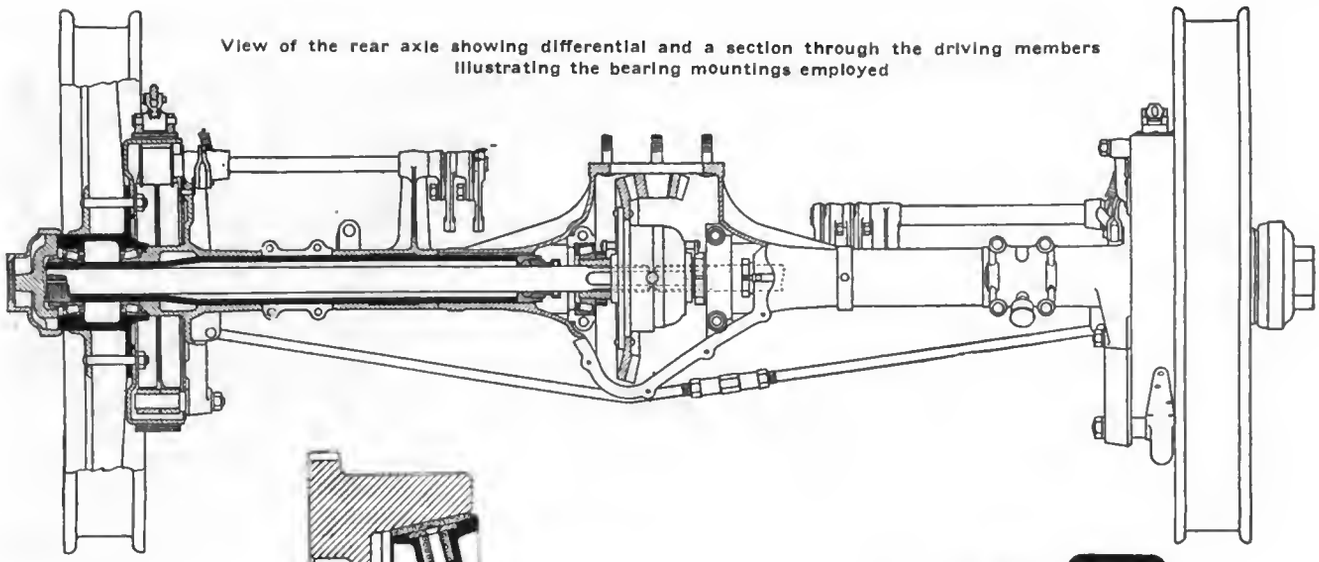
Back pressure is minimized by the fitting of a double exhaust pipe, there being a passage from the three front cylinders and another from the three rear ones.

Lubrication is a combination of force and splash feed, a plunger pump operated from the camshaft sending oil under high pressure to the main crankshaft bearings, camshaft bearings and the timing gears. Troughs catch the overflow and dippers on the connecting-rod caps distribute spray to all parts of the motor.

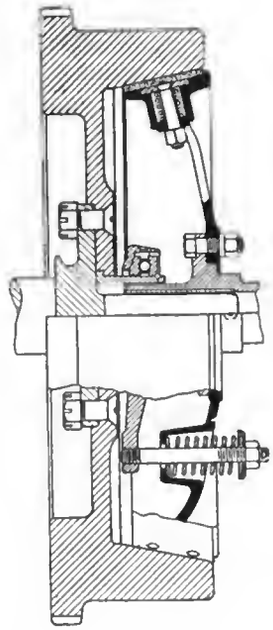
Leather Faced Cone Clutch

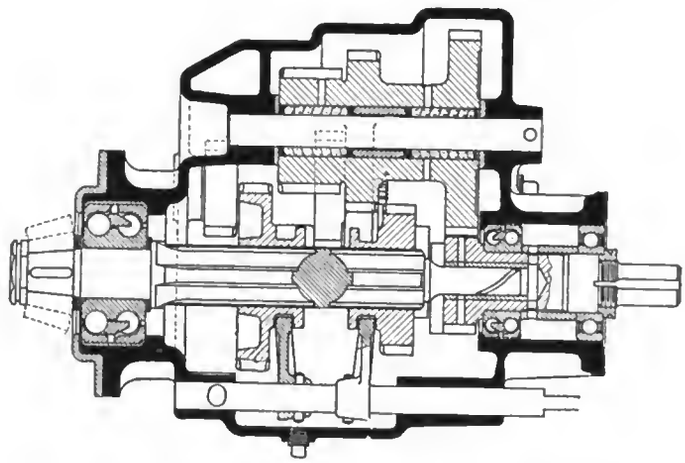
The clutch is a cone with a leather facing, and spring-actuated plungers which are equally spaced give smooth engagement by pressing out on the face. The clutch spider is held in engagement by three comparatively light springs

View of the rear axle showing differential and a section through the driving members illustrating the bearing mountings employed



Section through the leather faced cone clutch showing spring engaging members beneath the leather to give a gradual application and to ease starting shock





Three-speed gearbox used on the Willys model 88 six-cylinder car

placed near the rim, and gear shifting is facilitated by a clutch brake.

The gearbox is mounted on the rear axle, and torque and driving strains are taken by a torque tube which terminates in yoke, which is pinned to a cross member of the frame. The gearbox gives three speeds forward and reverse. The gears are double-treated nickel steel of the stub-tooth type. The main shaft is mounted on annular ball bearings and the countershaft is stationary, but the countershaft gears rotating on it have Hyatt rollers placed between them and the shaft.

The rear axle is a full-floating type with a spiral-gear drive, and Timken adjustable, taper roller bearings throughout.

Double Sets of Brakes on Drums

Service and emergency brakes are internal and external, acting on the same pair of drums, the former contracting and the latter expanding, the respective dimensions being 14⅝ x 2¼ and 14 x 2¼. Both are quickly adjustable.

The front axle is an I-beam drop forging, produced in one heat without welding, and the wheels have adjustable, taper roller bearings.

The steering gear is a worm and full-gear type of hardened steel. It is provided with ball-thrust adjustable bearings.

The doors are particularly easy to open, due to the use of a new handle, which is pulled in the direction to close the door. This movement is easier than that required to unlock the ordinary door, especially when the door is stuck. For the sake of cleanliness and safety, rubber pads with ridges on them have been placed on the running-boards under each of the four doors. They not only act as mud scrapers, but also give a firm foothold.

Light Pressure Releases Clutch

A very light pressure is required to disengage the clutch, merely the rocking of the foot on the heel being sufficient to depress the pedal. Horn button and ignition and lighting switches are placed in a box on the steering post, where they are easy to reach. Gear shift and emergency-brake levers may be operated without leaning forward. The two large pedals are adjustable as to length.

The cowl-board equipment is complete, including a Warner speedometer with ½-in. figures on the speed-indicating cylinder and ¼-in. figures on the 100,000-mile indicator and on the 100-mile-trip register. The latter may readily be set back by turning a small knob at the right. The oil gage registers up to 10 lb., and the ammeter has a range of 15-0-15 amp. A Boyce Motor-Meter relieves the driver of worry as to the condition of the cooling system.

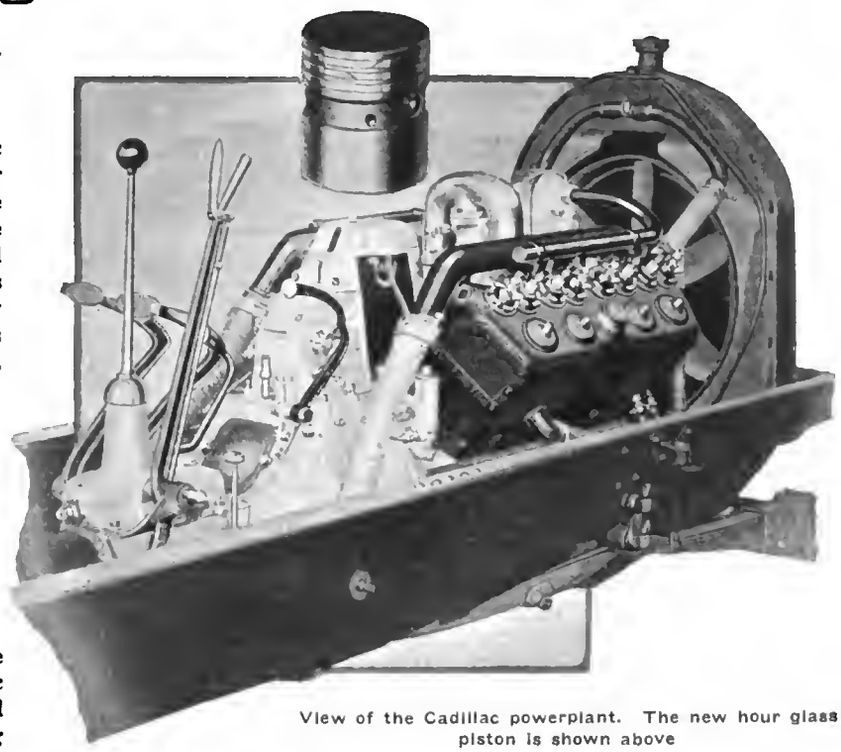
The body lines on this car are up-to-date and carry out a pleasing adaptation of the modern idea of streamline or moulded form. As will be noted there is little or no break at any point on the body as the cowl line joins the line of the body edge with an easy sweep. The rear of the body also rounds off in a graceful manner so that the lines of the car are distinctly long and low. When the top is down this lowness is accentuated, giving a very graceful form with plenty of room in the interior.

Cadillac 55 Longer and More Luxurious

Mechanical Changes of a Detailed Nature Giving Accessibility

FOR the third successive year the Cadillac Motor Car Co. ushers in its eight-cylinder car with no marked changes. There are some differences in the new Type 55 over the Type 53 which it succeeds, but these should be regarded more as refinements. Prices of the open models remain unchanged at $2,080; but the closed-body models, all built upon exactly the same chassis but of 132-in. wheelbase, are raised somewhat, due to the added cost of their manufacture.

Perhaps the most important difference in the new Cadillac is the lengthening of the wheelbase 3 in. to 125 in., a change which adds to the appearance of the car and increases its riding qualities at the same time. The rear of the body has been lowered somewhat, due to a little alteration in the bottom of the body in order to give it more clearance over the axle and also to some revamping of the top body line. These new features, together with the using of crowned fenders, make the new Cadillac the most beautiful car the concern has yet offered the public. As an added touch, there is a molding around the top of the body in the seven-passenger type, which sets it off in admirable shape.



View of the Cadillac powerplant. The new hour glass piston is shown above

Mechanically the changes are very few indeed. The motor has been fitted with new and lighter pistons which are somewhat on the hour-glass order in that the center is of smaller diameter than the top and bottom, thus reducing the bearing surface within the cylinders. There are a number of return oil holes drilled around this center portion to return any surplus lubricant to the crankcase, and, besides this, the wrist-pins have been enlarged somewhat as an added factor of strength. Last year's car had straight pistons. It is stated that the redesigning of the pistons and the slight refining of the rod assembly have resulted in the reduction of 1 lb. per rod and piston assembly, this meaning the two pistons, connecting-rods and bushing for any two opposite cylinders. This makes a net reduction of 4 lb. per motor due to the new piston design, etc.

Valves More Accessible

The valve alley between the blocks of cylinders has been made more accessible by redesigning the exhaust manifolds so that each is 1⅛ in. closer to its block of cylinders, a gain of 2¼ in. between these manifolds.

Due to the lengthening of the wheelbase the frame has been strengthened principally by making the side members 8 in. deep in the channel, an increase of 2 in. as compared with the previous model. This refers to the maximum frame depth, of course, there being the usual taper. A new feature in the frame also is the use of tubular cross-members at front and rear in place of the more generally used pieces of square or rectangular section. These, together with the deeper channel, make a more rigid frame that ought to be proof against any weaving that might be expected under severe road conditions. These tubular cross-pieces are not only stronger, but they are lighter than members of a different shape would be.

Another slight difference, which is nevertheless important in its effect, is the shifting of the torque arm from the left side of the propeller shaft to the right side, this being done to better absorb the torque of the motor, which turns from left to right. In the axle the mounting of the drive pinion shaft has been improved by placing both bearings ahead of the pinion itself instead of having one bearing either side of it, as in previous designs. This takes care of the thrust to best advantage.

These are all of the differences over the previous car, with the exception of several refinements that add to the convenience and comfort of the motorist as well as to the appearance. The tail lamp, for instance, has been redesigned so as to throw light upon the gasoline gage, making a very convenient detail at night. A splash shield now runs out horizontally at the front of the radiator and between the front ends of the frame, this giving better protection to the radiator than did the slanting guard formerly used.

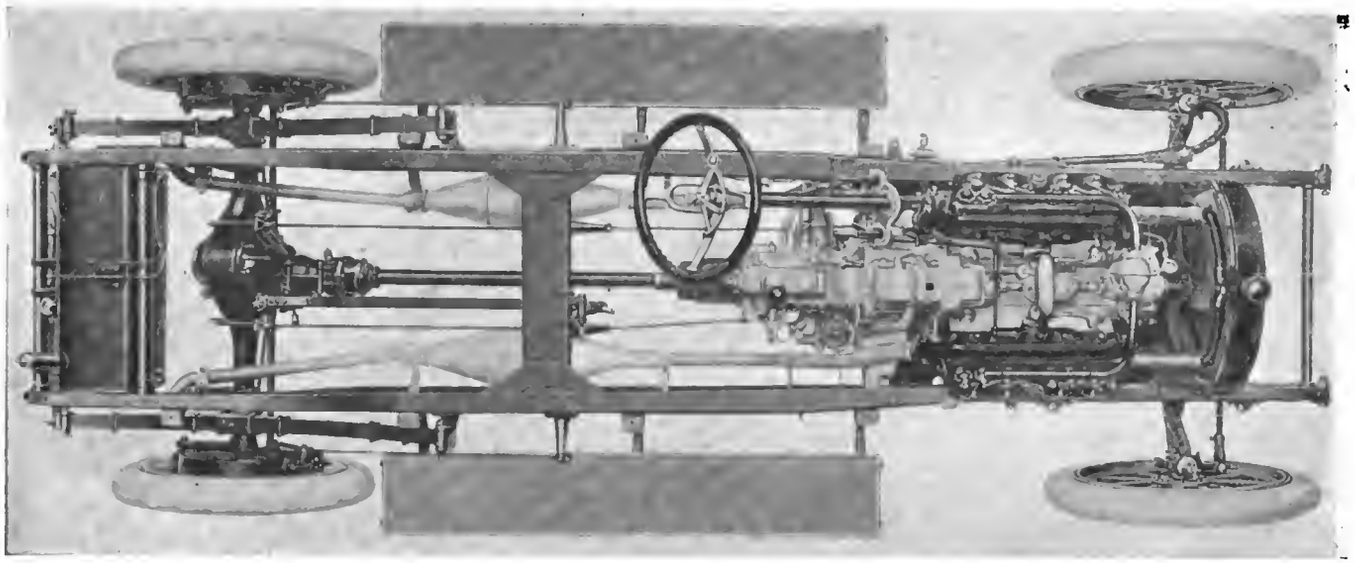
There has been a big upholstery change, adding materially to the comfort of the car. A new form of upholstery spring is used that is unusually soft, though it stands up well and will not settle. The leather is of dull grained variety instead of having a glazed finish, and in addition it is plaited instead of being tufted, undoubtedly adding to the appearance and comfort.

Head lamps of a new shape have been added, these having just a suggestion of the shape of the Cadillac coat of arms as it appears on the radiator and adding to the car's general good looks.

Gabriel snubbers swell the list of standard equipment, and are fitted both front and rear. A deep blue has been selected as the body color this year, taking the place of the dark green that was used on last season's cars. The color change, however, does not apply to the closed-body types; they still have a dark green paint.

Having summarized all of the important changes in the Type 55, it might be well to review the salient mechanical features of Cadillac construction for the benefit of those who are not familiar with them.

Since the Cadillac eight was first announced in 1914 there has been no alteration of the bore and stroke or of the motor



Plan view of the Cadillac model 55 chassis showing the accessible V powerplant and layout of the drive and torque members

basically. Cylinders have a diameter of 3⅛ in. and the stroke is 5⅛ in., giving a displacement of 314 cu. in. and a horsepower rating by the accepted formula of 31.25. This is nominal, for the motor will do well over 70 hp. on the block. In its general scheme the cylinders are in two blocks at 90 deg. and cast integral with the water jackets, heads and intake manifolds, making a simple construction. The aluminum alloy crankcase has the two blocks bolted to it in the usual fashion, and it carries the camshaft in its upper part, the crankshaft directly below the camshaft, and the oil reservoir at the bottom. A third shaft is placed vertically above the camshaft, this driving the Delco generator, ignition distributor and fan, and running in the alley between the cylinders. Actuation of the camshaft and generator shaft is by silent chains at the front, which are completely housed; and at the rear of the crankcase is the gearset, the bell-housing of which serves to complete the inclosure.

No Change in Principle

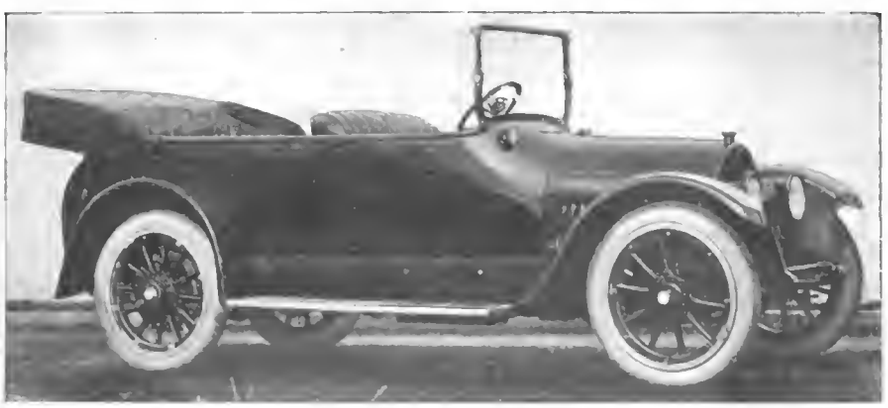
As the eight-cylinder type of engine is now known to the majority of persons, it need be said only briefly that the crankshaft is of the same form as used in a four-cylinder motor, only each throw bearing carries two opposite connecting-rod big ends instead of one. In the Cadillac adaptation the method of attachment of these two mating rods to the one bearing is by forming one rod with a yoked end and the opposite rod end of such width that it fits between the arms of the yoke. Two caps are, of course, required for the yoked end, one for each arm of the yoke; and in order to afford a proper bearing surface for each rod end the big-end rod is pinned to the outer ends of the bushing, while the other rod fits to the bushing within the yoke and is free to turn. Thus the bearing for the yoke rod is the inner surface of the bushing against the shaft, whereas that of the outer rod is the outside surface of the bushing.

Valves in the Cadillac engine are actuated by only eight cams, each cam operating two opposite intakes or two opposite exhaust valves, as the case may be. The cam assembly is on the under side of a plate which bolts to the top of the crankcase between the cylinder blocks, and pivoted to this plate are sixteen rockers (one for each valve), these being interposed between the ends of the push-rods and the cams so that the lift will be straight upward along the valve instead of having a side thrust, as would be the case if the cam worked directly against the end of the valve rod.

Force-feed lubrication remains practically unchanged in the new model. A gear pump positioned at the front of the motor and driven from the crankshaft draws on the supply in the oil reservoir at the bottom and forces it through a reservoir pipe running along the inside of the crankcase, from which there are outlets to each of the main bearings.

Thermostatic control of the water temperature is still used, there being interposed in each water pump line a thermostat which automatically closes the supply of water from the radiator when the temperature gets below a certain level, causing the jacket water to circulate and recirculate through the cylinders until such time as the water temperature mounts to the height at which the thermostatic valve is opened and the whole supply of water admitted, permitting the circulation of the water as in any other motor. Incidentally, each cylinder block has its own centrifugal pump, driven off the end of a transverse shaft below the crankshaft, to which it connects by spiral gears.

Some of the other specifications include a multiple dry-plate clutch having fifteen carbon steel plates 7¾ in. in diameter; floating rear axle having spiral-bevel driving gears and a pressed-steel housing; tubular open propeller shaft with universal joint at either end; platform rear-spring suspension that has long been a Cadillac feature; 20-gal. gasoline tank with fuel fed to the carbureter by pressure; power tire pump attached to the side of the gearcase and operating through the gears. The tire equipment consists of 36 by 4½ smooth treads in front and non-skids in rear.



Cadillac 55 touring car which has been rendered more comfortable and lengthened 3 in.

ACCESSORIES

Forbes Extension for Fords

THE Forbes extension renders the Ford chassis 36 in. longer. The change is made by removing the body, rear mudguards, splash plates, running boards, gasoline tank, muffler and exhaust pipe and cutting both side members of the frame through at the middle of the car with a hacksaw. A channel is then hot-riveted and swedged into the opened section, thus lengthening the frame. A cross-plate of cast steel is arranged between the lengthwise members of the extended section to take the thrust of the driveshaft. Each side of the frame is trussed throughout its length with steel rods secured to steel brackets at the ends of the frame. An intermediate driving shaft is furnished, together with brake rod extensions, longer running boards and splash plates and all other parts required in making the installation. The capacity of the truck is 1500 to 1800 lb. Price, packed for shipment, $100; installed, $135.—Walter J. Forbes, 243 Columbus Avenue, Boston, Mass.

Hartman Automatic Switch

When the switch is used fuses are not required, according to the maker, for an automatic circuit-breaker is incorporated in the switch and is said to instantly open the circuit when a ground occurs, and positively indicates the fact by throwing out a small button below the switch key. To close the circuit again it is only necessary to push the button in, and if it remains in position it shows that normal conditions have been restored. The switch key may be removed with the lights burning, so that they cannot be tampered with in the absence of the driver. A similar type of switch is made for the ignition circuit, thus preventing the draining of the battery in case the switch should be turned on while the motor is stopped.—Hartman Electrical Mfg. Co., Mansfield, Ohio.

Faw Wiring for Fords

Several improvements have been made in the Faw wiring sets designed for Ford cars. The terminals, which were formerly soldered on at the end of the primary wires, have been displaced by self-made terminals, which are produced by looping the end of the copper conductor and soldering it. Thus a solid terminal is made integral with the wire itself. A copper ferrule protects the end of the insulation at this point. Another improvement is the elimination of the rubber nipples at the end of the flexible metal tubing, a metal ferrule which screws in place being used instead. The primary wires are of different colors so that they may be easily traced. The outfit consists of four high-tension ignition cables cut to the right length and provided with soldered terminals and four primary wires. Price, $1.—J. H. Faw, Inc., 41 Warren Street, New York, N. Y.

Hartman automatic switch

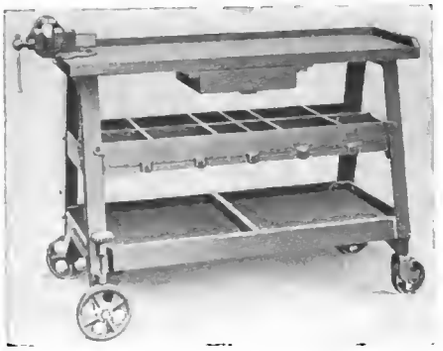

Howe searchlight

Howe Searchlight

The feature of this parabolic light, which is designed for mounting on the windshield, is the universal bracket, which has coil springs to provide a constant tension on the joints and thus holds the lamp firmly in place in any position. These springs, however, do not interfere with the ready movement of the lamp. The wiring is inclosed in the hollow bracket. Prices, $7.50; with rear-view mirror, $9.—Howe Mfg. Co., 61 East Twenty-fourth Street, Chicago, Ill.

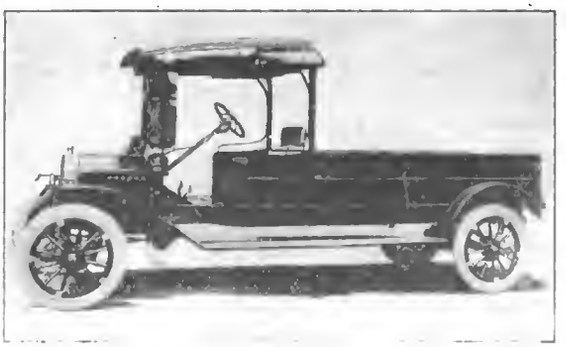
Manley Portable Bench

A floating machine shop is what the maker calls this bench. It is mounted on wheels on casters. The top is 12 by 44 in. and is equipped with a vise at one end as an extra. There is a drawer below the top of the table, and underneath are two shelves, the upper one having several compartments for parts of various sizes and the lower for heavier parts and tools. It should prove valuable in the repair shop, for it may be used right at the car, thus saving many steps. The construction is cast iron and steel throughout except for the top of the bench, which is wood.—United Engine & Mfg. Co., Hanover, Pa.


Manley floating machine shop

Economy Piston Ring

Economy piston rings differ from many in general use by not having pins to secure them in position. The illustration shows the method of joining the ends of the rings, with a tongue-and-groove device. They are concentric. In theory a concentric ring is said to insure equal bearing on the walls of the cylinder and consequently an even wear on the rings. This, and the absence of pins and loose parts, promote full compression, as the



Above—Forbes Ford extension. Right—Faw wiring

Anchor weatherproof top for Fords

ends of the rings can be sealed so tightly as to prevent any leakage whatever at the joint. The rings range in prices from 90 cents for 2½ to 3½ in. diameter, to $2.25 for 6 to 6½-in. diameter.—American Piston Ring Co., Minneapolis, Minn.

Anchor Tops for Fords

These tops are designed to be quickly attached to Ford cars, so that a closed car may be had for cold weather use and an open car for warm weather. The frame is of wood and the sides and back are glass. The doors of the top and car doors open together being operated by a single patented locking device. The interior of the top is upholstered and the windows can be lowered or may be removed and curtains substituted. Price, sedan $57.50, coupe $47.50.—Anchor Buggy Co., Cincinnati, Ohio.

Badger Tire Holder

This tire carrier is designed especially for the 490 Chevrolet, which is not regularly equipped. It is made to carry a single tire at the rear, and is suitable for a plain tire or one mounted on a wire wheel. It is attached to the rear body sill by through bolts. Price, per set, complete with straps, $3.25.

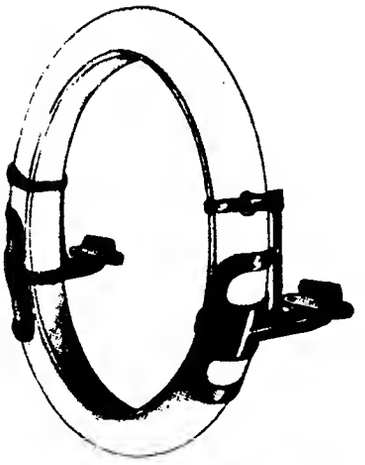
A new rear tire holder has been designed for Fords, consisting of a single drop arm which is clamped to the rear spring and from which extend two arms to support the tire at the side and also a central arm which carries the tail light and the license plate. Complete, without lock, $3.25, and with lock, $3.75.—Auto Parts Mfg. Co., Milwaukee, Wis.

Mud Cover for Ford Cars

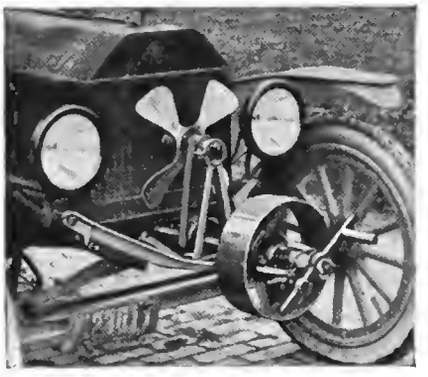
This is a new mud cover which slips on over the fenders, body and doors, and may be put on or taken off in 5 min. Waterproof material is used. Fasteners of the ordinary kind found on gloves are used. The covering protects the finish of the car against mud and water in wet weather.—Edward McClintock, Minneapolis, Minn.

Apco Spring Leaf Lubricator

These lubricators consist of a pair of semi-steel plates with oil reservoirs and felt inserts, as illustrated. When in position the felt rests against the spring, keeping it lubricated without any attention except occasional renewal of the oil supply. The devices can be installed in 2 min. with a screwdriver. They are finished in black enamel and are tapped to take oil cups. The large size is 2 in. between bolts and the small 1½ in. Ford cars require four sets, two small and two large, while cars with full elliptic springs will need sixteen sets; semi-elliptic need eight; three-quarter with semi-elliptic front need ten, as do cars with platform springs. The lubricators sell for 30 cents per pair.—Auto Parts Co., Providence, R. I.



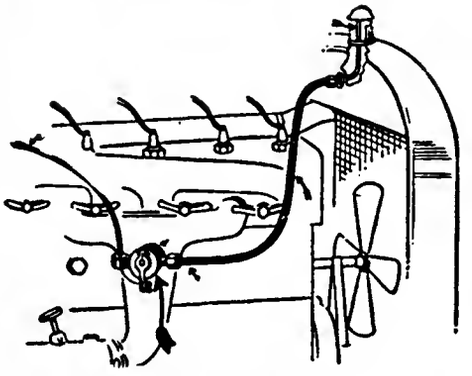
Badger tire holder



Autopower attachment for Fords

Autopower Attachment

Power for driving stationary farm machinery may be obtained from a Ford by the use of this device, which consists of a pulley mounted in front of the radiator and which is driven from the crankshaft. A belt-driven fan supplies extra cooling. It may be attached without any drilling, the only tool required being the wrench. It is capable of supplying 10 hp. continuously, it is said.—Autopower Co., 965 Woodward Avenue, Detroit, Mich.



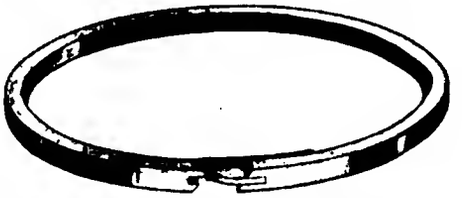
Vapo Humidifier supplies moisture to the carbureter

Vapo Humidifier

This device supplies warm, moist vapor to the manifold, the exact amount being controlled from the dash. It consists of a valve at the manifold from which runs a pipe to the filler spout of the radiator, from which point the vapor is procured. It is said to provide a better mixture and, consequently, to improve the power and smoothness of operation of the engine. Price, $5.—Auto Gas Saver Co., 29 South La Salle Street, Chicago, Ill.

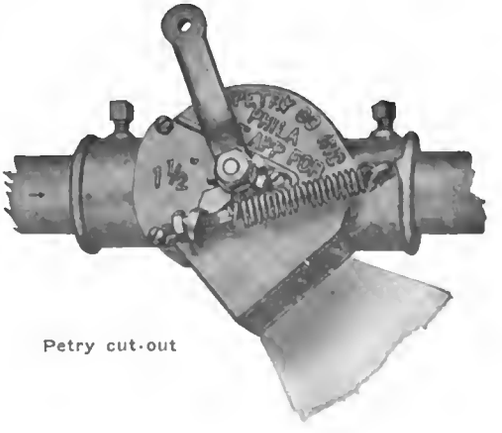
Petry Cut-out

This cut-out is a damper type, one position of the damper deflecting the exhaust gases down into the open and the other position allowing them to pass through to the muffler. The valve may be readily removed for cleaning, and the tension of the closing spring may be varied to suit the requirements. Prices: 1¼ to 1¾ in., $3; 1⅞ to 2½ in., $3.50; 2⅝ to 3 in., $4.—N. A. Petry Co., Inc., Philadelphia, Pa.



Economy piston ring. Note the absence of pins

Apco spring leaf lubricator which uses felt pads



Petry cut-out

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Federal Gasoline Report

NO one seems to be able to put his finger directly on the cause of the country-wide reductions in gasoline price That it is due to the investigation of the Federal Trade Commission is vigorously denied on all sides, but it seems quite a coincidence that the reduction comes just as the report is due. There has also been talk that the price has been forced down to allow the Standard Oil companies to buy up existing stores at bargain prices, but here again there is a cheerful indefiniteness about the reports.

Gasoline prices run in waves, and each time there is a rise or fall a host of explanations is always ready. The oil magnates cite the law of supply and demand, and yet a close investigation always seems to indicate that the ratio of demand has not varied much. It is to be hoped that the gasoline report from the Federal Trade Commission, which is just about due, will clear up a large part of this mystery.

Some of the oil men state, and very possibly with reason, that as soon as the oil demand rises to a high pitch all the little producers and independents all through the oil-bearing country immediately dig wells, and consequently the production goes up. In other words, it is a question of the production varying to meet the demand rather than a case of the demand being varied to meet the production. All over the country there are numerous wells of small output when taken singly or in small groups, but when the production of these wells is combined it makes a total that can very well swing the tide over toward a lower price scale. There is no doubt, also, that the automobilist is content with a lower-grade fuel now than he would have been a few years ago, because cars are being built that will burn the heavier grades satisfactorily.

Ford Service

FORD'S epoch-making announcement of an entirely new way of marketing automobiles, following closely on the heels of a deep slice into the price list, is so fraught with possibilities that it is only after the atmosphere begins to clear that the deeper significances of the plan become visible. Here and there the question is now being asked if the cut in price is not being made to some extent at the expense of a cut in service.

No doubt the new plan of merchandising will be more economical from every view point. If money is to be saved on service, that money will be left in the pockets of purchaser as well as in the coffers of the Ford company. When a man buys a plow or a lawn mower he does not ask the dealer searching questions regarding service for the implements. He knows that, having been built by a large factory that expects to continue in business, the service feature goes without saying. He knows that through any dealer handling the product of the large manufacturing organization he can buy or order parts.

The low-priced car is as much of a utility device as the lawn mower and the plow. Its use is just as widespread and general. Therefore, it is but natural that, since the marketing method of the car will follow out the plan found desirable in other lines of utility hardware, the service method will do likewise.

Stronger Financing

THE era of prosperity which has swept through the automobile industry, and which is still continuing its sweep, has brought about a result that will be appreciated should a period of depression ever ensue. It has always been said that many of the larger automobile manufacturing companies did not have sufficient reserve. This condition, if it ever in reality existed, is past. Almost each week there is some increase in capitalization among representative concerns in the industry to enable policies of expansion to be carried out.

In addition to expansion, most of the companies are building up a reserve that will prove a tower of strength should a period of need ever arise. Some of the increases made this year are a striking commentary on the vastness of the resources of the country and the tremendous buying power that has still been practically untapped. Larger schedules of production are being announced on every side for the new fiscal year. In spite of the quick growth, a soundness and firmness is being manifested which puts the industry in the best possible light before the banking interests of the country.

Judge Investigates Headlight Device

Makes First Bonafide Decision in Mass., Stating Warner Lenz Complies with Law

BOSTON, MASS., Aug. 19—The first judicial decision on the headlight law where a judge went out for himself and made an inspection of a device was rendered in the Boston courts yesterday when Judge John Perrins, Jr., stated that the Warner lenz complied with the Massachusetts law.

The importance of the decision lies in the fact that a judge has really passed upon the matter after a demonstration. Heretofore the judges sat in court and heard policemen say a light dazzled even if it had a device on it, and the officer's word was accepted, and the motorist fined or his case filed. But no judge would take the trouble to investigate the claims of the motorists. They seemed to hedge on the question when attorneys tried to fight the cases.

The Highway Commission refused to approve any device because the devices were so made that improper focusing defeated the purposes of the inventor. When the case of the Warner Lenz came before Judge Perrins the attorneys laid much stress upon the fact that the judge should investigate the facts rather than rely upon the policeman's word. Judge Perrins said it seemed fair, and a trial was made one evening. The judge was convinced the Warner was not a lawbreaker.

In his decision he said: "The fact is that a certain space must be illuminated, according to the law, and a certain strength of light must be used for this purpose. When space 150 ft. away must be made light, the illuminating source must be accordingly brilliant. But I find this light not to be dazzling." In a former case with a Frecto device he discharged the defendant, but said that it may have been possible to break the law by improper focusing of the bulbs. If other judges follow Judge Perrins' lead and make investigations for themselves the police and the motorists will then know just where they are at. Police officials accompanied the judge on his trip in the Boston parkways while making his tests.

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A. L. Westgard to Build Tires

YOUNGSTOWN, OHIO, Aug. 18—A. L. Westgard, well known in this country as an authority on good roads, is at the head of a new company which will build tires. He has formed the Westgard Tire & Rubber Co., with a capital of $1,500,000, and will locate a plant on a site of 4½ acres just northeast of Warren.

The concern has its building plans completed and is at present negotiating with contractors for the erection of the plant. Concerning the operations at the new plant, it is stated that 400 tires will be the daily production and 200 men will be employed at the start.

Mr. Westgard is president of the corporation. Other officers are: A. E. Gordon, vice-president and manager, and F. A. Vallbrecht, treasurer.

Mr. Westgard is well known in this section. For many months past he has been connected with the National Good Roads' Assn., and in the interests of the organization has made twelve trips across the continent.

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Denmo Is New Truck

CLEVELAND, OHIO, Aug. 21—A new assembled truck to be called the Denmo has just been put on the market by the Denneen Motor Co., this city. The truck sells for $1,385 chassis, and is rated to carry 1¼ tons. It has a Splitdorf-Aplco lighting and starting system as stock equipment. The engine is a Wisconsin four, 3¾ by 5 in. and transmission is through a three-speed gearset to a Torbensen internal gear axle. There is a governor driven from the propeller shaft, so that it is the truck speed and not the engine speed which is controlled. Special pains have been taken with the thermo-syphon cooling system, the radiator, a Fedders, being mounted on a cushion base which gives it a more widely spread support than the usual spring brackets at the lower front corners.

Nine feet of loading space are provided, the wheelbase being 124 in., but it is stated that the truck will turn in 21 ft., as a very wide steering lock.

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Pays Customer for Broken Parts

INDIANAPOLIS, IND., Aug. 21—A novel service policy has been started by the Fisher Automobile Co., local Reo dealer. This company has advertised that all parts broken in normal service within 1 year from delivery date will not only be replaced promptly free of charge for material and labor, but it will, in addition, pay to the customer an amount equal to the price of the new part as shown in the price list, as compensation for the annoyance and loss of time.

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U. S. Advocates System

WASHINGTON, D. C., Aug. 21—The Federal Trade Commission which was formed to better trade conditions and relations has taken a deep interest in accounting systems and has issued two pamphlets covering the principles of accounting. One pamphlet is for manufacturers and the other for retailers. These do not advocate the use of any particular system, but urge greater attention.

Overland Adds $15,000,000 to Capital

$7,500,000 Has Been Sold and Remainder Is Being Underwritten

NEW YORK CITY, Aug. 23—The Willys-Overland Co., Toledo, has increased its capital from $22,500,000 to $37,500,000 by the sale of $15,000,000 of its common stock held in the treasury to J. S. Bache & Co., and C. D. Barney & Co.; $7,500,000 of this has already been sold and the remainder is being underwritten. The new stock will carry a 5 per cent stock dividend declared payable on April 2, 1917, to stockholders of record on March 15, 1917.

Common shareholders of the Overland company may subscribe at $44 a share to the new stock, two-thirds of a share of the new for each share held. There is also outstanding $15,000,000 of 7 per cent preferred, convertible into common stock.

The preferred shareholders, under the law, have no right to subscribe to any part of any new issue of common stock, but in view of the fact that the preferred stock is convertible into common stock, Mr. Willys has waived, in favor of the preferred shareholders, a sufficient amount of the stock to which he has the right to subscribe, to permit of an offering to the preferred stockholders of one share, par value $25, for each share of preferred stock outstanding.

The new common stock is worth about $2.50 a share less than the stock now outstanding, since the 10 per cent common stock dividend ordered on July 12 last is payable 5 per cent on Oct. 2 next and 5 per cent on April 2, 1917. As stated above, the new stock will not carry the 5 per cent payable in October.

After the receipt of the proceeds of the $15,000,000 of stock, the Willys-Overland Co. will have approximately $15,000,000 of cash and $30,000,000 of other strictly quick assets, with no liabilities other than strictly current monthly bills. The earnings of the corporation on a basis of the first 6 months of this year are approximately 40 per cent upon the par value of the common stock, including that proposed to be issued.

Proceeds from the new stock issue will be used to provide for the company's present requirements, for future growth, to insure prompt delivery of all orders, and to permit of increased disbursements from time to time in the way of dividends.

The company has an authorized issue of $50,000,000 of stock, that amount having been fixed upon, according to a statement issued by the bankers, in order to furnish adequate capitalization for the

growth of the business. Deliveries of cars for the first 6 months of this year were 94,477, being more than for the entire year 1915. The company is now approximately 25,000 cars behind in actual deliveries of cars sold.

Broken Marmon Seals Due to Road Contact

INDIANAPOLIS, IND., Aug. 8—The Nordyke & Marmon Co., this city, has made a statement in regard to the report of the Automobile Club of America on the examination of the Marmon car which established a record between New York City and San Francisco in 5 days, 18 hr. and 30 min. The club had placed seals and marks of identification on the car before its departure and on its return found certain of these broken. These seals that were missing, according to the Nordyke & Marmon Co., were so placed that they came in contact with the road, and were in this way either broken or torn away. The breaking or loss of these seals, under the circumstances, is not significant, being due entirely to an unfortunate choice of position and not for the purpose of making repairs.

The report shows the original wheels were missing. Inasmuch as wire wheels, standard equipment, were used, changes were made quickly by taking the wheels with the tires mounted completely off and substituting others with inflated tires.

King Making 2-Week Run

WASHINGTON, D. C., Aug. 19—An 8-cylinder King touring car is making an unofficial 2-weeks' non-stop run on the boulevard between this city and Baltimore. The start was made at noon, Aug. 12, from the plaza fronting the United States Capitol, and at the conclusion of the first 168 hours' run had a mileage of 3515 miles. The gasoline consumption has averaged 12.126 miles to the gallon. Ankeny and Ldutbecher are alternating as drivers. Edelen Bros., of this city, and J. Stewart Smith, of Baltimore, are promoting the run.

Pullen Will Captain Five Mercers

SANTA MONICA, CAL., Aug. 21—Eddie Pullen will captain a team of five Mercers in the Vanderbilt Cup and International Grand Prize races.

Sixteen-Valve Stutz Roadster Ready

Car Featured by Getaway and Silence—Remains Cool with Retarded Spark

INDIANAPOLIS, IND., Aug. 22—The Stutz Motor Car Co. announces a new speedster model in which will be installed a sixteen-valve, four-cylinder D-head motor. Experimental cars have been on the road since Stutz first introduced the sixteen-valve motor in racing cars, and rumors have been current for some time that the motor would eventually be marketed. The speedster model alone will have the new motor, the four- and six-passenger and roadster bulldogs continuing with the eight-valve motor as stated previously in THE AUTOMOBILE. A representative of THE AUTOMOBILE drove the car and the motor is as quiet if not more so than the eight-valve Stutz. Although twice as many valves are in operation, the second set seems to have been quieted to the minimum.

The car has a getaway rarely equaled in a four-cylinder motor. The acceleration has a smoothness comparable with an eight or a twelve. One of the speedsters was driven a distance of 5 miles on high gear with throttle half open and the spark fully retarded. At the conclusion of this test the radiator was still cool enough so that the hand could be kept on the shell without discomfort. The stock car will easily attain a speed of 75 m.p.h. The motor has a bore and stroke of 4⅜ by 6 in.

The cylinders are cast in a single block, which is a departure from previous Stutz practice. The exhaust ports are separated, there being eight ports extended into the manifold. The crankcase is aluminum and the breather is so designed that oil vapor cannot escape and thus dirty the parts.

Ball bearings are used in the pump and magneto shaft bearings. The crankshaft is three bearings. Valves are operated by roller lifts. Cooling is by centrifugal pump and lubrication is force feed through the hollow crankshaft. Pistons are lubricated from the main and rod bearings. The push rods and valve springs are inclosed by aluminum cover plates held in place by wing nuts, allowing removal of the plates without need of tools.

Woman Crosses Continent in 11.23 Days

NEW YORK CITY, Aug. 19—What probably sets a new mark for women drivers was established when Miss Amanda Preuss arrived here to-day, having driven an Oldsmobile stock eight roadster across the continent in 11 days, 5 hr. and 30 min. Miss Preuss was alone in the car and was checked out of San Francisco on Tuesday, Aug. 8, by Major Hilton of the U. S. artillery. The route followed was the Lincoln Highway which, with detours, gave a total of 3600 miles. The longest continuous run was 580 miles from Cheyenne to Council Bluffs.

Master Carbureter Co. Holds National Economy Test

DETROIT, MICH., Aug. 22—The Master Carbureter Corp., this city has just finished a nation-wide economy test with its carbureter in which over 200 of its dealers participated.

The results of the tests appear in the following tabulation and take up a few of the most important cities:

Car	City	M. P. G.
Pope-Hartford	Phoenix, Ariz	31 7/10
Overland 83	Nashville, Tenn	15 3/8
Overland 59	San Francisco, Cal.	20
Cole	Portland, Ore.	12 4/10
Haynes	Salt Lake City, Utah	22 4/10
Buick	Los Angeles, Cal.	22 3/10
Dort	Boston, Mass.	28
Ford	Tulsa, Okla.	24
Paige	Spokane, Wash.	25

Doble Steam Car in Detroit

DETROIT, MICH., Aug. 21—Abner Doble, expert on steam automobiles, who was at one time consulting engineer for the Stanley Motor Carriage Co., makers of steam cars, and who has spent a number of years in the development and perfection of steam propulsion of motor cars, is in Detroit. He has associated with him C. L. Lewis, former president of the Consolidated Car Co., and M. J. Hammers, also connected with that organization. The General Engineering Co. has been organized with a capital stock of $200,000 to market a high class car after Doble's designs.

Resta Easily Wins Speedway Grand Prize

(*Continued from page* 310)

get his car working right and finally withdrew at this point after having been a poor tail-ender in each of the first four heats. He managed to run the requisite five laps each heat, however, and worked on his car between heats to get the kinks out of a valve that insisted on sticking.

There was little contest for first place in the final 50-mile dash, Resta taking the lead at the start and never giving it up but once—at the end of 36 miles Lewis lead but only for a few hundred feet. Likewise there was no doubt from the first who would be the last to finish, for D'Alene could not get his Duesenberg to perform as he had earlier in the race. Resta was never far ahead of Lewis, Buzane and Galvin. These four kept well bunched and the latter three vied with each other for second place and furnished most of the thrills for the final heat. For example, Lewis crossed the tape ten times in second place; Galvin eleven times, and Buzane three. Lewis was third across the tape five times, Galvin ten times and Buzane ten. Fourth place was held by Lewis nine times, Galvin four times and Buzane twelve times.

Security Prices Are Steady

Firestone Common 20 Points Higher—Chalmers Common Rises 10 Points

NEW YORK CITY, Aug. 22—Automobile and accessory issues continued active and strong last week. The tire issues were especially active and several of them made substantial gains. Firestone common featured with a gain of 20 points and closed yesterday at 935. Goodyear common rose 2 points, Kelly-Springfield 2¼ points, Portage 15 points, and U. S. Rubber 2⅜ points.

Chalmers common featured the automobile issues with a 10-point gain, reaching 170. Chevrolet experienced a setback yesterday and dropped to 198, a loss of 14 points for the week. General Motors common also closed yesterday at a loss, this being 10 points.

Springfield Body saw a good demand and rose 10⅛ points as a result of the announcement that the company's earnings are running at a rate equivalent to over 43 per cent on the $1,500,000 common outstanding.

Peerless advanced to 25½ at a gain of 3½ points. This company has just received a large truck order from the Allies.

General Motors preferred reached a new high record of 123 yesterday. It is reported that this company is about to recapitalize on the basis of $75,000,000 common.

Saxon stock rose to 77 at a gain of 5½ points. This company has just announced a large production for the coming year with a large part of it already contracted for. Changes on the Detroit Stock Exchange were for the most part small, ranging from a fraction to 2 points higher. Studebaker common rose to 129½, a gain of 2 points. Maxwell common also rose 2 points, quoting at 82½.

Both the first and second preferred of the Maxwell company rose 1½ points.

Lead and Steel Higher

NEW YORK CITY, Aug. 22—The rise of lead and open-hearth steel featured last week's market activities. Lead rose 70 cents per 100 lb. and Bessemer steel rose $2.00 per ton. Lead quoted yesterday at $6.75 and Bessemer steel at $45.00. The rest of the metals were steady and in good demand. This was especially so with copper which is being ordered for November and December delivery.

Rubber prices were also higher yesterday in sympathy with the rise on the London market. The price of hard Para moved more or less in sympathy with that of plantation, but it has remained at a comparatively high level, due to the restricted supply available. Last week Para rose to 67½, a gain of 1 cent a pound, while Ceylon rose 2 cents to 58½ cents.

Enger Announces New Financing

One Share of 7% Preferred and Two Shares Common for $105

CINCINNATI, OHIO, Aug. 21—The Enger Motor Car Co., this city, which recently took over the Frank J. Enger Co. for the purpose of handling the company's increased business, this week elected the following officers, all of Cincinnati: F. J. Enger, president and general manager; Daniel McLaren, first vice-president; E. L. Jones, second vice-president; and G. W. Platt, secretary-treasurer. The company will begin at once the erection of an additional building which will give it a capacity of 7500 cars per annum.

The directors are as follows: F. J. Enger, E. L. Jones; D. C. Keller, president of the Dow Drug Co.; R. H. Wurlitzer, president of the Rudolph Wurlitzer Co.; L. R. Marks, president of L. R. Marks Co.; Daniel McLaren, president of the Hamilton County Bank; R. B. Goodrich, president of the Engle Mfg. Co.; F. E. Wesselmann, County Commissioner and President First National Bank of Cheviot; A. A. Taylor, vice-president the Stearns & Foster Co.; W. B. Hay, president the Hay Lumber Co.; Edward Ritchie, president the Guarantee Deposit Bank; and

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co. (new)	..	..	64⅜	66	+ ⅜
J. I. Case pfd	70	79	84	87	+1
Chalmers Motor Co. com	89	92	170	176	+10
Chalmers Motor Co. pfd	94	97	97	102	—1
*Chandler Motor Car Co	..	..	104	106	..
Chevrolet Motor Co	..	..	198	205	—14
Essex Motor	..	..	74	77	..
Fisk Rubber Co. com	..	..	..	150	..
Fisk Rubber Co. 1st pfd	..	..	..	..	..
Fisk Rubber Co. 2d pfd	..	..	..	..	..
Firestone Tire & Rubber Co. com	518	525	935	945	+20
Firestone Tire & Rubber Co. pfd	111	..	112	113	..
*General Motors Co. com	202	207½	560	585	—10
*General Motors Co. pfd	106	107	122	122½	+4
*B. F. Goodrich com	55	57	72¼	72⅞	+ ¼
*B. F. Goodrich pfd	107	108	113½	114⅛	+ ½
Goodyear Tire & Rubber com	271	275	235	239	+2
Goodyear Tire & Rubber pfd	108½	110	106½	107¼	+ ¼
Grant Motor Car Co	..	..	7½	8½	..
Hupp Motor com	..	..	6½	7	..
Hupp Motor pfd	..	..	80	110	..
International Motor Co. com	23	25	6	8	+1
International Motor Co. pfd	50	52	15	20	+2
*Kelly-Springfield Tire & Rub. com	174	177	72¼	72¾	+2¼
*Kelly-Springfield Tire & Rub. 1st pfd	85	87	96	97	..
Kelsey Wheel pfd	..	..	100	100	..
*Lee Rubber & Tire Corp	..	..	45½	46½	+ ½
*Maxwell Motor Co. com	40	41	84⅛	84¾	+2⅝
*Maxwell Motor Co. 1st pfd	86	87	85	87	— ½
*Maxwell Motor Co. 2d pfd	34	35	57	57½	+1¼
Miller Rubber Co. com	..	195	220	226	—5
Miller Rubber Co. pfd	107	107½	105	106	+1
Mitchell Motor	..	..	65	67	..
Motor Products	..	..	62	68	..
Packard Motor Car Co. com	112	119	170	176	+5
Packard Motor Car Co. pfd	99	100½	99	103	—1
Paige-Detroit Motor Car	..	..	46	47	+1
Peerless Truck & Motor Corp	..	..	25½	26½	+3½
Perlman Rim Corp	..	..	..	..	..
Portage Rubber Co. com	42	..	130	135	+15
Portage Rubber Co. pfd	92	94	130	135	+15
Pratt & Whitney	..	..	104	106	..
Princess Motor Corp	..	..	1	1⅛	..
Regal Motor Co. pfd	..	..	17	22	..
Reo Motor Truck Co	17	18	35	36	— ½
Reo Motor Car Co	32½	34½	42½	43¼	+ ¾
Saxon Motor Car Co	..	..	77	78	+5½
Scripps-Booth	..	..	50½	50½	—1
Springfield Body	..	..	81⅛	85	+10⅛
Standard Motor Co	..	..	6	6½	+ ½
Stewart-Warner Speed. com	65½	67	103¾	104¼	+1¼
Stewart-Warner Speed. pfd	105	107	..	..	..
Stromberg	..	..	44¼	44½	+1
*Studebaker Co. com	99	101	129¾	130½	+1¾
*Studebaker Corp. pfd	102	103	109	111	..
Stutz Motor	..	..	65	66	..
Swinehart Tire & Rubber Co	85	90	95	100	—5
United Motor Corp	..	..	64	64½	—1½
*U. S. Rubber Co. com	48½	50	57¾	58	+2¾
*U. S. Rubber Co. pfd	104	105	110¼	112	+ ¾
White Motor Co. (new)	..	..	53¾	54½	+1¾
*Willys-Overland Co. com	169	171	55	55½	+1¼
*Willys-Overland Co. pfd	105	106½	103¾	104¼	+ ¾

*At close August 21, 1916. Listed New York Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co	..	..	36¾	38½	+ ¼
Chalmers Motor Co. com	88	..	..	165	..
Chalmers Motor Co. pfd	96¼	97¼	..	103	..
Continental Motor Co. com	270	295	35½	37	—1½
Continental Motor Co. pfd	83	86	9½	10½	..
Ford Motor Co. of Canada	1490	1525	..	344	..
General Motors Co. com	211	216	540	600	..
General Motor Co. pfd	107	109	116	121	+1
Maxwell Motor Co. com	43½	46	82½	85	+2
Maxwell Motor Co. 1st pfd	89	91	85½	88½	+1½
Maxwell Motor Co. 2d pfd	36½	38	56	59	+1½
Packard Motor Car Co. com	115	..	..	172	..
Packard Motor Car Co. pfd	99½	..	101	104	..
Paige-Detroit Motor Car Co	..	..	..	52	..
W. K. Prudden Co	20¼	22	..	..	..
Reo Motor Car Co	33	33¾	42½	43½	+ ½
Reo Motor Truck Co	17⅜	18⅛	35¼	36¼	..
Studebaker Corp. com	107	110	129½	132½	+2
Studebaker Corp. pfd	105	108	105	..	..
C. M. Hall Lamp Co	..	..	..	30	..

INACTIVE STOCKS

Atlas Dron Forge Co	27	30	30	..	..
Kelsey Wheel Co	205	..	55	60	..
Regal Motor Car Co. pfd	21	..	17	..	..

G. W. Platt, secretary-treasurer the Block & Platt Co.

The new company has an authorized capital of $4,000,000, divided into $1,000,000 of convertible preferred stock and $3,000,000 common. One million dollars of the common is reserved for the conversion of the preferred.

The stock is offered on the basis of one share of the 7 per cent convertible preferred, par $100 and two shares of the common, par $10 each, for $105. The preferred is convertible into common, at the option of the holder, at any time prior to July 1, 1918.

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Receiver for McClurg Tire Co.

COSHOCTON, OHIO, Aug. 21—Dr. H. R. McCurdy is appointed receiver for the McClurg Tire & Rubber Co. The receiver's bond was fixed at $25,000 which was given and the receiver took charge. The suit was brought by Jesse McClain, J. S. McClurg, and Dr. L. C. McCurdy. Inability of the company to market its automobile tires is given as the cause for the receivership. J. L. Rue, M. A. McConnell and C. H. Howell were named as appraisers.

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Allard on Torpedoed Ship

TORONTO, ONT., Aug. 12—M. L. Allard, assistant superintendent of the Dunlop Tire & Rubber Goods Co., Ltd., has just returned to Toronto after a most adventurous trip to Europe and the Far East for the Dunlop company. Mr. Allard was the only Canadian passenger on board the Yasaka Maru when that liner was torpedoed in the Mediterranean. Mr. Allard lost everything and was for hours drifting around on a raft. Finally the party were picked up by a passing steamer.

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Redden Truck to Expand

DETROIT, MICH., Aug. 21—The Redden Motor Truck Co. has recapitalized at $500,000 in order to expand its business. It manufactures an attachment for making a Ford into a 1-ton truck.

Capt. Lewis Pays L. P. C. Debts

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Personal Pledge of 100% to Creditors Redeemed in Full

RACINE, WIS., Aug. 19—Capt. William Mitchell Lewis, former president of the Mitchell-Lewis Motor Co. and later the moving spirit in the L. P. C. Motor Co., Racine, Wis., has fulfilled his promise to creditors of the L. P. C. company that all claims would be paid at 100 per cent of value, regardless of the amount accruing from the sale of assets.

The L. P. C. Motor Co. made a voluntary assignment 11 months ago. At that time Capt. Lewis gave creditors his personal pledge that none would lose even a penny in the transaction. On Aug. 16, last, the assignee, F. Lee Norton, filed in circuit court his report of receipts and disbursements, amounting to $102,000. It was stated that preferred creditors were paid in full some months ago, and checks were mailed to other creditors on Aug. 15 for 100 per cent of their claims, although the sale of assets gave general creditors only 23.7 per cent of claims. The referee states that Capt. Lewis gave him his personal check to make up the balance amounting to 76.3 per cent, thus making it possible to liquidate every cent of the indebtedness.

The Lewis family recently disposed of its holdings in the Mitchell-Lewis Motor Co. to the Mitchell Motors Co.

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Swiss Exports Valued at $5,790,000 in 1915

BERNE, SWITZERLAND, July 26—Swiss automobile manufacturers closed the year 1915 with exports valued at $5,790,000. By weights the exports of 1915 exceeded those of the preceding year by over 100 per cent, and by value even a larger gain was made. Proportionally the Swiss automobile export industry, it is said, has increased at a greater rate than that of the United States.

Finished trucks and truck chasses formed the principal exports. The former export increased by more than 300 per cent and the latter by 100 per cent. They were sent largely to France.

The imports fell from 1,868,416 lb. to 571,438 lb. Among imported cars the American product is only slightly represented. But three American cars have been seen in this section during the past 6 months.

About 750 cars and trucks are imported annually. The most popular foreign car is the Fiat. Small 10 to 20 hp. five-passenger cars are in greatest demand.

Local automobile dealers declare that the absence of supply stations for American cars is the principal drawback to the sale of such automobiles here. Repairs under the circumstances are expensive.

At least two high-class cars are manufactured in the country, and in normal times these cars sell, even in France, in competition with French machines. The price of these Swiss cars usually is from $1,660 to $2,190, but 15 per cent increase has been exacted by the manufacturers since the war.

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Chiniquy Heads Kankakee Co.

KANKAKEE, ILL., Aug. 17—R. L. Chiniquy was elected president of the Kankakee Automobile Co., this city, at a meeting of the stockholders held this week. The other officers are: Vice-President, E. Betourne; treasurer, E. C. Chabot; secretary, O. L. Chiniquy; general manager, R. E. Parker. The directors are R. L. Chiniquy, E. Betourne, E. C. Chabot, R. E. Parker, and O. L. Chiniquy.

The company was incorporated for $500,000, and at the election it was reported that over $300,000 worth of stock had been subscribed for.

The plant is located on North Greenwood Avenue near the N. Y. C. tracks. A small six has been assembled and tested. A new model, a larger six, is being worked out in the shop.

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Brown Takes Lubricating Bolt

SYRACUSE, N. Y., Aug. 21—The Brown Co., this city, has taken an exclusive license to manufacture the automatic lubricating bolt recently patented by David Landau, New York, and H. G. Farr, Springfield, Mass. The lubrication is from a main reservoir wick of felt that is positively attached to a threaded cap plug with feed wicks.

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Dividends Declared

Edmunds & Jones Corp.: $1 per share on common, and quarterly of 1¾ per cent on preferred, both payable Oct. 2 to holders of stock Sept. 20.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.57	.57	.57	.57	.57	.57	...
Antimony	.10	.15	.15	.15	.15	.13	+ .03
Beams and Channels, 100 lb.	2.77	2.77	2.77	2.77	2.77	2.77	...
Bessemer Steel, ton	43.00	45.00	45.00	45.00	45.00	45.00	+2.00
Copper, Elec., lb	.27	.27	.27	.27	.27	.27	...
Copper, Lake, lb	.27	.27	.27	.27	.27	.27	...
Cottonseed Oil, bbl	9.30	9.22	9.15	9.20	9.18	9.12	— .18
Fish Oil, Menbaden, Brown	.55	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl	.23	.23	.23	.23	.23	.23	...
Lard Oil, prime	1.05	1.10	1.10	1.10	1.10	1.10	+ .05
Lead, 100 lb	6.05	6.05	6.25	6.40	6.60	6.75	+ .70
Linseed Oil	.73	.73	.73	.73	.73	.73	...
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.95	.95	.95	.95	.95	.95	...
Petroleum, bbl., Pa., crude	2.30	2.30	2.30	2.30	2.30	2.30	...
Rapeseed Oil, refined	.90	.90	.90	.90	.90	.90	...
Rubber, Fine Up-River, Para	.66½	.67	.67	.67	.67	.67½	+ .01
Ceylon, First Latex, lb	.56½	.57	.57	.57	.57	.58½	+ .02
Sulphuric Acid, 60 Baume	2.50	2.50	2.50	2.50	2.50	2.50	...
Tin, 100 lb	39.25	39.00	38.87½	38.80	38.50	38.50	— .75
Tire Scrap	.05⅜	.05⅜	.05⅜	.05⅜	.05⅛	.05⅛	..

Ollier Taboos Factory Convention

In Favor of Getting Dealers Together in Their Own Territories Less Expense

DETROIT, Aug. 19—Shedding some new light on the matter of conventions of dealers, L. J. Ollier, vice-president and director of sales of the Studebaker Corp., who has just returned from a long trip to thirty-five of the leading cities in all sections of the country where he addressed conventions of the Studebaker dealers, says that the idea of holding one big convention at the factory each year is all wrong. This method of getting the dealers together is quite generally practiced, but Ollier's plan is to hold territorial conventions, where each man gets more individual attention and feels himself a bigger unit in the general assembly.

Ollier points out that if all the 6500 Studebaker dealers were to attend a big factory convention, the expense of bringing them in and entertaining them would be prohibitive. Of course, only a comparatively small proportion of them would attend, probably about 2000. A factory convention would therefore not be representative. A further difficulty is that those dealers who would attend would get lost in the shuffle, so to speak.

With the series of territorial conventions among dealers, it is entirely different. The dealers can afford to leave their business and travel 100 or 200 miles to attend a one-day convention at a branch, whereas they would not feel like traveling 1000 miles or more to go to the factory for a 3- or 4-day convention. At the district conventions, each dealer feels more important, and he gets a chance to talk with the factory officials and realizes his place in the general factory fabric. In a word, the territorial conventions are simply a means of attaining efficiency and reducing waste. They save time for the dealer at a period such as we are now experiencing when he is busy selling cars.

Studebaker, Ollier says, has never held a factory convention that was nearly so satisfactory, and practically every dealer in every district takes advantage of the territorial gathering and there is an element of personal contact that is impossible in annual factory affairs.

$150,000 Addition for National

INDIANAPOLIS, IND., Aug. 21—For the year ending July 1, National Motor Vehicle Co. sales increased more than 300 per cent.

Work has been started on the new $150,000 addition to the factory which made necessary the purchase of one-half a city block east of the present plant. Two new buildings are to be built at once. The new ground is 140 by 410 ft. Most of this ground has heretofore been occupied by one-story houses which must now give way for factory space.

The new building is to be 60 by 380 ft. and three stories high. It will be of reinforced-concrete and steel of the same general design and construction of the new National buildings which were built just 1 year ago.

The other new building will be 140 by 328 ft. and one story high. This building will be erected on the ground recently purchased.

More than 114,000 sq. ft. of floor space will be added to the National factory by the new buildings.

Fuller & Sons Output Increased

KALAMAZOO, MICH., Aug. 22—The new factory of the Fuller & Sons Mfg. Co., this city, is now completed and fully occupied. This company, which manufactures automobile parts and does a large business in transmissions, increased its output in July, 1916, 400 per cent over the same month last year. This output was nearly as great as the entire output of 1914. The production during the first 6 months of 1916 was 1 1/3 times greater than the entire year of 1915. To take care of this large increase in production, the company was forced to greatly increase the number of employees. At the end of July, 1916, the company had 250 per cent more men than in the corresponding month of 1915.

Overland Secures N. Y. Headquarters

NEW YORK CITY, Aug. 21—The Willys-Overland Co., which recently took control of its sales in this city by the establishment of temporary quarters at Columbus Circle, has leased the property at Broadway and Fiftieth Street belonging to the Wendell Estate. This building has remained vacant for 14 years. The Overland company will be the first tenant and will occupy the entire three floors and basement. The company has also opened a used car department at 1700 Broadway, near Fifty-fourth Street.

Trenton Plants Being Enlarged

TRENTON, N. J., Aug. 17—Trenton's manufacturing activity in the automobile industry is indicated by plant additions in course of construction or about to be erected at different establishments.

The Thermoid Rubber Co. has under way construction work designed to double the present capacity of the plant.

The Mercer Automobile Co. is erecting new buildings which will add nearly 100 per cent to its present output facilities.

In addition to other extensions made during the last year, the Ajax Rubber Co. has started work on a four-story steel and brick addition.

Saxon Employees Get Bonus

Will Turn Out Over 60,000 Cars for 1917—Contracts for 50,755 Closed

DETROIT, MICH., Aug. 21—The Saxon Motor Car Corp. will share a special bonus with its employees both in the office and factory departments, in accordance with a new plan just made public. This action is the result of the knowledge the Saxon officials have of the share the employees have in the success of any organization.

Office employees who have been with the concern for a period longer than 90 days will receive a bonus at the rate of 5 per cent of their yearly salary. Factory workers will share on a like basis, with the exception of those who have been paid a premium on the piece work basis. These will get a bonus of 3 per cent. The payment of this bonus will be made Sept. 1.

Although the Saxon organization has not decided upon a policy of bonuses each year, it is the intention, in years of prosperity, to pay some form of bonus as an appreciation of their services.

The idea is to get the employees interested in their work. and to build the best they can, for each step in manufacture is linked with the good-will of the men who actually do the manufacturing or fill the cogs in the industrial machinery.

DETROIT, MICH., Aug. 21—The Saxon Motor Car Corp. plans for an output for the 1917 selling year of more than 60,000 cars. Contracts for 50,755 cars have been closed within the past 3 weeks with Saxon dealers, and it is expected that the coming week will swell this to over 60,000. There is a definite monthly schedule of cars embodied in each contract which constitutes a bona fide order against which the concern can make shipments, which is a new feature for safety in dealer contracts. It is stated that Saxon is experiencing no let-up in the demand for its cars, and more orders for immediate shipment have been received since Aug. 1 than in any similar period in previous years.

Dodge Will Have Carpenter Shop

DETROIT, MICH., Aug. 21—The Dodge Bros. plant is to be enlarged by the addition of a five-story carpenter shop to cost $40,000 and measuring 240 by 40 by 80 ft., a six-story core shop to mean an outlay of $300,000 and having the dimensions of 425 by 60 by 105 ft., and another smaller building, one-story and 24 by 148 ft. Building operations on these will be started immediately.

Factory Miscellany

Superior Castings Plant Nears Completion—Work is being speeded on the erection of the plant of the Superior Steel Castings Co., Benton Harbor, Mich., whose main factory building will occupy a tract of land 138 by 200 ft. It is expected that the plant will be ready for occupation by Nov. 1. As the name indicates, the concern will manufacture steel castings.

No Homes for F. W. D. Employees—Because of the large growth of the business of the Four Wheel Drive Automobile Co., which has made it necessary to bring several hundred workmen to Clintonville, Wis., that city is confronted by a serious housing problem. To afford relief, business men have formed the Home Building Co., with $25,000 capital and will erect a large number of cottages, to be leased or sold practically at cost.

Case Issues New Shop Paper—The 5000 or more employees of the J. I. Case T. M. Co., Racine, Wis., are receiving the first issue of a new shop paper published at the expense of the company and distributed free to all members of the Case company. The paper is a monthly and much space is devoted to discussions of better shop practices, safety methods and topics bearing on the general welfare of the workers.

Rotary Engine Co. Starts Work—The Rotary Gas Engine & Pulverizer Co., which was organized recently at Antigo, Wis., with $25,000 capital, intends to engage at once in the manufacture of rotary gas and steam engines, tractors, transmissions for automobiles and other mechanical devices. The design is by Clarence Rishel, Denver, Colo., who has come to Antigo to take charge of the manufacture. For the present the production will be done under contract with local machine shops and foundries.

Continental Truck's New Plant—The Continental Motor Truck Co., Superior, Wis., has broken ground for its new $50,000 factory at Belknap Street and the Soo line tracks. The shop is to be ready Nov. 1, at which time the output of trucks will be largely increased. Dr. J. G. Barnsdale is general manager.

Boone Tire to Build—The Boone Tire & Rubber Co., Des Moines, Iowa, has practically concluded negotiations with the Business Men's Association to establish a branch plant in Beloit, Wis., to cost $25,000. The Iowa company is capitalized at $500,000 and operates a large tire and rubber works at Des Moines. This is overcrowded, however, and a branch plant must be provided. It is the intention of the company to build a plant.

Aluminum Co. Adds—The Werra Aluminum Co., Waukesha, Wis., which supplies numerous motor and automobile manufacturers with aluminum crankcases and other castings, is having plans prepared for a foundry addition, made necessary by the demand for its product.

Neverleek Co. Builds—F. S. Carr Co., Boston, Mass., maker of The Neverleek, is putting up two new buildings. The contract has been given and work will be started in Framingham at once.

Agnew Joins Chalmers—W. L. Agnew, who was the advertising manager of the Hudson Motor Car Co., Detroit, Mich., during the past 4 years, has joined the Chalmers Motor Car Co., where he will be connected with the sales promotion department.

Coey School to Build Plant—The Coey Auto School, 2010 South Wabash Avenue, Chicago, will build a one-story automobile factory to cost $50,000.

Chester County Motor Co. Moves—The Chester County Motor Co., Coatesville, Pa., will move to Philadelphia, Pa., where its plant will be located at Cherry Street, near Fifty-eighth Street. This company, of which J. E. Brinton is president, has been manufacturing a light gasoline commercial vehicle.

The Automobile Calendar

ASSOCIATIONS

Aug. 28-Sept. 1 — Milwaukee, Wis., Booster Tour of Milwaukee Automobile Dealers.

Sept. — Indianapolis, Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.

Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.

Oct. 2-7—Kansas City, Mo., Dealers' Show, American Royal Live Stock Show; Kansas City M. C. Dealers' Assn.

Oct. 13—Flint, Mich., Fall Meeting National Assn. of Automobile Accessory Jobbers.

Dec. 2-9—Electricians' Country-wide Celebration.

CONTESTS

Aug. 26—Kalamazoo, Mich., 100-Mile Track Race.

Sept. 1-2—New York, N. Y., Sheepshead Bay Speedway, 24-Hour Race, Trade Racing Assn.

Sept. 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.

Sept. 4—Cincinnati, Ohio, Speedway, Cincinnati Speedway Co.

Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.

Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.

Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.

Sept. 9—Indianapolis Speedway Race.

Sept. 16—Providence Speedway Race.

Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.

Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.

Sept. 30 — New York City, Sheepshead Bay Speedway Race.

Oct. 7—Philadelphia Speedway Race.

Oct. 7—Omaha Speedway Race.

Oct. 14 — Chicago Speedway Race.

Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.

Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.

Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 1-9—Cincinnati, Ohio, Good Roads Exposition and Convention, Music Hall, Hamilton County Dixie Highway Council of Cincinnati.

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

SHOWS

Sept. 2-9—Cleveland, Ohio, Show, Industrial Exposition and Fair, Edgewater Park.

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.

Sept. 4-8 — Hartford, Conn., Show, Connecticut Fair Assn.

Sept. 4-9—Minneapolis, Minn., Show, State Fair.

Sept. 4-11 — Indianapolis, Ind., Show, Indiana State Fair, Indianapolis Automobile Trade Assn.

Sept. 10-16 — Milwaukee, Wis., Show, Wisconsin State Fair, Machinery Bldg.

Sept. 25-30—Salem, Ore., State Fair, Joseph M. Rieg, manager.

Oct. 14-31 — Dallas, Texas, Show, State Fair.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 13-20 — Montreal, Que., Show, Montreal Automobile Trade Assn.

Jan. 27-Feb. 3, 1917 — Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb.—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

TRACTOR

Aug. 21-25—Bloomington, Ill., Tractor Demonstration.

Aug. 28-Sept. 1—Indiana Tractor Demonstration.

Sept. 4-8—Madison, Wis., Tractor Demonstration.

Sept. 11-16 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Week in the Industry

Ramsden With Oakland.—J. M. Ramsden, formerly with the implement departments of the J. I. Case Plow Works, Racine, Wis., also the Moline Plow Co., and the Kingman Plow Co., is now a general traveler with the Oakland Motor Car Co., Pontiac, Mich.

French Bour-Davis Purchasing Agent—W. F. French has been appointed purchasing agent of the Bour-Davis Motor Car Co., Detroit. Mr. French is a newcomer in the automobile field, but has been associated in the mercantile and commercial fields in Chicago in a similar capacity.

Riess to Move Sept. 15 — Charles E. Riess, Hupmobile distributor in New York City, will move to 1741 Broadway about Sept. 15, at which address his organization will occupy all four floors. The service station, which will continue at 226 West Fifty-sixth Street, will be enlarged and improved.

Overland to Open Cafeteria — The Willys-Overland Co., Toledo, Ohio, will open a cafeteria about Sept. 1 for nearly 1000 office employees. The cafeteria will be opened simultaneously with the removal of the offices to the new seven-story office building, just completed, on the Boulevard, near West Toledo.

Mason Plant Leased by Ford—The old Mason Motor Car Co. plant, Des Moines, Iowa, has been leased as temporary headquarters for the Ford branch assembly plant for Iowa, which ultimately will be located in a new building at Eighteenth and Grand Streets. The old Mason plant has about 20,000 ft. of floor space.

Canadian Items — The Canadian Double Tread Tire Co., Vancouver, B. C., has removed to 1260 Granville Street.

The Vancouver Motor Co., Vancouver, B. C., has removed to 825 Pender Street.

J. H. Beaton, former assistant sales manager of the McLaughlin Co., Oshawa, Ont., has been appointed to the above position for all of Canada. This company trebled its output in 1916 and will double the output for 1917.

Bour Sells Advertising Interest—C. J. Bour, president of the Bour-Davis Motor Car Co., Detroit, and former head of the National Railway Advertising Co. of Chicago, has become so interested in the automobile business that he has disposed of his interests in the Chicago company. Mr. Bour will devote a great deal of his time to the automobile business, spending the weeks in Detroit and the week-ends in Chicago at his home.

Ohio News Items—The Central West Motor Car Co., Columbus, has taken the central Ohio agency for the Liberty car.

The Broad-Oak Automobile Co., Columbus, will act as central Ohio distributor for the Studebaker. The distribution of the Studebaker was formerly done by the Brasher Motor Car Co.

The Toledo Central Garage Co., Toledo, has purchased the stock of Oakland and Hollier cars from the Toledo Auto Sales Co., and will operate the business in the future.

The Kissel Service Co., Columbus, has taken a lease on a new building on the southwest corner of Spring and Fourth Streets, where the salesrooms and service station will be located.

Philadelphia Items—The Hawley Motor Co., 632 North Broad Street, increased its capital stock from $50,000 to $250,000.

C. W. Mann, for 10 years with the Buick Motor Co., Philadelphia, has opened a Buick agency at 322 West Main Street, Norristown, under the name of the Charles W. Mann Motor Co.

G. H. Patterson, formerly with Hurley & Early, Philadelphia, has been promoted to sales manager of the Lexington Motor Co., 150 North Broad Street. The latter, it is announced, will be in new, larger quarters by fall.

The Remey Motors Co. has been organized here by Robert Remey and A. P. Whitman, who will distribute the twelve-cylinder H-A-L in Pennsylvania, New Jersey, Maryland, Delaware, Virginia and West Virginia.

Northwest News—The Twin City Cord Tire Co., Minneapolis, has amended articles of incorporation permitting increase in capital to $250,000.

The Chevrolet Motor Co. of Minnesota, Inc., is the name of a new factory branch, Minneapolis, opened by the Chevrolet Motor Co. to give service, distribution and repair parts depot for Minnesota, North and South Dakota, western Wisconsin, Montana, Iowa, Nebraska and Wyoming. Address is Sixth Avenue South and Fourth Street.

The Goodrich Tire Co., 506 Andrus Building, Minneapolis, has begun construction of the first unit of a factory at Redwing, Minn. It will cost $75,000, will be three stories, 100 by 100 ft. The capital is $300,000. Officers are: President, H. Scott Ewers; secretary, F. E. Oberg; superintendent, H. J. Smith. The company will make tires and mechanical rubber goods.

New England Trade Items—Connell & McKone, Eastern Massachusetts dealers for the Overland, have opened a salesroom on Main Street, Worcester, Mass.

The Ford Motor Co. has opened its new branch at 75 Liberty Street, Springfield, Mass.

R. O. Spiller has been appointed manager of the Franklin Square Motor Car Co., Dover, N. H.

The Becker-Stutz Co. of Boston has leased a large building at Springfield, Mass., for its branch there.

F. H. Kenney, who has the Chalmers at Worcester, Mass., has moved into new salesrooms.

G. D. Niles has been appointed manager of the Boston branch of the Portage Tire Co.

W. C. Goodchild, formerly manager of the Metz company's branch at Providence, has been made manager of the Boston branch.

P. S. Clark, secretary-treasurer of the Rhode Island Automobile Dealers' Association, and formerly the Mitchell agent at Providence, has formed a new company to handle the Apperson automobile there.

The Pennsylvania Rubber Co. has moved its New England branch at Boston to a new structure on Beacon Street.

Frank Crockett, for a long time with the Knox company, has joined the Connell & McCone Co., to have charge of their Overland service station.

The big Overland service station at Portland, Me., was finished last week, and a similar one is to be built at Bangor.

J. W. McGuire, Pierce-Arrow dealer at Boston, Mass., has had a set of plans drawn for a service station that will cost more than $100,000.

Alvan T. Fullerr, who has the Packard agency for Eastern New England, has just signed a contract for an addition to his mammoth service station in Boston, Mass., that will be a duplicate of the present one. It will be connected with the other by a bridge of U shape, leaving an 80-ft. court between the two buildings. The additional structure will give him 150,000 additional sq. ft. of floor space, and make it what is claimed to be the largest plant in the country controlled by one dealer. The first floor of the new building will be for the used cars, and the rest for a service station. The cost will be about $250,000, making the total plant worth more than $500,000.

The AUTOMOBILE

Vol. XXXV
No. 9

NEW YORK, AUGUST 31, 1916

Ten cents a copy
Three dollars a year

A Cowl Board With Every Speedometer for Ford

Just what every Ford owner needs, and wants—a Cowl Board beautifully finished in black enamel with a Stewart Speedometer, set off with a heavy nickel flange, mounted in the center.

It's a beautiful job.

And it gives a finished appearance to the Ford dash—and brings the speedometer up in a position where it can be easily read—even at night.

Ford owners are going to literally snap up this new Stewart product as soon as they see it. It is put on so easily—and is such a marked improvement. And the price complete is only a trifle more than the cost of the speedometer itself.

Dealers. think of the market this new Stewart Product opens up for you.

Speedometer for Ford $10

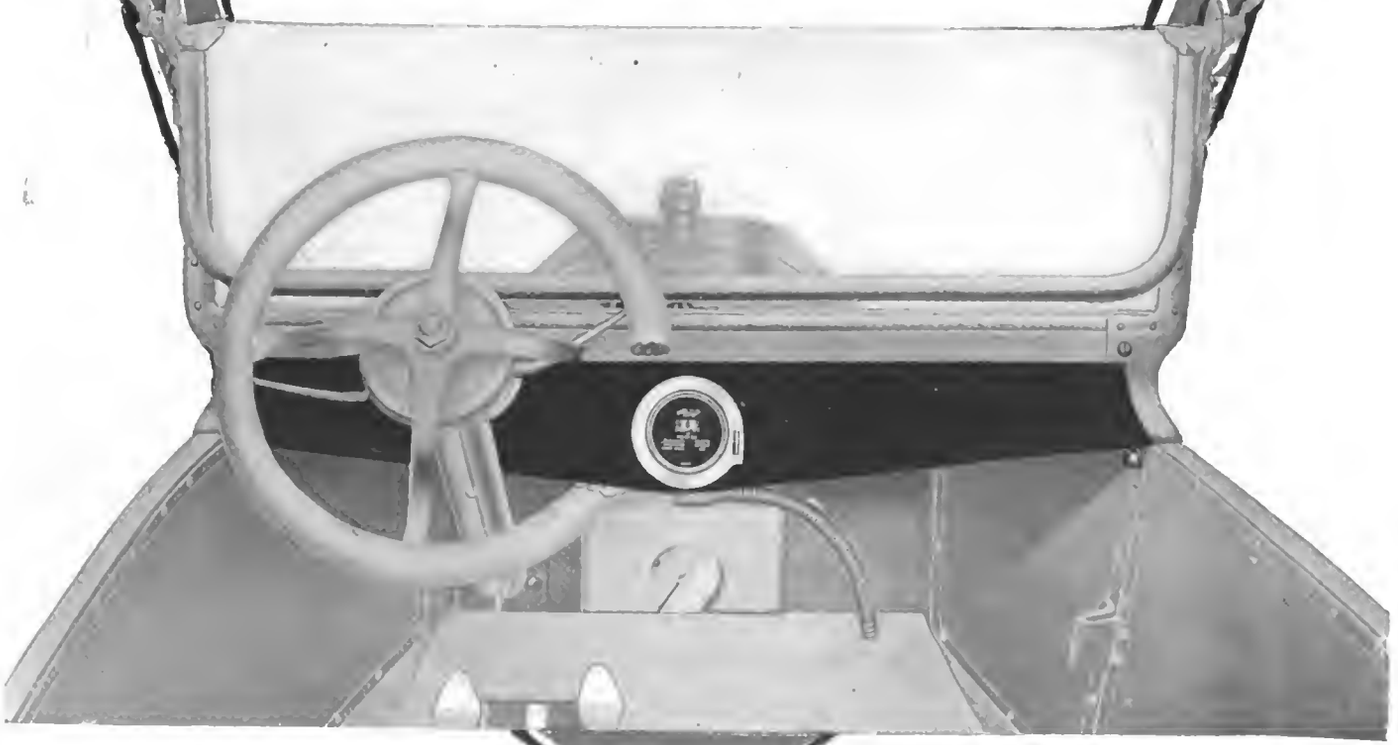
Cowl Board $1.25 Price Complete $11.25

"It will pay you to see that the car you buy is equipped with Stewart Products"

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Stewart

Speedometer and Cowl Board for Fords



The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, AUGUST 31, 1916—CHICAGO NO. 9

Cashing in on an Ill Wind

Railroad Strike Would Mean Opportunity to Cars and Trucks

NEW YORK CITY, Aug. 30—Should the threatened national railway strike materialize, automobiles and motor trucks will be offered the greatest opportunity in the history of the industry to demonstrate their ability in practical inter-city service. Already every city in the country is turning to the automobile as a possible means of passenger travel. More important still, these cities are looking to the motor truck as a means of furnishing their populations with food and other necessities from which the cessation of railroad operation would cut them off.

For Inter-Urban Work

Passenger lines may be organized for inter-urban transportation and if the strike should prove of appreciable duration these lines could be arranged without difficulty to form a network covering practically all the more thickly settled portions of the country.

The same applies to motor trucks so that passengers and goods could be carried from Boston to New York by one line, for example, and thence by another line, or perhaps a continuation of the same one, to Philadelphia and so on to Baltimore, Washington, etc. Chicago and Detroit, Buffalo and Cleveland and other large centers not separated by too great distances could be similarly supplied. Operation in a commercial way on such a large scale would do much in proving to the general public the efficiency and economy of the modern automobile and motor truck.

Car, truck and accessory manufacturers, like all other industries, would be handicapped in making deliveries if the railroads stopped running but in the case of the cars and trucks, these could be delivered under their own power in the form of driveaways from the factories to points not too far removed. Accessories would have to be shipped by motor trucks like all other commodities.

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Chevrolet $490 Electrically Equipped —Baby Grand $50 Higher

NEW YORK CITY, Aug. 26—The Chevrolet Motor Co., this city, has raised the price of its Baby Grand model from $750 to $800 and also announces that hereafter the price of $490 for its small model, known as the Four-Ninety, will include electric light equipment and electric self-starter. Heretofore, the Four-Ninety model equipped with electric lights and starter sold at $550.

—

Daniels Price Raised $200

NEW YORK CITY, Aug. 28.—The price of the Daniels eight will be increased on Sept. 1 $200, to $2,800 on all models.

—

Lozier Resigns as H-A-L Head

CLEVELAND, OHIO, Aug. 29—H. A. Lozier has resigned as president of the H. A. Lozier Co., this city, maker of the H-A-L twelve.

—

Murphy Resigns from Chalmers

DETROIT, MICH., Aug. 28 — Gail Murphy, advertising manager of the Chalmers Motor Co., has resigned.

—

Jones with Federal Brass Works

DETROIT, MICH., Aug. 28—The Federal Brass Works has appointed L. P. Jones sales manager.

—

Hebner Joins Bearings Service Co.

DETROIT, MICH., Aug. 28 — A. K. Hebner, service supervisor of the Hyatt Roller Bearing Co., has resigned to become general manager of the Bearings Service Co.

Haynes Sold to N. Y. Syndicate?

$4,500,000 for Stockholders in Addition to Half Stock of Holding Company

INDIANAPOLIS, IND., Aug. 29—By a deal made last week the stock of the Haynes Automobile Co. of Indiana may be taken up by the Haynes Automobile Co. of New York, a holding corporation, a consideration of $4,500,000 being paid to the stockholders of the Indiana corporation, in addition to receiving half of the stock of the holding company. Plans already are under discussion for placing a cheaper car on the market, to be known as the Junior Haynes.

Horace C. Stilwell, a promoter of Anderson, Ind., who represents New York financiers, signed an agreement with the stockholders of the Haynes company on Aug. 23. The agreement provides that 90 days shall be given the New York group to consummate the deal. The holding company is to have 600,000 shares of stock. Each stockholder in the present Haynes company is to receive six shares of the holding company's stock for each share of the present stock. It is proposed to place the other half of the holding company's stock on the market. The agreement provides that the present stockholders are to elect half of the board of directors.

According to announcements coming from Kokomo, A. G. Sieberling, who has been manager of the company for the last 3 years, and his assistants will remain in charge should the deal be consummated.

—

Dodge Resigns from Houk

BUFFALO, N. Y., Aug. 28.—L. G. Dodge has resigned as general sales manager for the Houk Mfg. Co., this city, to take effect Sept. 1.

Lamp Standards Are Progressing

S. A. E. Experiments Approach Solution of Glare Problem—May Eliminate Focusing

NEW YORK CITY, Aug. 29—It is thought possible that the experimental work now being done by the electrical equipment division of the S. A. E. standards committee may result in a great reduction of glare in headlamps and also in the elimination of all focusing devices. A focusing device is only an adjustment to counteract the ill effects of inaccurate reflectors and lamp bulbs. Experiments made at Nela Park, Cleveland, by a committee of the division some months ago showed that certain types of bulb filament and certain types of reflector were less sensitive than others, that is to say, they found it possible with some bulbs and reflectors to alter the adjustment of the focusing device quite considerably without affecting the nature or quality of the light seriously.

Another meeting held at Cleveland last week discussed the results of the tests having full specifications of the best bulbs and reflectors before them, and ascertained that it is possible commercially so to make bulbs and reflectors that any pair will assemble correctly without individual focusing.

The essential with respect to the bulb is that the filament shall be truly central within fairly fine limits, and for the reflector the focal length must be close to 1¼ in. With a reflector accurate in form within the limits of normal manufacture and with a bulb just a little more accurate than the present average and the right shape of filament no focusing is necessary.

Size of Filament

The committee on lamps reported the results of their meetings to the whole electrical equipment division at a meeting here to-day and the following subcommittee report and suggestions were approved:

The vacuum bulb which was selected as most practical at the tests had a filament in the form of a helix 2.5 mm. in diameter and 4.2 mm. long. The gas-filled bulb which was selected had a V shape filament, the spread of the V being 3 mm. and the height 2.5 mm. Both of these were 2½ amp. bulbs.

The National Lamp Works is making both 1½-in. and 2-in. bulbs with filaments located the same in reference to the base. Filaments are located by eye in manufacture, and the variation is held within 1/16-in. plus or minus. If jigs are introduced to secure more accurate location, the expense will be greater and the manufacture slower.

It is possible to locate the centers of filaments within 1/64 in. of the true axis and within 1/32 in. of standard distance from the pins in the base. Figures will be furnished as to the approximate increase in cost per bulb if they make the necessary apparatus and perform the necessary operations to locate centers of filaments within these limits.

The subdivision tentatively recommends that for all headlamp bulbs the center of the filament be located in the axis of the bulb, 1¼ in. from the nearer or locating side of the locating pins of the base.

Vacuum bulbs are to have filaments in the form of a helix 4.2 mm. long and 2.5 mm. in diameter.

Gas-filled bulbs are to have filaments in the form of a V (each leg of the V being formed of a fine helix) 3 mm. wide at the base and 2.5 mm. in length. The plane of the filament is to be at 90 deg. from the plane of the locating pins.

These tentative recommendations are to be tested out under manufacturing conditions by the latter part of November, after which time the final report can be made.

Reflectors

The subdivision recommends that reflectors be made as near as possible to the outline of a true parabola of 1¼ in. focal length. The receptacle shall be located concentric to the reflector and so that at the central point of adjustment in the reflector the portion of the bayonet slot where the pin comes to rest shall be 1¼ in. from the focal point of the reflector.

Tail-Lamp Glasses

Investigation has shown that practically all makers of tail lamps are using glasses having a nominal diameter of 3 in. with tolerance of minus 1/64 and plus 1/32 in. It is recommended that these dimensions be made standard.

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American Junior to Compete with Jinrikisha

INDIANAPOLIS, IND., Aug. 30—The American Junior, a little car carrying two passengers, is to be built here to compete with the jinrikisha in China and for juvenile trade. This car, with a 40-in. tread and a 70-in. wheelbase, will be built by the American Motor Vehicle Co., Lafayette, Ind., beginning Sept. 1.

The company will also manufacture motor chairs, which are driven by storage batteries. The directors are Jacob Weisenthal, Lafayette, president; Louis Marx, Chicago, vice-president; and W. M. Crockett, Lafayette, secretary. B. J. Mills, Chicago, is one of the principal stockholders. The capital is $25,000.

S. A. E. Session in Show Week

1-Day Professional Session with 2 Days for Committee Work—Dinner Thursday, Jan. 11

NEW YORK CITY, Aug. 28—According to the plans now under discussion, Tuesday, Wednesday and Thursday of New York show week in January are the days that S. A. E. members should bear in mind. They are the days of the annual mid-winter meeting. This year the New York automobile show is held a week later than formerly, so that the New Year's holidays are not molested as they have been for years past.

The show week begins Saturday, Jan. 6, and ends the following Saturday night, Jan. 13.

The annual S. A. E. dinner, the social feature of the week, will surely be held in Hotel Biltmore on Thursday evening, Jan. 11. The grand ball room with capacity for 750 guests has been selected because in connection with this hall are other large reception halls that have accommodation for that number.

As a climax to the dinner the Society through its 1916 Meetings Committee has secured the Midnight Frolics for that night, practically the entire seating space being reserved for S. A. E. members and guests.

Thursday will be the big day for professional papers, discussions, etc. The session will start at approximately 10 a. m., the official morning hour for New York show week and the work will be over at 4 p. m. At noon there will be a buffet luncheon. This session will be held in the large assembly room of the Engineering Societies Building.

Although Thursday will be the big Society day of the week, the work of the session will start Tuesday, when the many committee divisions of the Standards Committee will meet and add the finishing touches to their various reports.

Wednesday will be an important day. In the morning at 9.30 will be held the usual business session for various reports such as membership, treasurer, election tellers, the discussion of constitutional amendments and other work. After this short business session of an hour the various reports of the Standards subcommittees will be presented for final action by the Society. This will occupy the remainder of the forenoon.

Wednesday afternoon will largely be given over to a consideration of aviation matters. There will be at least two important papers on aeronautical topics, and these will be followed by three 15-minute discussions on important aviation subjects, to be announced later.

Illinois Farmers Want Tractors

Their Problem Is Quest for Best Size and Type—Too Many Models

BLOOMINGTON, ILL., Aug. 25—The Illinois farmer wbo visited the 5-day tractor demonstration held here tbis week is not concerned over whether he shall buy a tractor or not. He has already settled that question. He has made up his mind that he must have a tractor and he is going to buy one. The problem that is worrying him to-day is what tractor he will buy. His vexing problems are what size of machine, and what type of machine. Size and type confuse him immeasurably.

Tbe attendance was much larger than exhibitors had anticipated. The opinion was expressed very freely that although the numbers were not quite so great as at Fremont, the demonstration was quite as successful, from a business point of view. Perhaps the reduced attendance may partly be explained by the fact that Henry Ford and his new tractor were not present.

The attitude of the farmer toward tractors was well answered by the fact that at Wednesday's demonstration more than 5000 automobiles were on hand, a large percentage of these representing farmer machines.

Standards Needed

One of the most serious handicaps to the more rapid development of the tractor business is the very apparent uncertainty of tractor manufacturers as to the most suitable type of tractor. Frequently a farmer asking for information finds that he cannot get any convincing advice regarding the size of machine best suited to his requirements. The position is not improved by the attitude of more than one of the old implement manufacturers, as several of these concerns are making a needlessly wide range of machines. When one firm has six machines all quite different, the tendency is to put it up to the farmer to decide what he wants rather than to advise him to have one or another. When it is obvious that the manufacturer has not made up his mind as to which is the best type the farmer's confidence is naturally not very swift in coming.

The variation in type is certainly holding back the sale of tractors because the technical arguments placed before the farmer by different manufacturers are so antagonistic. For example, the champions of the very low-speed and the moderately high-speed engines are very bitter regarding each other, and the farmer cannot possibly reconcile the statements made by the two camps. It is the same with different systems of transmission. The tractor is nowhere near the stage of development reached by the automobile and the least discerning can readily perceive this. Consequently the more the tractor men get together and the more closely they agree from the broader features of design the easier will it be for tbe farmer to make up his mind and the greater the number will be sold.

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Brown-Lipe Gear Buys Deere Plow Plant

SYRACUSE, N. Y., Aug. 25.—As a starter to practically doubling its output, the Brown-Lipe Gear Co. has purchased the Fayette Street plant of the John Deere Plow Co., this city. The new purchase gives this company an entire block of its present plant on Fayette Street.

Last week the executive offices were moved into what were the executive offices of the plow company, and as rapidly as the change can be made the grinding department, control set department, tool room, rough stock department and service department are being taken out of the old plant and moved into part of the new plant. The balance of the new plant is being equipped with new machinery and the entire new plant will be in full swing by the first of the year.

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U. S. Truck Capital $1,000,000

CINCINNATI, OHIO, Aug. 24.—Increased from $300,000, the capital of the United States Motor Truck Co. is now $1,000,000. This increase was made at the annual meeting beld here recently. The new stock is both preferred and common, the preferred being 7 per cent cumulative and participating with tbe common up to 10 per cent. A part of the issue has been subscribed to by present stockholders and an additional block offered to the public.

Besides the regular 7 per cent dividend on the preferred the directors have placed an additional sum in surplus. The company was established 7 years ago and in 1914 was reorganized with R. C. Stewart as president.

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Parker Collapsible Rim Corp. Formed with $5,000,000 Capital

DOVER, DEL., Aug. 24—A charter has been filed here by the Parker Collapsible Rim Corp. to manufacture and deal in and with rims and parts of automobiles and other vehicles. The capital is $5,000,000.

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Perkins-Campbell Adds 10,000 Sq. Ft.

CINCINNATI, OHIO, Aug. 25—The Perkins-Campbell Co., this city, has added 10,000 sq. ft. to its factory. A second additional building with over 8500 sq. ft. is being rushed and will be added to the plant about Sept. 15.

Republic Truck Expands

Offers $750,000 of 7% Cumulative Preferred for Expansion of Business

NEW YORK CITY, Aug. 26—Conservative financing has been undertaken by the Republic Motor Truck Co., Alma, Mich., in offering $750,000 of 7-per cent cumulative preferred of $100 par, tbrough George H. Burr & Co. of New York.

Of an authorized capitalization of $1,000,000 preferred stock, $750,000 has been issued. None of the 62,500 shares of common which are authorized has been issued, nor has it any par value.

Financial Condition Sound

The exceedingly sound financial condition of the Republic company is indicated by the fact that it has no bonded indebtedness, nor can it have any except by consent of tbree-fourths of the outstanding preferred stock. Similar referendum is required in order to increase the preferred beyond that already authorized.

The company was established in July, 1913, with a paid-in capital of $8,000. Its capital and surplus, prior to the sale of this latest issue of preferred stock, was $852,219.98, $269,300 of which represented cash contributed from time to time. Dividends of $198,717 have been paid.

The entire proceeds of this issue of stock will go into the treasury of the company to care for the development of its business, the nature of which has been rumored, but not officially made public. According to an audit by Price, Waterhouse & Co., the balance sheet as of June 30, 1916, with the addition of the new capital, will show tangible assets of over 210 per cent and net quick assets of more than 169 per cent of the preferred issue. The certificate of incorporation requires that the net quick assets must be at least 100 per cent of the outstanding preferred.

Net earnings for the fiscal year ending June 30, 1916, according to Treasurer George W. Moore of the Republic company were $530,593.66, or ten times the requirements for preferred stock dividends.

The company has 407 agents, of whom 309 are exclusively devoted to the sale of Republic trucks. In tbe first 6 months of the concern's existence, from July 1, 1913, to Jan. 1, 1914, fifty-four trucks were sold. In the calendar year of 1914, 376 trucks were sold. In 1915, 1855. In the first 6 months of 1916, 2780. Since the beginning of the war, 4837 trucks have been sold, of which but 212 were on war orders.

ACCESSORIES In South America

No. II

Dealers Need Batteries, Jacks, Garage Tanks and Air Compressors—Oils and Greases Find Ready Market

By David Beecroft

IN addition to the spare parts, accessories and speedometers reading in kilometers wanted by the Ford dealer in Cordoba, Argentina, as mentioned in the first part of this article last week, he wants some form of constant lighting electric system for Fords, his request being only one of many similar ones received. Ford has been selling over 300 cars per month in Argentina, Chile and Uruguay. One month it rose to 470 cars; that was last February. With this output there is certainly a large demand for lighting as well as starting outfits. The people buying Fords have generally plenty of money. They are so pleased with the way the cars perform as compared with the impossibility of using the expensive European cars that they are glad to get anything additional that aids them.

Batteries Follow Cars

More U. S. A. starting and lighting batteries are needed. We must have them for nearly all of the 800 cars. Batteries are sure to give more or less trouble in Argentina. They gave us trouble in the U. S. A. the first year or so of electric starters, simply because our owners did not give them the attention they should have—generally distilled water when needed. That trouble is facing Argentina. Everywhere our batteries were conspicuous by their absence. We saw the Willard in several places, only one or two in a place; a few Vestas and a few Exides. There were more French batteries, and we were generally told of the superiority of the French types. It reminded us of the fact that we must look to our own interests in this work. Our battery people will have to fortify themselves in Argentina, Brazil, Chile, Uruguay and many other South American countries, as well as in the West Indies. In the fiscal year we shipped 4444 cars to Argentina alone. We shipped to all of South America 6725 cars. Those that were Fords have no batteries but are in the market for batteries, starters and lighting outfits. We shipped to the West Indies 4658 cars, making a total of 11,383 to Latin America. Spanish instructions on how to take care of batteries will be needed in all of this field excepting Brazil, where Portuguese is needed.

Metal running-board boxes are good sellers.

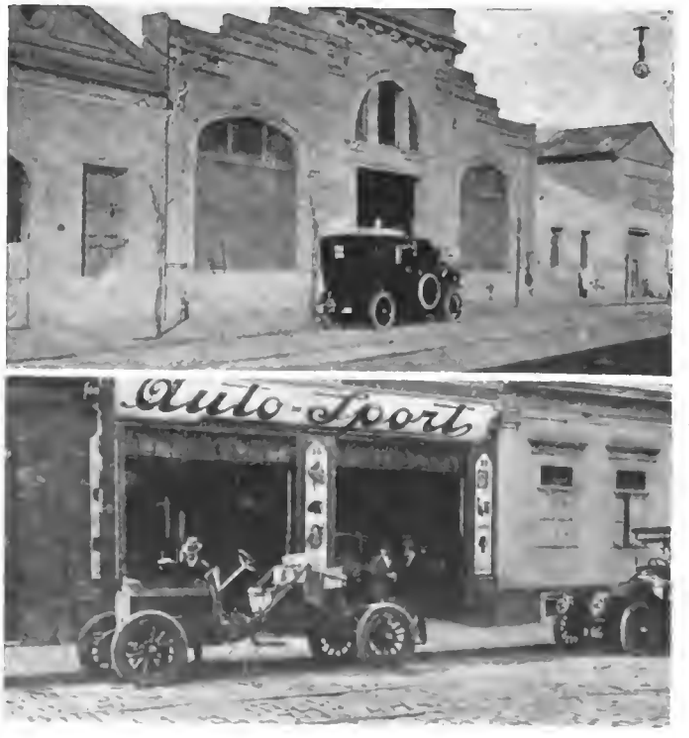
Market for Jacks

There is a good market for jacks in Argentina. You see French and English types and a few U. S. A. varieties. One English jack with a long handle for easy operation was selling well. A Paris jack was also much in demand. Two or three U. S. A. houses were well represented, but the field can be exploited much further.

We might go on indefinitely through the accessory field endeavoring to show different lines of possibilities for our accessory makers. We could add gaskets of all kinds and sizes; wrenches and screwdrivers and like tools, which have largely been supplied by France and Belgium; clocks, which are in demand; tire-removing tools, tire-repair kits, and a score of others. Space will not permit. Enough has been said to suggest the remainder.

Tank System for Garages

A word on garage equipment. Up to the present all of South America has bought gasoline in the square 5-gal. can, two cans being crated together. This is the English system.



Upper—Typical garage in Montevideo in which accessories are sold in large quantities. This is modern building constructed expressly for garage uses

Lower—Auto-Sport is one of the large accessory houses in the City of Sao Paulo, Brazil. It handles all lines of accessories and is much interested in U. S. A. lines. Our cars have been good sellers in the State of Sao Paulo and the accessory market should be proportionately good

Previous to the war England supplied practically all of the gasoline to South America, but now the U. S. A. supplies all and still supplies it in the 5-gal. cans. This is a costly and unhandy way, and the movement is gaining headway to sell in bulk, as is done in the U. S. A. The first curbside gasoline pump in Buenos Aires was started in May. It was proving popular. Argentines may be a little slow in installing new devices, but they are not slow in grasping their advantages. The "you-are-next" rule was in force before it was in place a week. Bowser has a good representation in Buenos Aires, and by this date perhaps several curbside ones are in place.

Not a garage in Buenos Aires in June had gasoline pumps and bulk systems, but they are all in the market for such. Here is a real field, not only in all of Argentina but in all of South America and the West Indies as well. You can add much of Australia. The garage people are a little afraid of the price but are convinced that tanks will have to go in, and we hope that in a year or so the gasoline curbside pump in front of the garage in Buenos Aires will be as common as in our own cities.

Garage Air Compressors

There is a good chance for manufacturers of air compressors for garages. I could not find a garage in any South American city that had a compressed-air system for tire inflation. You have to use the hand tire pump every place. Our makers should get busy with this market. The air system is needed just as much in South America as in the U. S. A. Perhaps smaller systems may be needed. Generally the garages can accommodate fifty to 100 cars. You rarely find larger ones. Our makers should bear this in mind.

Nearly all garages in South America are good centers for selling accessories. They are generally immaculate so far as cleanliness is concerned. They are lessons to us in the U. S. A. in this respect. The manager invariably has a clean business office, and you never see the chauffeurs hanging around. There is invariably a good show window for accessories and generally a very large glass showcase for them. The chauffeurs are in the habit of buying many accessories from the garage.

One bad thing about South American accessory business is that the chauffeurs invariably try to collect 10 per cent commission on all goods bought. They do it on tires as well as on supplies. Added to this is the fact that accessories are generally sold on 90 days. The garagemen and supply-house men would like to eliminate the chauffeur's commission but have not been able to get together in a satisfactory way to do it.

Oils and Greases Sell Well

U. S. A. oils and greases are generally good sellers in South America. One or two brands have good blue-and-white or yellow-and-white enamel signs that you see in most of the garages and supply houses. Generally oil and grease are handled by large concerns that have their own representatives in Argentina and Brazil. Previous to their establishing themselves there were many troubles, and still are. One of the commonest abuses was U. S. A. oil companies not sending the grade of oil ordered. We saw one shipment of oil that was entirely too thin. The shipment was not according to order. Apparently the oil man in New York thought he knew better than the Rio dealer. The result was that the dealer started buying from an oil company that would ship him the grade of oil he wanted. He ordered in $3,000 lots.

Another example was that of a grease shipment which did not come as per order. It was necessary to buy a supply of thicker grease and mix with the first order. On a successive order the price was raised on the Sao Paulo dealer. The result was that now he buys his grease in bulk from Europe—he is still able to get it—and he has made his own cans with his own labels and markets the grease under his own name. He has no objection to selling U. S. A. greases, but the prices must be lower.

Upper—This is one of the largest automobile accessory houses in Montevideo, a city of 375,000 population and the capital of Uruguay, which, although the smallest country in South America, and having a total population of 1,300,000, is a very active motor car country and has more miles of improved highways than any other country in South America, Brazil and Argentina included

Middle—This reproduction of the Overland agency in the City of Rosario, Argentina, shows how car dealers generally handle accessories and display them in the window. Inside there is invariably a good showcase well stocked with accessories

Lower—Casa Tonglet is one of the several large automobile accessory houses in the City of Sao Paulo, Brazil. This house handles U. S. tires for the State. It carries a varied line of accessories but is not so strong in U. S. A. accessories as it should be

Still another example of where our prices will have to be lowered was the case of carbide in Sao Paulo, Brazil. The dealer bought it through a New York exporting house, paying 36 milreis per unit in Santos, and on top of that he had to pay the freight from Santos to Sao Paulo. He was able to buy it from a German house in Sao Paulo for 34 milreis per unit, with no freight.

Bad Business Examples

In a trip visiting a score of supply houses you meet with many examples of bad business. Very frequently these supply houses buy through exporters who sell them goods that are not trade-marked and there is no possible way of telling where they were made. I saw one shipment of a dozen hand horns, and out of the dozen eight would not make a single note. There was no name on the horns and no way

of telling where they were manufactured. The dealer went back through the exporting house, but had not got any redress at the time I saw him.

Another example was an oil shipment in a camp town in Argentina. The oil was in 5-gal. cans with a New York label. The oil was so thin that it was useless. Trade records show no New York house of the name carried on the label. The job may have been put up by some house that was simply exploiting foreign trade. It was a bad advertisement for us.

All cases of this kind hurt U. S. A. goods. Their bad odor travels far and wide. It is no wonder U. S. A. accessories are not so much in demand in some places as they should be. We want our best men in South America to establish our trade there.

Co-operative Accessory Selling

Bad business of this nature suggests that some co-operative plan of introducing our accessories may be necessary in Buenos Aires and also in Rio de Janeiro. In these two cities we should have large supply houses well stocked with our goods. If the existing houses will not adequately stock our goods but prefer to favor European lines, then it is essential that we take active steps to establish ourselves. It would be wise to consider going so far as several of our accessory concerns not in conflicting lines combining to open one shop in each place for the sale of goods.

By establishing such a house those makers would be assured of proper representation. They could carry adequate stocks of parts, and could have one or more representatives selling the goods through the respective countries.

England has several large department stores in Buenos Aires, in Rio de Janeiro, in Sao Paulo, and other cities. Naturally, these stores push English goods. It is a wise foreign policy to establish such stores. To-day it looks feasible that it might be wise to open a large supply house in Rio and another in Buenos Aires for U. S. A. accessories. It is too expensive for many of our individual makers to open shops for their own line. That would prove impractical. But co-operation can solve the difficulty.

We found quite a few examples of where South American supply houses are buying direct from U. S. A. agents, and in not a single instance did we find any difficulties. The goods invariably came as ordered, they were properly packed, and prices were generally lower than where the goods were bought through a New York exporting house.

Get Close to Market

The main objection to so many of our large concerns selling through exporting houses is that the manufacturers do not get in as close business relationship with the South American retailer as they should. There are many abuses that never reach the ears of the manufacturer. He may note that the sale of his goods is dropping off, but he may never learn the exact reason. By establishing a Buenos Aires representative he will keep in close touch with his market and be in a much better condition to build up an export trade.

To-day a large percentage of the sales of our accessories there are not active sales, but rather orders filled by exporting houses in response to orders from South American houses. It would surprise you to see the line of goods manufactured by some of our largest houses and yet sold through exporting concerns. Such business is not permanent business, and such is not the correct way of building up a foreign business. The business is worth going after, and going after in a businesslike way. We should go after it to-day, otherwise our goods will gain a reputation for higher prices than European lines, due to the added percentages charged by exporting houses for their work. This can be saved by direct business. To-day we cannot afford to get a reputa-

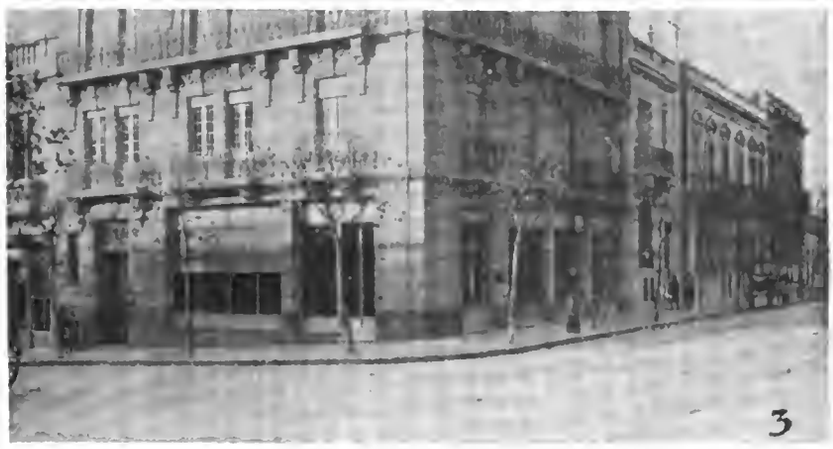
1—*This shows the salesroom of the Ford dealer in Montevideo. There is the usual salesroom with good display windows. Inside you find a very complete line of accessories and spare parts. From this house the whole of Uruguay is controlled*

2—*Here is a typical accessory store in a Brazilian city. The show window in front is well filled, and window dressing is about as well followed out as in U. S. A.*

3—*This is the egency of Cadillac and Chevrolet in Montevideo. It is typical of those large machinery houses that make motor cars a side line. The front windows are not used for car or accessory display. The accessories are generally handled on side shelves, resembling a hardware store*

1—*This is the Ford agency in the City of Sao Paulo, Brazil, from which over 800 Fords have been sold. This agency has a fine show room and in addition has a separate store for spare parts and accessories. Tires of several well known U. S. A. makers are also carried in Ford sizes*

2—*This is the display window of Antonio Prado in Sao Paulo, who carries a stock of accessories worth $50,000 U. S. gold. It is the largest accessory stock in Sao Paulo and a very complete one. Every line of European accessory is carried and many U. S. A. lines, but there are many U. S. A. lines found missing. Senor Prado has found it hard to do business with many U. S. A. firms, which accounts for too few of our goods*



3—*This is the Hudson dealer in Montevideo, Uruguay. It is a typical modern business place. Inside you find show cases filled with accessories. No more modern business place could be found. The store is as clean inside and out as one of our own. Cars are displayed in exactly the same way*

tion for high prices on our goods. Such reputations will live after we lower the prices, and will be sure to work us injury when Europe gets back in the market.

Need Spanish Stenographers

In carrying on business direct with the large supply houses in Buenos Aires, Rio de Janeiro, Sao Paulo, Santiago, Montevideo, and other cities, we must conduct business correspondence in the language of the country. For Brazil, use Portuguese, and for all of the other countries Spanish. You cannot satisfactorily carry on business correspondence in English. There is not any difficulty in securing competent Spanish stenographers in U. S. A., but you will have to pay them more than you pay the average stenographer.

You must get catalogs in Spanish and Portuguese. Do not send catalogues in English, as it only tends to give the impression that you are snatching a little easy business and that you do not intend to stay permanently in the field. You must go into the field for keeps, to stick. That is the greatest business advertisement you can use. South Americans like to see us go there to stay. They will trade much quicker with us when they see us sending our own men, opening adequate quarters, and building for the future.

Make your catalogs simple, much more simple than you would use for the U. S. A. The Latins of South America are not so mechanically inclined as are our people. They are more given to arts, music and sculpture. They like illustrations, and your catalogs should abound with them.

Keep Prices Out

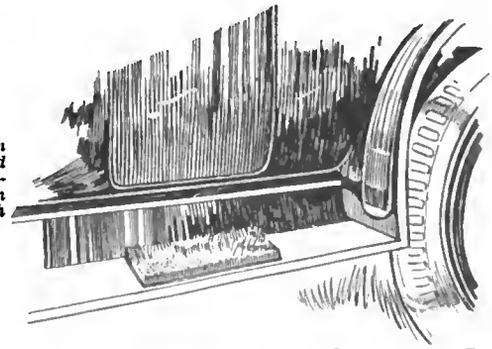
Do not put prices in the catalogs. There are several reasons for it. First, the South American dealer must pay the freight, he must pay the customs, and he must pay marine insurance, and, in these days, war insurance. His selling price must be based on all of these factors, and so, if any U. S. A. maker tries to add prices to his Spanish or Portuguese catalogs for South America or the West Indies, he is only clogging the wheels.

(To Be Continued)

Door-Mat for a Town Car

WHEN the interior of a closed car is fitted up with delicate trimmings and carpets like a lady's boudoir, and many cars are of this nature, it is an advantage to keep dust and mud off the floor, yet anyone stepping into the car from the street cannot help carrying a little dirt on his shoes.

To avoid this an idea which originated in Paris and ought to be popular in the big cities of America is worth mentioning. This is to have a small piece of stout door mat neatly cut and edged and strapped to the running board just below the door opening. The mat can be sewn to metal end pieces and screwed to the running board, or it can be fixed with screws and washers, the heads of the screws being well buried in the mat. As an accessory a device of this sort should sell well. It would need to be of a quality to suit high-grade cars, but need not cost a great deal.



Door mat on running board of finely upholstered town car to catch street dirt

Fascination in Tractor Design

Tractor Engineering 13 Years Behind Automobile—Concentrated Effort Will Overcome This Rapidly—Some Difficult Problems of Wide Scope and Many Minor Easy Ones

By A. Ludlow Clayden

AUTOMOBILE engineers are going to take up the tractor and men trained in the automobile industry are going to make possible 13 years of progress in 5 years or less. They are going to do this largely apart from any business reasons.

They are going to enter the tractor field as individuals because of the immense fascination of the machine. There are many passenger car engineers who have never been able to work up much enthusiasm over the motor truck, probably because the truck is rather like a passenger car shorn of many refinements, but the tractor has a different appeal. The effect of a first sight of a tractor demonstration is indescribable; one feels he is witnessing a manifestation of a new form of energy. It provokes much the same tingling of the blood as does the first sight of a speedway with a bunch of cars tearing past. Probably the explanation is that one sees and realizes in the deep-biting plows and the rapidly changing face of the landscape that same raw *power* which is the fascination of the speedway.

Whatever be the truth the fact remains that any man who took up automobile engineering for the love of the art has only to see a dozen tractors blazing their trail across acres of stubble in order to discover a new enthusiasm.

Development Will be Rapid

Even among tractor engineers it would be difficult to find a man who would contend that the gasoline tractor has reached more than an early stage in its development. To make a comparison with the automobile or motor truck is far from easy, the conditions of service and the requirements being so greatly different, but it is fairly close to the truth if we say that the gasoline tractor to-day is at about the same stage of its development as was the passenger automobile in 1903.

This does not mean that the tractor is going to need another 13 years to reach a stage equal in development to the 1916 automobile. Probably what took 12 years for the passenger car will be done in 5 or fewer for the tractor, general accumulated experience now being so much greater, but the amount which remains to be done will provide sufficient work to give the tractor engineers a very full 5 years.

An automobile engineer in approaching the problems of tractor design must first clear his mind completely of all prejudices. He must manfully resist the natural impulse to compare tractor features with, for instance, motor truck convention. In many ways it would be possible to draw a closer parallel to the motor boat than to any road vehicle. Really, though, the tractor is not comparable with any other self-moving machine. While it is more difficult a problem than the automobile in some ways it is easier in others, but is essentially different. A most successful truck engineer could easily make a very bad tractor if he took on the job with a light heart.

None the less, the automobile is going to benefit by reason of what will be learned in developing the tractor. To give an example, the kerosene carburetor is essential to the tractor, and already experience is being gained which will be valuable throughout the whole range of internal combustion engineering. Another thing which is as yet imperfect for tractors is the ignition system, and a curious little thing which comes to light in this respect is a growing demand from the tractor men for a smaller spark plug, the engineers quoting all the arguments recently advanced by aeroplane engine builders in favor of the metric size of plug shell.

Six Major Problems

Having said that the tractor is as yet only partially developed it may be well to mention the major problems that are yet not overcome:

First: Reliability is not good enough yet, not nearly good enough. This is partly due to poor engineering that can be recognized as such and partly to the peculiarly difficult conditions of a tractor's work.

Second: The efficiency of the machine as a whole can be improved very greatly; must be improved, in fact. At present the horsepower at the drawbar and the horsepower at the flywheel are too widely different.

Third: The weight is usually out of proportion to the horsepower. Weight is an essential in order to permit a sufficient drawbar pull, but it can be applied scientifically so that every ounce tells, or otherwise. Frequently the amount of waste weight is as great as the amount of useful weight.

Fourth: The question of drive is unsolved. We have one-wheel, two-wheel, three-wheel and four-wheel machines, all-caterpillar machines and machines which are combinations of the wheel and the caterpillar. They cannot possibly all be right, yet there is not enough experience today to enable any one system to be named as the best for all purposes.

Fifth: The trouble of rapid turning is important. There are some machines which can turn in their

own length, but to do it they require mechanical features regarded as revolutionary by the more conservative builders. The advantage of a square turn is very great and it must be decided whether this advantage can be given without any drawback.

Sixth: Then there is size. We have now every conceivable size and power from very little to very much. There are too many sizes. The biggest machines will always have a market, but a limited one. The very small machine will also have its uses, but it will have to be decided just what size the great big majority of farmers will find most efficient. This is best stated in terms of drawbar pull and the ideal size for general work is variously estimated at anywhere from 1500 up to 6000 lb. This is a matter for experience mainly, but study can help to solve the problem.

There is no need to itemize further; this will be done in a subsequent article when the different problems will be tackled one by one at greater length.

Torque and Ratio Determine Drawbar Pull

Fallacy of the Horsepower Rating Self-Evident When Its Variation With Speed Is Taken Into Consideration

THE belief is being rapidly accepted that the most logical method for rating tractors is by the drawbar pull rather than by the horsepower characteristics of the engine. If a rating of this nature is to be made it is necessary that some allowance be made for the nature of the soil through which the plow is to be pulled in order that the soil resistance factor may be taken into account.

To make such checking easy, the Hyatt Roller Bearing Co. has invented a hydrostatic instrument which can be placed between the tractor and the plow, and the gage mounted upon it registers the actual force of the pull which the tractor is exerting. In addition to the pressure gage there is a recording device which registers variations in the pull.

It has been pointed out that tractors working within a few yards of each other will show great differences in performance, although the horsepower ratings of the engines will be the same. One tractor may be pulling three plows and the other four and yet the ratings by horsepower will be equal. Of course, where the difference comes in is in the tractive speed. The actual work involves all the factors of pull, distance and time. It is impossible to get a performance figure unless all of these are included in the calculations.

With an instrument of the nature mentioned, the objectionable guess work rating is avoided. It is quite customary among farmers to make a rough guess at the performance rating of a tractor by stating that it is capable of pulling so many plows under average soil conditions. This is at the best only a rough approximation as the tractive pull necessary to carry a plow through different kinds of soil is subject to the widest possible variation. Even in the same kinds of soil the pull required will vary with conditions.

It must be remembered that the torque of the gasoline engine is fairly constant through a wide range of motor speeds. With the torque constant the horsepower output will naturally bear a practically constant ratio to the speed or r.p.m. Pulling ability is determined fully by engine torque and gear ratio. It does not require a mathematician to see that if the torque is constant, and the gear ratio is constant, the pulling power of the tractor is going to be constant also for a wide range of speeds. The horsepower curve will be going up as the speed increases, however, and thus the fallacy of a tractor rating by horsepower is self-evident.

Coming to a practical rating by pull alone, the question at once arises as to how to secure a standard condition in order to make a rating. It is for a purpose of this kind that the hydrostatic instrument should be available. It has been suggested that the tests be carried out on a hard, dragged dirt road, and this really seems a practical manner of getting at the much-mooted question.

Power of Martin Engine

LEE N. GRIFFITH, the engineer responsible for the Martin-Griffith aviation engine described in THE AUTOMOBILE for Aug. 10, has written stating that the maximum power of the engine does not occur at 1326 r.p.m. but at about 2000 r.p.m. The official tests made at Washington was performed with a propeller and not a dynamometer.

Hyatt hydrostatic instrument for measuring pull mounted on a tractor under actual service conditions

Welfare Department a Factory Necessity

Sociological Work Is Not a Matter of Philanthropy But Results in Pure Gain to both Employer and Employee—Examples in Cadillac Plant in which their Work Is Under Well-Defined Jurisdiction

WORKMEN, performing their labor under advantageous conditions of heaolth and mental well-being, give a better return for their wages than those who work under the opposite conditions. In a nutshell, this gives the entire selfish side of the factory welfare question. Taken as a matter of dollars and cents, of return for a given investment, a happy workman, and that means a healthy one, is a better paying proposition than one who is under the disadvantage of mental strain or ill health.

Sunshine, open air, sanitary conditions and freedom from accidents are the basic necessities for a high health rate among the employees of a factory. Men who are paying frequent visits to the hospital, or who are staying home on sick leave are a loss to themselves and the concerns which employ them. They are not happy, their thoughts are distracted by their own personalities and instead of the mind being on their work it is upon their own physical condition. In each individual workman in which this condition exists, there lies a loss for the concern that employs him. More important still from the human standpoint, there is a man who is not happy in his work and is therefore incapable of doing himself justice, no matter how he may try.

Output Versus Outlay

The automobile industry, in its mushroom-like growth has been compelled to expand in a very disadvantageous way, in a great many instances. More space to carry out greater production schedules has been demanded and the result is that there has often been no time to stop for the best possible layout of factory as regards the human welfare standpoint. Competition has been so keen that factories could not afford to lose time while adding more space and consequently the growth in the factory has led to results which compare with some of our older cities.

Where a city has been laid out new, in a new part of the country, the streets are broad and regular. They run parallel to one another and are intersected at right angles by other streets. The houses are spaced regularly, the streets are clear and the sunshine has a chance to filter through. Old cities which have grown so fast that they have been unable to follow any well laid-out plan of development have crooked, winding streets that follow the old Indian trails. They are compelled to stick to the old methods because they are unable to grow and to change at the same time. So it is also in the automobile factory—to keep up with the march of progress it has had to grow, to keep up with the new ideals in manufacturing welfare it ought likewise to change.

The automobile industry is only now beginning to find itself. There have been factories advantageously located that have been able to adopt the new methods while developing, there are a great many others that are adding space at the present time and in this new space they are taking care that the welfare angle is given all possible attention.

In the past few years, we have heard much about the sociological side of a manufacturing plant. It has shown itself in direct and indirect ways. An example of the direct way is where the manufacturer has declared profit-sharing or bonus schemes that put cash directly into the pockets of the workmen. In the indirect way, the money has been spent by the factory in supplying more sunshine, more air, better conditions and often better food. The hygienic side of the factory worker's life is being looked into. In many cases even his family life has been made the subject of study by a special part of the employers' organization that is fitted to take care of this delicate work in a way that is suitable to a democracy.

Not Philanthropy

It is not a question of philanthropy. If it were, the employee would be the only one to benefit. On the other hand, it is not wholly and purely economic, because the expert accountants cannot render even at the end of a stated period an exact statement as to the money saved or made through the establishment of the new methods. But it does represent a saving,—a saving to industry, a saving to the individual and also a saving to the family, in that it means fewer hours of unemployment due to illness or accident.

Taking the Cadillac company as an example of what has been accomplished, some very interesting things can be learned. It was in 1910 that this concern first established an organized welfare department. Before that time there were various unorganized schemes of assisting workmen who suffered from various combinations of adverse circumstances, but a close study of the question showed the officers of the concern that the men were not securing the maximum return even from the fitful efforts that were then made.

One of the lunch rooms in the Cadillac factory where pure food, well-cooked, is served

View of the lunch room at the main plant, showing menu board, coffee, pie, fruit and sandwich counters

All these different branches of activity naturally fell under the one head of sociology. It did not mean by any means that the Cadillac company was forced to philanthropical work among its employees, but it did mean that in order to see that the men and women in the employ of the company were getting the best possible nourishment and were kept in the best possible health that food supplied at actual cost, without loss to the company, well cooked, and above all clean, should be furnished.

If the number of factories having large bodies of workmen employed are considered it will readily be seen that few of them are surrounded by restaurants that supply good food at moderate prices.

The food question is not the only one which was taken up under the Cadillac organization. The prevention of accidents, prevention of fire, sanitation, accident relief, benefit society, legal aid and accident claim were also considered and made divisions of the department as well as that of lunch counter and restaurant.

A Safety Engineer in Charge

The way this is worked out is quite simple. A safety engineer is in charge of the accident division, who, with two assistants, is directly responsible for cutting down accidents about the factory. Not only does he investigate existing safeguards, but designs others which are placed upon the apparatus about the plant. Failure on the part of workmen to observe the rules of this official and his staff will bring dismissal and there is no appeal.

A fire marshal who is an experienced man, being a retired captain of the city fire department, is in charge of fire prevention. His duties are quite similar to those of the safety engineer, except that he is in direct charge of all means of preventing conflagrations. He is the court of final appeal in all fire matters as the safety engineer is the court of last appeal in accident-prevention matters.

Saves $9,500,000 in Eyes

There is an emergency hospital always ready and always fully equipped. A chief surgeon is in constant charge of the hospital. His assistants form the remainder of a committee which looks after the medical and surgical end of factory matters in the same way as the accident and the fire committees look after theirs. Eye operations, etc., can readily be taken care of. In a single year there were 37,757 dispensary cases handled here, 4300 cases of grippe in one winter, 6250 cases of headache, 800 cases of toothache and 437 cases of injury in which disability of more than one day was caused. Over 40,000 abrasions of a small nature were taken care of and more than 9000 cases of foreign bodies in eyes. Under the Workmen's Compensation Act, these eyes have a valuation alone of from $3,500,000 to $9,500,000. The men are encouraged to take all their ills to the doctor's office, no matter how small they may be.

$35,000 in Sick Benefits

The Mutual Aid or Benefit Society paid in the first 3 years of its existence $35,000 in sick accident and death benefits. A payment of 10 cents per week is exacted from each workman to take care of this fund. In the restaurant and kitchen work, a steward is in general charge. It started with stew being served at 6 cents a cup to the men. This proved to be so popular that a universal restaurant service was demanded with the result that an employee of the company can purchase an ordinarily 5-cent article of food for 3 4/7 cents. Milk is sold at the same figure per pint, and during a single year 456,000 pints of milk were distributed among the employees. The gross business of the restaurant division of the welfare committee is about $50,000 a year and the cost to the company is practically nil. It is self-supporting and yet of untold value to the mental and physical condition of the men—and must bear its reflection in the quality of the work of the individual.

Left—One of the lunch rooms in the main plant. Right—One of the factory pie and fruit counters

Constant Pressure Efficiency 25 Per Cent Lower

Cannot Compare in Theoretical Efficiency with Constant Volume or Otto Cycle According to Napier—Mathematical Comparison of the Two Working Cycles

THE efficiency of the constant pressure cycle may be all the way from 25 to 60 per cent less than that of the constant volume or Otto cycle according to James Langmuir Napier who has just published in *The Automobile Engineer* a criticism of the paper on the constant pressure cycle read by Messrs. A. B. Brown and Herbert Chase before the summer meeting of the Society of Automobile Engineers.

In his criticism Mr. Napier makes a particular point of the fact that the authors, Messrs. Brown and Chase, state that they have purposely avoided the use of formulas having to do with the thermo-dynamics of the constant pressure cycle. He goes on to say:

"Neglect of elementary principles is always unsafe, and in this case peculiarly disastrous for the reason that the author's enthusiastic advocacy of the constant pressure cycle is confessedly founded upon a quasi-scientific statement, attributed to one R. M. Neilson, and promulgated by Henry D. Suplee, to the effect that with a compression pressure of only 30 lb. absolute (approximately 15 lb. gage) a constant pressure engine has an ideal efficiency of 84 per cent.

"This statement is so far from being true that it appears desirable to set forth exactly the results which might be anticipated from a constant pressure engine under 'ideal' conditions, understanding, of course, that while such conditions are impossible they constitute an easy but rough ground of comparison between engines in which combustion takes place at constant volume and constant pressure respectively.

"The basic diagram in respect of a constant pressure engine is indicated in Fig. 1. At the point C the gas is assumed to occupy n volumes at atmospheric temperature and pressure, both expressed in absolute units. Compression reduces the gas to one volume at the point A, and heat is added at constant pressure between A and B, which latter point is here assumed to be the end of the stroke. The equation to the curves BD and ACE is $PV^{1.4} = \text{Const.}$, and these curves are supposed to extend infinitely. Under these conditions the heat added during the cycle is represented graphically in PV units by the area $ABDEC$, and the work done during the stroke by the area ABC. The principal pressures and temperatures are:

Pressure at $C = 14.7 = p$
" " $A = pn^{1.4} = P$
Temperature at $C = T = 290°$ abs. Cent.
" " $A = Tn^{.4}$
" " $B = Tn^{1.4}$

These quantities are calculated in Table I. for values of n up to 10.

TABLE I

n	$pn^{1.4}$	$Tn^{.4}$	$Tn^{1.4}$
2	38.79	383	765
3	68.42	450	1,350
4	102.30	505	2,019
5	139.90	552	2,761
6	180.60	580	3,482
7	224.10	632	4,421
8	270.20	666	5,330
9	318.50	698	6,285
10	369.30	728	7,285

In Fig. 1, area $ABDEC$

$$= P(n-1) + 2.5\,Pn - 2.5\,P$$
$$= 3.5\,P(n-1) \quad \ldots \quad (1)$$

And area $ABC = P(n-1)$

$$- 2.5\,P\left(1 - \frac{1}{n^{.4}}\right) \ldots \quad (2)$$

Therefore, when combustion at constant pressure is continued to the end of the stroke, the thermal efficiency of the cycle is represented by:

$$\frac{P(n-1) - 2.5\,P\left(1 - \frac{1}{n^{.4}}\right)}{3.5\,P(n-1)}$$
$$= \frac{1}{3.5} - \frac{\left(1 - \frac{1}{n^{.4}}\right)}{1.4\,(n-1)} \quad \ldots \quad \ldots \quad (3)$$

"Values of this quantity are given in Table II., where they are compared with values of $\left(1 - \frac{1}{n^{.4}}\right)$, which represents for any value of n the thermal efficiency of the cycle, which includes combustion at constant volume. In the meanwhile it may be noted that the quantity (3) has a maximum value, for when n is infinite its limit is $\frac{1}{3.5} = .2857$, and therefore, under the assumed conditions, the ideal efficiency of the constant pressure cycle cannot exceed 28.57 per cent.

Following the analogy of the steam engine, improved economy may be looked for in an early cut off, as indicated in Fig. 2, where the point B, at which addition of heat ceases, is located so that the gas has expanded only to m volumes, m being some quantity less than n. Then, the pressures at A and C being equal to those of Fig. 1, we have:

Temperature at $C = T = 290°$ abs. Cent.
" " $A = Tn^{.4}$
" " $B = Tmn^{.4}$

Also:

Area $ABDEFC$
$$= P(m-1) + 2.5\,Pm - 2.5\,P$$
$$= 3.5\,P(m-1)$$

And area $ABDC = P(m-1)$

$$+ 2.5\,Pm\left(1 - \left(\frac{m}{n}\right)^{.4}\right) - 2.5\left(1 - \frac{1}{n^{.4}}\right)$$

Therefore:

Efficiency =

$$\frac{(m-1) + 2.5\,m\left(1 - \left(\frac{m}{n}\right)^{.4}\right) - 2.5\left(1 - \frac{1}{n^{.4}}\right)}{3.5\,(m-1)}$$
$$\ldots \quad \ldots \quad \ldots \quad (4)$$

$$= \frac{1}{3.5} + \frac{m\left(1 - \left(\frac{m}{n}\right)^{.4}\right) - \left(1 - \frac{1}{n^{.4}}\right)}{1.4\,(m-1)}$$
$$\ldots \quad \ldots \quad \ldots \quad (5)$$

"Here m has two limits, 1 and n, and obviously when

$m = n$ the value of the expression (5) is the same as that of (3). If we assume the other limit and put $m = 1$ in Eq. (4). we arrive at the indeterminate fraction $\frac{0}{0}$, which may be evaluated in the ordinary way by differentiating both numerator and denominator and again substituting 1 for m.

Collecting the terms containing m in Eq. (4), we have

$$\frac{3.5\ m - \frac{2.5\ m^{1.4}}{n^{.4}}}{3.5\ m}$$

differentiating:

$$\frac{3.5 - \frac{3.5\ m^{.4}}{n^{.4}}}{3.5}$$

and, putting 1 for m,

$$\text{Efficiency} = \left(1 - \frac{1}{n^{.4}}\right)$$

which, as might have been anticipated, is the efficiency at constant volume combustion. The efficiency of a constant pressure engine under the conditions of Fig. 2 is therefore improved by early cutoff, but only attains (for equal values of n) the efficiency of a constant volume engine when the power evolved falls to zero. For purposes of comparison the theoretical efficiencies are calculated for a constant pressure engine, assuming that addition of heat ceases at half-stroke; that is, when $m = \frac{n+1}{2}$, or $m - 1 = \frac{n-1}{2}$ These figures are embodied in Table II., which exhibits, therefore, the relative efficiencies at different values of n of (a) constant volume combustion, and (b) constant pressure combustion under the conditions shown by Figs. 1 and 2, the addition of heat ceasing at half-stroke in the latter case.

TABLE II

	Thermal Efficiencies Per Cent		
		Constant Pressure Engine	
n	Constant Volume Engine	Heat to End of Stroke	Heat to Half-stroke
2	24.22	11.27	17.26
3	35.55	15.87	24.55
4	42.56	18.44	28.70
5	47.47	20.09	31.41
6	51.17	21.26	33.34
7	54.08	22.13	34.78
8	56.47	22.81	35.94
9	58.47	23.35	36.83
10	60.19	23.79	37.57

"These are not the ultimate ideal efficiencies for either cycle, but before proceeding further in search of Mr. Neilson's 84 per cent it will be well to pay some attention to conditions of temperature, in which connection the first obvious consideration is the mode of addition of heat, a matter which is not taken into account in the diagrams Figs. 1 and 2.

"Since we are dealing with ideal conditions we may imagine that in a constant pressure engine heat is added from a source of varying temperature, so that the temperature of the charge increases in proportion to the volume, and under these conditions the mean temperature in the cylinder during addition of heat will be the mean of $Tn^{.4}$ and $Tn^{1.4}$, or the mean of $Tn^{.4}$ and $Tmn^{.4}$, according as the conditions are those of Fig. 1 or Fig. 2. Addition of heat in this manner can, however, scarcely be considered practicable, since each particle of

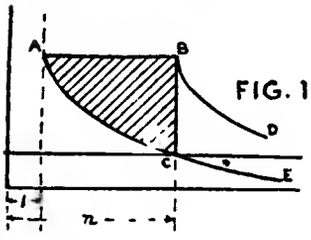


FIG. 1

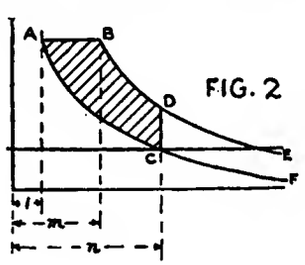


FIG. 2

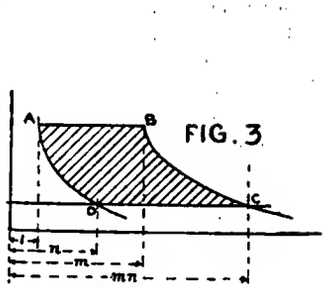


FIG. 3

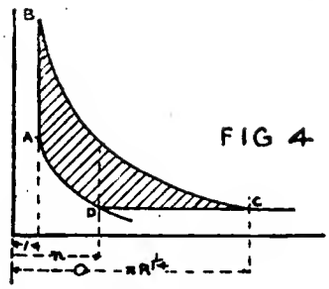


FIG 4

charge entering the cylinder is assumed to carry with it its own supply of combustible, and we must, therefore, consider alternatively that the temperature in the cylinder during addition of heat is constant, and is $Tn^{1.4}$ or $Tmn^{.4}$, as above. This condition is described in Tables III. and IV. as 'practical'; that is, relatively practical as compared with the 'ideal' assumption of a source of heat of varying temperature.

"In comparing the mean temperatures during the working stroke in constant volume and constant pressure engines, it may be found under certain circumstances that for the same consumption the mean temperature of the constant volume engine is the higher. But its power for the same consumption will also be higher, and I have therefore introduced in Tables III. and IV. a column showing the mean temperature at constant volume combustion when the powers are equal. This necessitates the assumption of a lower temperature of explosion at equal powers than at equal consumption, and this assumption is made throughout these two tables, the heating value of the charge being taken as proportional to the value of n. It will be understood, of course, that the tables are merely illustrative.

"In adiabatic expansion the mean temperature during expansion to n volume is:

$$\frac{\int_n^1 CV^{-.4}dV}{V-1} = \frac{C(n^{.4}-1)}{.6(n-1)} \qquad \ldots \quad (6)$$

which expression is used in calculating the mean temperature during expansion in the constant volume engine, and also in the latter half of the stroke in the constant pressure engine illustrated by Fig. 2; noting in the latter case that the n of Eq. (6) becomes $\frac{n}{m}$, the expansion ratio, and C becomes Cm.

In Fig. 1 the increase of temperature between A and B is $Tn^{.4}\ (n-1)$, therefore on combustion of the same charge at constant volume the increase of temperature would be $1.4\ Tn^{.4}\ (n-1)$, and the temperature of explosion would be $Tn^{.4}\ (1.4\ n - .4)$. The temperature of explosion in the case of equal powers is, therefore,

$$Tn^{.4}\left\{1.4\ (n-1)\left(\frac{\text{efficiency at const. press.}}{\text{efficiency at const. vol.}}\right) + 1\right\}$$

a similar calculation being made in the case of Fig. 2.

TABLE III

Mean temperatures during working stroke, when heat is added in constant pressure engine throughout stroke.

	Constant Volume		Constant Pressure	
n	Equal Consumption	Equal Powers	Ideal	Practical
2	890	544	574	765
3	1,330	787	900	1,350
4	1,892	1,027	1,262	2,019
5	2,452	1,203	1,656	2,761

TABLE IV

Mean temperatures—addition of heat ceasing at half stroke.

	Constant Volume		Constant Pressure	
n	Equal Consumption	Equal Powers	Ideal	Practical
2	559	493	503	551
3	840	688	751	864
4	1,128	880	1,012	1,202
5	1,422	1,022	1,294	1,570

The comparison between the constant pressure engine and one operating on the Otto cycle should properly cease at this

point, but our authors claim additional economy by the process of expanding the products of combustion down to atmospheric pressure. This operation is by no means wholly impossible, and has, in point of fact, been carried out in a modified form by Atkinson and a few others, and precisely with the additional economy which might have been anticipated. The system in its complete form involves the use of cylinders much too large for automobile work, but it is theoretically interesting, and it is here, if anywhere, that a sanguine investigator might hope to re-discover Mr. Neilson's marvel.

"Fig. 3 represents the final possibilities of the constant pressure engine. The volume of the charge is n, which as before, becomes one volume at A, and has then a temperature of $Tn^{.4}$ and a pressure of $pn^{1.4}$. By addition of heat this volume becomes m volumes at the point B, the value of m being such that $m = \frac{C}{Tn^{.4}} + 1$, where C is a constant representing the heating value of the mixture. For present purposes I assume $m = 1{,}428$, which represents a mixture capable of adding 2,000 deg. C. on explosion at constant volume. This value is adhered to throughout what follows.

From B the products of combustion are assumed to expand to atmospheric pressure at the point C, where they have the volume mn. The atmospheric line completes the power diagram.

In this diagram the area $ABCD$ is equal to:

$$P\ (m-1) + 2.5\ Pm\left(1 - \frac{1}{n^{.4}}\right) - 2.5\ P\left(1 - \frac{1}{n^{.4}}\right) - \frac{P}{n^{.4}}\ (m-1) = 3.5\ P\ (m-1)\left(1 - \frac{1}{n^{.4}}\right)$$

and, since the heat added is, as shown in connection with Fig. 2, $3.5\ P\ (m-1)$, we have

$$\text{Efficiency} = \frac{3.5\ P\ (m-1)\left(1 - \frac{1}{n^{.4}}\right)}{3.5\ P\ (m-1)} = \left(1 - \frac{1}{n^{.4}}\right)$$

which is precisely the efficiency of the ordinary Otto cycle with expansion only to n volumes, as given in the first column of Table II.

"Table V. exhibits some of the principal figures relating to Fig. 3, and includes for comparison the mean temperature during the working stroke of an engine on the Otto cycle expanding to n volumes only.

"As already indicated, it cannot be admitted that the constant pressure engine has any monopoly in the matter of expansion to atmospheric pressure. The arrangement is equally practicable, or equally impracticable, as you choose to consider it, in the case of the engine where combustion takes place at constant volume. Fig. 4 relates to such an engine using a mixture of the same heating value as that of Fig. 3, and, in this case, if we put $\left(\frac{2{,}000}{Tn^{.4}} + 1\right) = R$, the expansion curve coincides with the atmospheric line at $nR^{\frac{1}{1.4}}$ volumes.

TABLE V

Constant pressure engine—expanding to atmosphere

n	m	Volume Swept by Piston	Maximum Pressure	Maximum Temperature	Mean Temperature	Mean Temp. Otto to n Vols.	Efficiency
2	4.73	8.46	38.79	1,811	1,669	2,049	24.22%
3	4.17	11.51	68.42	1,878	1,575	1,905	35.55%
4	3.83	14.32	102.30	1,933	1,502	1,807	42.56%
5	3.59	16.95	139.90	1,980	1,439	1,729	47.47%

"The efficiency of such an engine is represented by the fraction:

$$\frac{2.5\ PR\left(1 - \frac{1}{n^{.4}R_{\frac{1}{n}}}\right) - 2.5\ P\left(1 - \frac{1}{n^{.4}}\right) - pn\ (R^{\frac{1}{1.4}} - 1)}{2.5\ P\ (R-1)}$$

$$= \frac{R\left(1 - \frac{1}{n^{.4}R_{\frac{1}{n}}}\right) - \left(1 - \frac{1}{n^{.4}}\right) - \frac{.4}{n^{.4}}\left(R^{\frac{1}{1.4}} - 1\right)}{(R-1)}$$

$$= 1 - \frac{1.4\ (R^{\frac{1}{1.4}} - 1)}{n^{.4}\ (R-1)} \quad . \quad . \quad . \quad . \quad . \quad . \quad (7)$$

"Temperature are calculated by the methods already used. Results similar to those of Table V. are embodied in the following table:

TABLE VI

Otto cycle—with additional expansion to atmosphere

n	R	Volume Swept by Piston	Maximum Pressure	Maximum Temperature	Mean Temperature	Efficiency
2	6.222	6.38	241.3	2,383	1,442	45.34%
3	5.444	9.07	372.5	2,450	1,349	52.22%
4	4.960	11.49	507.4	2,505	1.295	56.65%
5	4.623	13.92	646.9	2,552	1,241	59.70%

"For further convenience of comparison these figures are arranged in Table VII. so as to indicate more conveniently the relative temperatures, pressures, and cylinder dimensions in (a) the ordinary Otto cycle with expansion to n volumes, (b) the Otto cycle with additional expansion to $nR^{\frac{1}{1.4}}$ volumes, and (c) the constant pressure cycle with expansion to mn volumes. The value of n is taken at the convenient figure of 4 in each case, and as a mixture of the same heating value is assumed in each case, the powers will be directly proportional to the efficiencies. It will, I think, be admitted that the figures do not support the somewhat peculiarly sanguine conclusion of Messrs. Browne and Chase.

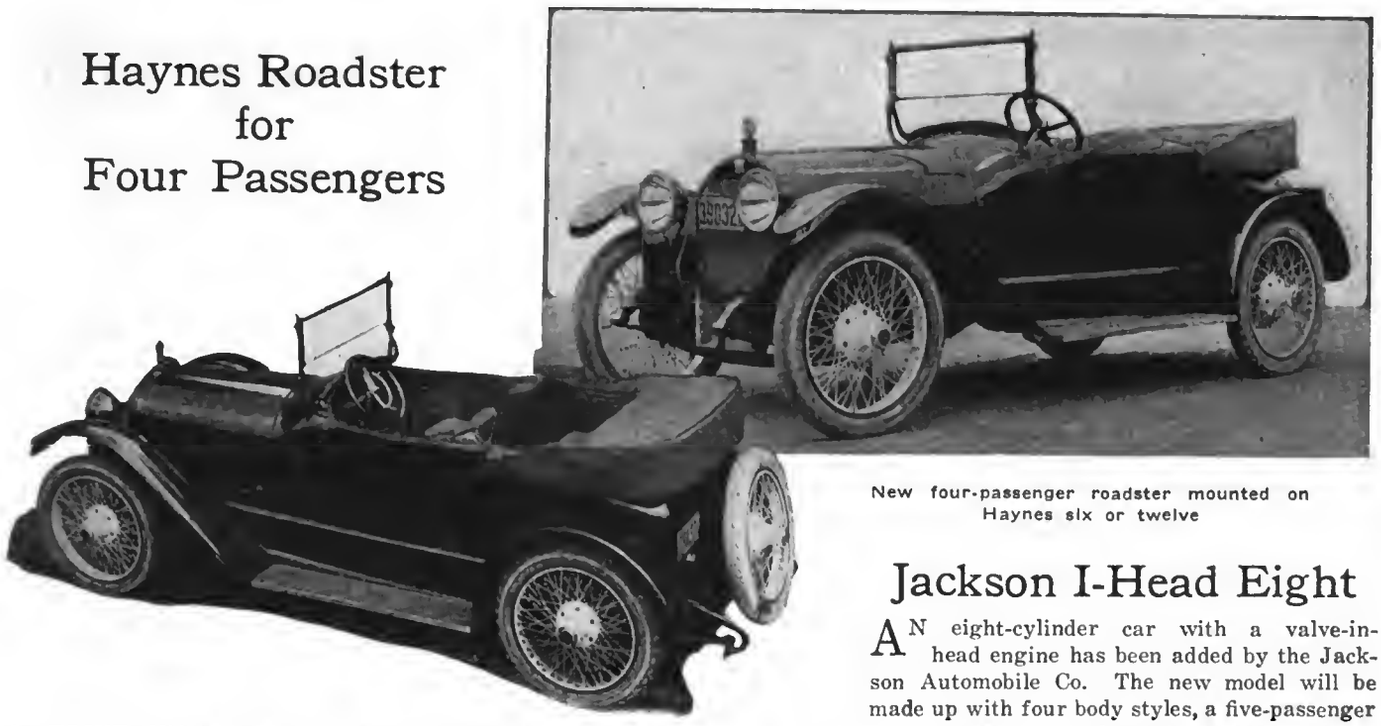
TABLE VII

	(a) Ordinary Otto	(b) Expanded Otto	(c) Constant Pressure
Volume swept by piston	3.00	11.49	14.32
Maximum temperature	2,505	2,505	1,933
Mean temperature	1,807	1,295	1,502
Maximum pressure	507.40	507.40	102.30
Efficiency, per cent	42.56	56.65	42.56

"The first point obvious here is the enormous cylinders required by the constant pressure engine. Without any gain in power or economy over the ordinary Otto cycle engine the volume would have to be increased from 3000 c.c. to 14,320 c.c. This appears prohibitive, but even if large cylinders were admissable for the sake of economy the choice would certainly lie with the expanded Otto, which, with a volume of 11,490 c.c., would, on the same consumption, give power in the proportion of 56.65 to 42.56 provided by the constant pressure engine, and with a lower mean temperature.

"The constant pressure engine apparently scores in the matter of maximum pressure, but the advantage is to a large extent merely apparent, for it is unlikely that two cylinders of 3.00 and 14.32 volumes respectively would be designed with the same bore. It will also be noted that the vaunted flexibility of the constant pressure engine exists only in the imagination of its advocates; the methods available for altering its power output are simply those used in a constant volume engine with a fixed spark; that is, altering the quantity and the quality of the mixture."

Haynes Roadster for Four Passengers



New four-passenger roadster mounted on Haynes six or twelve

DELIVERIES have been going on since early in August on a new four-passenger Haynes roadster which is mounted on either the twelve or six chassis. The new car is a successor to the Haynes three-passenger So-Sha-Belle model, and although it has a greater capacity, it resembles the former model to a great extent in body lines.

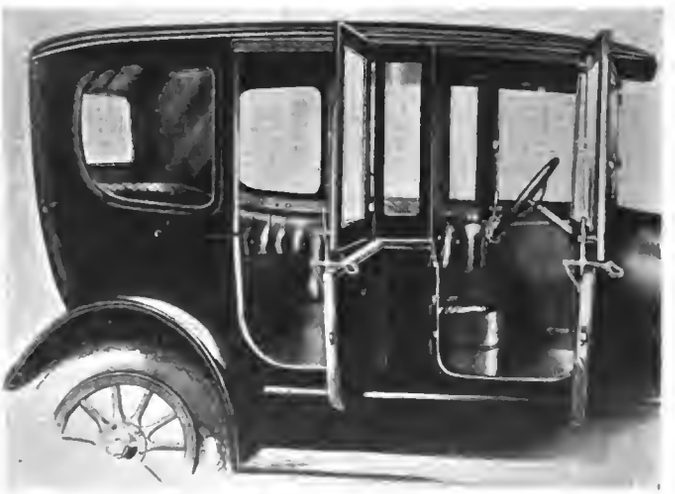
The front seats of the four-passenger roadster are divided and the aisleway between them affords easy passage to the tonneau. The rear seat is wide enough for two passengers, and, when circumstances require, it will accommodate three persons. The rear passengers are given an extra amount of leg room by sloping the backs of the front seats downward toward the brake and clutch pedals. The seats and the sides of the tonneau are upholstered in hand-buffed leather which in turn is covered by gray water-proof seat covers of soft cloth. The body is low and the running boards have a ground clearance of 10 in.

Special attention has been given the comfort of the driver in that the pedal pads may be brought to the desired position and the seat moved forward or backward. By grouping all the cowl instruments on a compact board the controls are moved up within easy reach. The 18-in. steering wheel is heavily notched and highly polished, so that it has an easy grip and good leverage. The accelerator pedal requires a minimum amount of effort, as it moves in a vertical direction and no vibration is transmitted to the arms of the driver since the steering column is mounted in the cowl apron.

Jackson I-Head Eight

AN eight-cylinder car with a valve-in-head engine has been added by the Jackson Automobile Co. The new model will be made up with four body styles, a five-passenger touring and a two-passenger roadster at $1,295, a four-passenger body with divided front seats and sloping rear deck at $1,395 and a seven-passenger touring at $1,370. The two eights and the four, which are now on the market, will be continued without change.

The only difference between this car and other Jacksons is in the power plant as the specifications of the new model include all the features of the others, such as full elliptic springs front and rear. It is stated that the new engine will develop 48 hp. It has a bore of 3 and a stroke of 3½ in. and is fitted with a Zenith duplex carbureter, Stewart vacuum feed, Auto-Lite starting and lighting, Remy ignition, 34 by 4 in. tires and has a 118-in. wheelbase. One of the bodies mounted on the new model is illustrated below.



Body suitable for town or country use mounted on the eight-cylinder, valve-in-head Jackson just added to the line. The two eights and the four previously manufactured will be continued

Hackett Body Is of Striking Design

Straight-Line Effect Characterizes New Four-Cylinder Touring Car—3¾ by 4¼-In. Engine—A Three-Passenger Roadster, a Cabriolet and a Demountable Top

A FOUR-CYLINDER, five-passenger car at $888, with distinctive straight-line body and low, comfortable seats, is the initial offering of the new Hackett Motor Car Co., Jackson, Mich., formerly the Argo Motor Co.

The body design is original, a straight line running from the top corners of the radiator all the way back. The effect is accentuated by the use of a narrow deck extending all around the rim of the body, and also forming the double cowl on the back of the front seat. The straight-line idea is still further emphasized by the fact that the seats are low. The windshield is tilted and there are large louvres in the hood at the same angle.

A Three-Passenger Roadster

In addition there will be a runabout, at the same price, seating three, with the driver's seat slightly ahead of the other two, a cabriolet for about $1,000 and a winter top for the five-passenger at $110 additional.

The chassis is standard with a unit power plant consisting of a 37-hp. engine, G. B. & S. clutch, Grant-Lees gearbox and Walker-Weiss axles.

Detachable Cylinder Head

The engine is a detachable L-head design with cylinders in block and crankcase in two pieces, the lower part being made of pressed steel and acting as an oil pan. Bore and stroke are 3¾ by 4¼ in., giving a formula rating of 22.5, and a piston displacement of 188.2 cu. in. It gives this rating at a piston speed of 935 ft. per min., instead of 1000, and produces its maximum of 36.9 hp. at 2000 r.p.m.

The crankshaft is 35 to 45 point carbon steel, drop-forged and heat-treated, and has three main bearings. The front bearing is 1½ by 3⅞ in., the center, 1⅝ by 2¼ in., and the rear, 1½ by 2 in. Connecting-rod bearings are 1½ by 2 in. Bearings are babbitt, reinforced with perforated steel shells.

Force Feed and Splash Oiling

Lubrication is by combined force feed and splash. Oil is drawn from the reservoir by a plunger pump which is operated by No. 4 exhaust cam, passes through a sight feed on the cowl and from thence to the three main bearings. The overflow from the bearings makes its way to the splash troughs into which the connecting-rods dip. The oiling system is extremely accessible, as the pump and all the piping are on the exterior of the engine.

Valve Adjustments on Stems

The valves are unusual in that the adjusting nuts are on the stems instead of the push rods, and consequently act as spring retainers. The end of the stem is threaded and on it is placed a thimble nut which is held solid by a lock nut. The valves consist of cast iron heads welded on ⅝-in. carbon steel stems. The lift is 7/32 and the clear opening 1⅝ in. The valve stem guides are bushed with 3 3/16 cast iron sleeves.

Camshaft and Disco motor-generator drive are by silent chains, adjustment of the latter chain being accomplished by rocking the bracket on which the unit is carried.

Ignition is furnished by a Remy coil and distributer, mounted at the front and driven off the camshaft.

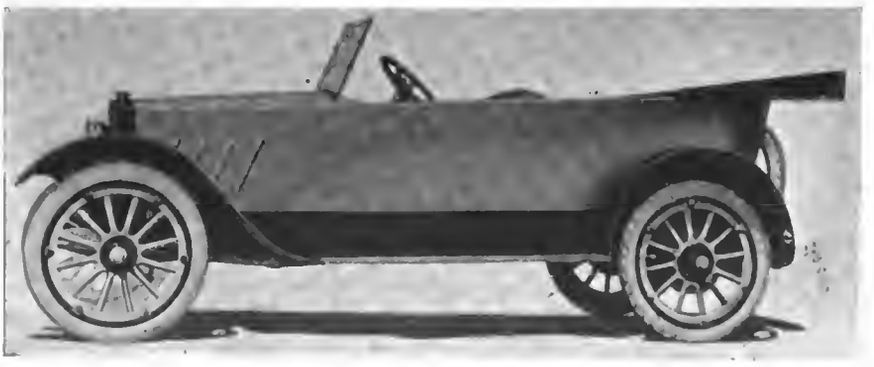
Stewart Vacuum Fuel Feed

The fuel system consists of a tank at the rear from which gasoline is drawn by a Stewart vacuum system to the carbureter, which is a Justrite, a single jet design in which the correct proportion of air and gasoline is obtained by varying the size of the venturi passage.

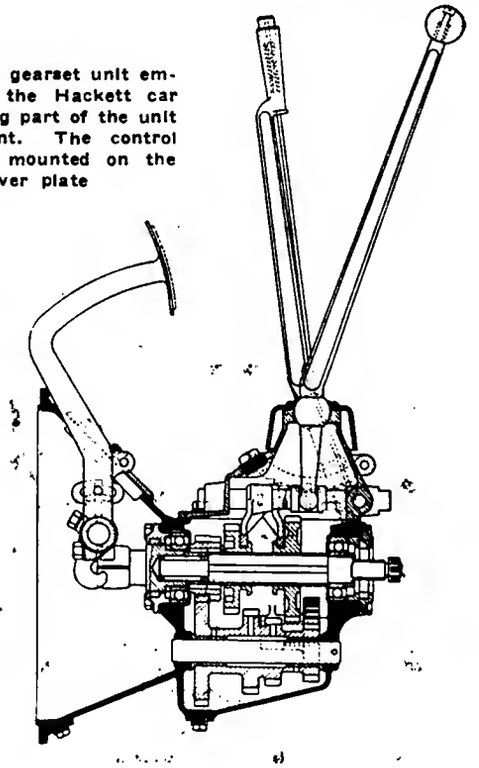
Cooling is by thermo-syphon, a cellular radiator and a four-blade fan being used with it.

Clutch Runs in Oil

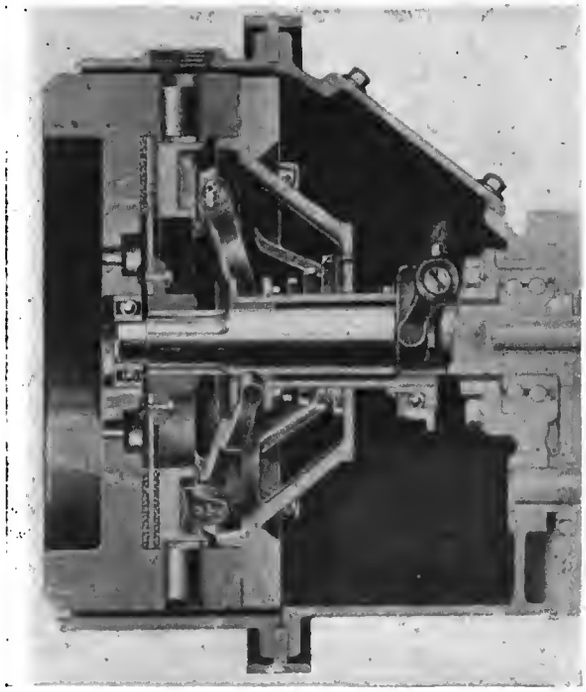
The G. B. & S. clutch is housed in the flywheel and has a single driven disk of steel. A ring of wire-woven asbestos



Straight-line car manufactured by the Hackett Motor Car Co., Jackson, Mich., selling for $888. This is fitted with a winter top for $110 additional. This car and the three-passenger roadster are mounted on a 112-in. wheelbase chassis



Grant-Lees gearset unit employed on the Hackett car and forming part of the unit power plant. The control levers are mounted on the cover plate



Section through the clutch unit on the Hackett car, showing yoke and spring mounting

fabric bears against either face. Smooth action and reduced wear are obtained by running the clutch in oil. It is so designed that no adjustment is required.

The gearbox gives three speeds forward. The gears are 3½ per cent nickel steel. The main shaft is carried on annular ball bearings and the countershaft gears are in one piece, are bushed and are free to rotate on the stationary shaft.

The clutch and gearset are accessible and may be removed quickly and easily without disturbing the engine, which is supported at the rear by arms attached to the flywheel housing. The gearbox bolts to the bell housing.

Semi-Floating Axle

The rear axle is a semi-floating Walker-Weiss with chrome-nickel driving shafts, open hearth ring gear and 3½ per cent nickel pinion. There are two sets of brakes operating on the one set of drums. The front axle is an I-beam design, and steering is by worm and gear. Half-elliptic springs are used in front, 36 by 1¾ and three-quarter elliptic in the rear, 48 by 1¾ in. Wheelbase is 112 in., and the Ajax tires are 32 by 3½, with demountable rims.

The car will be finished in Packard blue with ivory white wheels, and the upholstery will be French pleated.

Control pedals and levers are conveniently placed and the steering wheel is 17 in. in diameter. Cowlboard equipment is complete, including speedometer, oil gage, gasoline choke lever, lighting switches, ammeter and instrument light with metal trimmings heavily nickeled.

Landau-Farr Lubricating Bolt Now on the Market

DAVID LANDAU and H. G. Farr, well known in the automobile trade as spring engineer and chief engineer of the Knox company respectively, have combined their experience in the production of an automatic lubricating bolt. This is to be marketed by the Brown company, Syracuse, N. Y., which has taken an exclusive license.

While this bolt is new to the trade, it has really been in existence for about 3 years and was first shown on a car at the 1913 Madison Square Garden show. It is intended for a spring shackle bolt but can be used in principle in other mechanisms requiring a continuous feed of fluid oil for internal lubrication.

Felt Wick for Oiling

The lubricating features consist of a main reservoir with a felt wick that is positively attached to a threaded cap plug and one or more feed or filter wicks. The reservoir felt when in position in the hollow shackle bolt is under a slight amount of compression, forcing all the surfaces of the felt against the interior of the bolt. The feed and filter wicks rest against the main reservoir wick and carry the oil to the bearing by capillary attraction. The reservoir wick fits tightly into the hollow bolt and thus forms an efficient oil pump when filling the reservoir. The cap plug forms a handle for operating the wick which can be pulled back in the same way as a plunger.

Operation of the Bolt

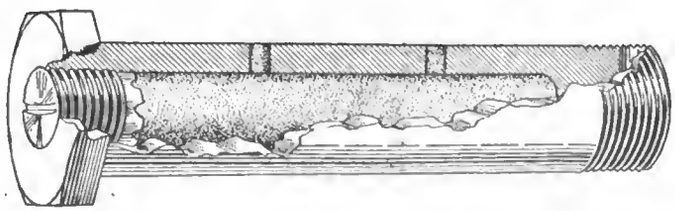
In operating the bolt the reservoir plug is removed and the oil put in with an oil gun or squirt can. The wick is then inserted and worked back and forth like a pump plunger and enough pressure can be generated to force the oil through the cross wicks which can be seen in the illustration and out through the ends of the spring bearings. The wick in this manner becomes saturated with oil and when the wick plug is screwed in place against the bolt head the reservoir wick is put under compression and automatic lubrication starts and continues until the main wick is exhausted.

The manufacturers state that about 1200 of this type of bolt were fitted to a series of heavy cars weighing 5100 lb. empty, in 1913. After running from 28,000 to 52,000 miles thirty of these bolts were removed and the wear from them was found to be 0.009 in. as a maximum and 0.002 as a minimum. Sample bolts have already been placed in 1917 cars.

Concealing the Spare Tire

EXPERIENCED motorists who have plenty of mechanical knowledge but no active engineering work to their credit, are constantly expressing surprise that no means has yet been discovered for inclosing the spare tire and rim or spare wheel except on runabout designs with rear decks. They point out that the usual spare tire mounting is a disfigurement to the fine body lines now the rule, and they say they cannot see the difficulty in providing a compartment somewhere at the back of the body, where the spare could be stowed.

Probably nearly every designer has had a good long look at the problem and been unable to discover a way out, but it may be doubted if the matter has ever been studied as carefully as it might have been. To look at a few dimensions, the average back seat cushion is well over 40 in. wide, and few tires exceed an actual 36 in. diameter. The rounded back is coming into favor; in fact, there will be some cars at the 1917 shows with rear ends to the bodies almost hemispherical. Studying these new styles there seems no obvious answer to the question "Why is the spare tire never inclosed?"



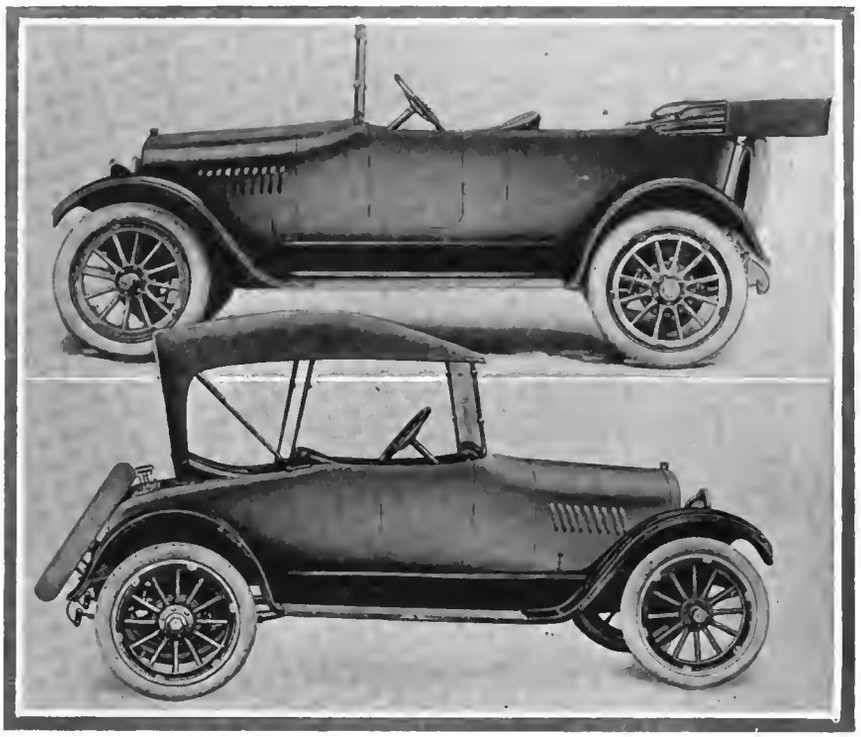
Part section through the Landau-Farr shackle bolt, showing main wick and side feed wicks

Details of the 1917 Dixie Line

Above—Three-quarter plan view of the new four-passenger roadster, showing how the roadster lines are maintained with full four-passenger seating capacity

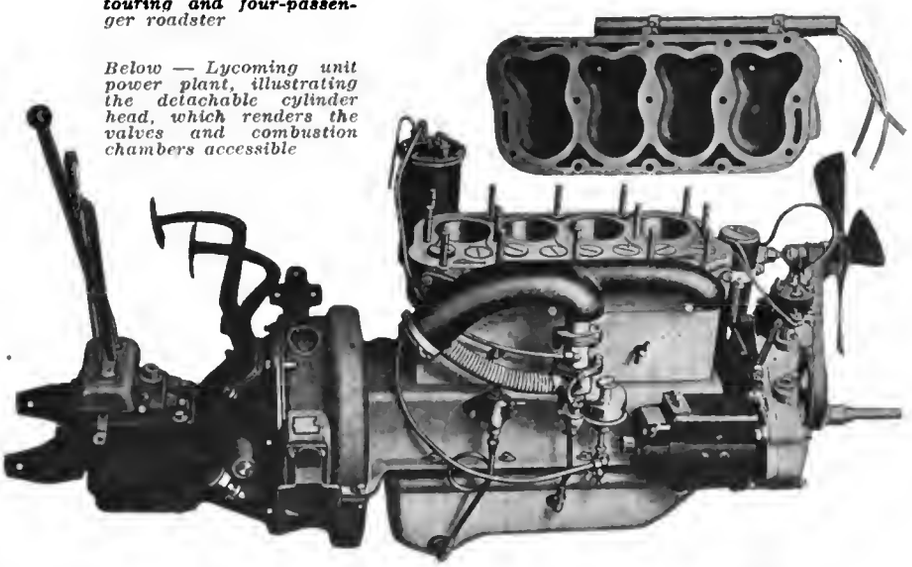
Lower left—Wheel removed, showing the bearing mounting and the assembly of the brake bands

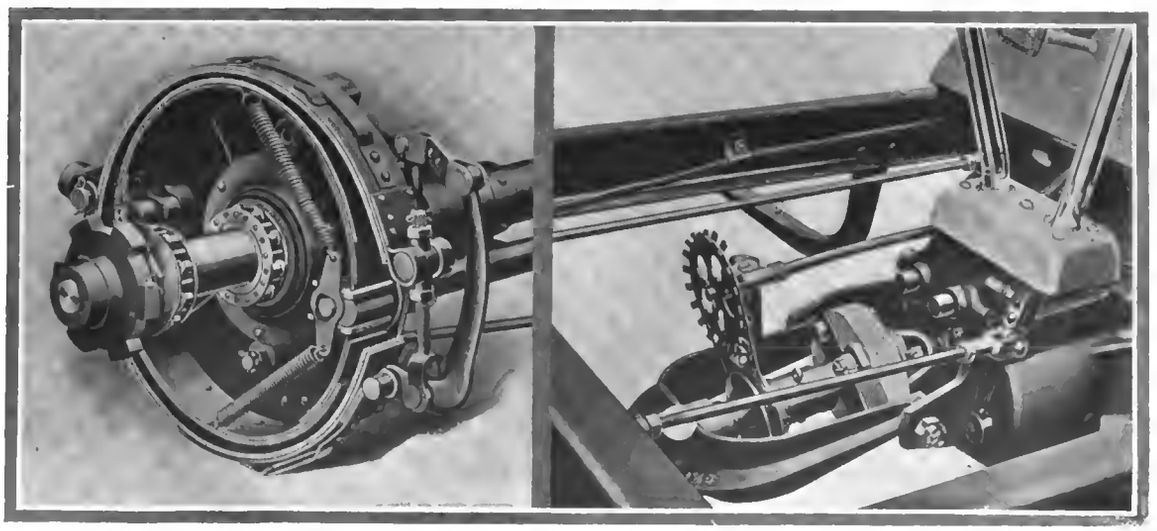
Lower right—Flexible universal and speedometer mounting just back of the gearset, also shows connection at the front of the torque tube



Above — Five-passenger touring and four-passenger roadster

Below — Lycoming unit power plant, illustrating the detachable cylinder head, which renders the valves and combustion chambers accessible





Dixie Flyer Battery Mounting Sole Change

Current Source Removed from Motor Vibration — Line Comprises Five-Passenger Touring and Four-Passenger Roadster with Lycoming Engined Chassis

VERY little change has been made in the four-cylinder 1917 Dixie Flyer cars which are now going through production. All the alterations are only detail refinements, with the exception of battery location. In the 1916 chassis the battery occupied the conventional location under the floorboards close to the motor supporting arm. For 1917 it is placed on the left side of the main frame well forward. The reason for this change is that considerable disadvantage was found resulting from the vibration of the engine, and the heat. In the present position the battery is free from heat and vibration and is now so arranged that raising the hood exposes every connection to the eye and allows of considerably shorter lead wires to the starting motor.

Lycoming Power Plant

The power plant consists of a Lycoming engine. This has not been changed and is a four-cylinder 3¼ by 5, L-head design with an S. A. E. rating of 16.9 and, according to the manufacturers, develops 29 hp. at 1900 r.p.m. The cylinders are cast in a block and are of gray iron with the water inlet at the bottom of the casting on the opposite side from the valves. A feature of the motor block is the reinforcement of the attaching flanges where it is bolted to the crankcase, giving maximum rigidity with a minimum of vibration. The head is cast separately allowing space for large valves and also permitting of machining of the cylinders and giving access to the cylinders and valves. The head is also reinforced with ribs preventing warping during machining and permitting a perfect joint between the head and cylinders. Tightness is secured by a copper-asbestos gasket.

The pistons are close-grained iron centered from the inside to secure even thickness of wall. Three piston rings are used, these being eccentric and ground on three sides. The piston pin is hollow of case-hardened steel with a scleroscope test for hardness. The pin is held tight in the piston with the upper end of the connecting-rod forming the bearing through a bronze bushing.

Drop-forged I-beam connecting-rods of 40 carbon steel are used with split type lower ends having a diameter of 1¾ in. and a length of 2⅝ in. on the bearing. The cap is retained by two nickel-steel bolts.

A drop forging is also used for the crankshaft. It is 40-50 carbon steel supported on two bearings. The front is 1¾ in. diameter by 3¼ in. long and the rear 1¾ in. diameter by 3 15/16 long. The flywheel is bolted to a flange on the rear end of the crankshaft, this flange being forged integral and the whole assembly placed in running balance. The bearings are split die cast white metal, adjustable by removing brass shims.

Carbon Steel Camshaft

Low carbon steel is used for the camshaft which is 1 in. in diameter and supported on three bearings. Dimensions of these from front to rear are 1¼ in. diameter by 2 15/16 in. length, 1 55/64 by ⅝ in. and 1 in. by 2 9/16 diameter and length respectively. Scleroscope tests for hardness are used on the cams and each is tested on a special jig for eccentricity.

Helical timing gears are employed to drive the camshaft and other auxiliaries. The camshaft gear is of cast-iron meshing with the steel crankshaft gear. The gears are marked for mesh so that after taking down the engine, retiming is simple. The remainder of the valve action is through flat head pushrods also case-hardened and the valves themselves have gray iron heads fused on steel stems. They are 1⅜ in. in diameter and located on the right side of the engine, so that the steering column does not interfere with valve adjustments.

Lubrication is worked out along the lines of the conventional combination pressure and splash system. The oil is contained in the bottom half of the crankcase which has a capacity of 5 qt. A plunger pump circulates the oil, this being driven by an eccentric on a camshaft. The oil is carried to leads which supply the crankshaft and also the troughs beneath each connecting-rod throw. There is an oil scoop on the bottom of each of the rods, which, due to the design of the oil pan, dips an equal depth regardless of grade and road conditions.

Cooling is by a thermo-syphon system which has several distinctive features. It will be noted from the illustrations that the radiator is on the frame instead of between the frame members, thus placing the lowest level of the cooling water in the radiator above the cylinder jackets, allowing circulation to commence as soon as the engine is started. The inlet and outlet pipes are both extra large, with the radiator being connected to the engine by 2¼ in. hose. Additional efficiency in cooling is secured by having each cylinder barrel independent from its neighbor, thus permitting the free circulation of water all around and between the cylinder walls. Extra large waterways are also provided around the valves.

Stewart Vacuum Feed

The gasoline system comprises a cylindrical gasoline tank, hung at the rear of the chassis, a Stewart vacuum feed and a Carter carbureter, with special adjustment on the instrument board. There is an arrangement for holding a reserve of 1 to 3 gal. in the supply tank and for automatically notifying the driver when the reserve is reached. A 2-in. section of the gas supply pipe works perpendicularly through a specially packed sleeve in the connection at the top of the tank. A stop is provided on the lower section of the pipe inside the tank to limit its travel upward. When the supply pipe is drawn up to the top the vacuum feed draws gas from a point 2 in. above the bottom of the tank. Should the car at some out-of-the-way place run out of fuel, it is only necessary to push down the feed pipe to secure additional feed.

The clutch is a cone of pressed steel with leather facing and with six compensating spring plungers under the leather to secure easy engagement. A straight line drive is secured by underslinging the rear springs and inclining the motor in the chassis, so that when the car is underloaded the drive does not deviate greatly from the straight line. From the clutch the drive is taken through a Grant-Lees standard gearbox with a semi-steel case having a strength of 28,000 lb. per sq. in. tensile. The main shaft has four splines and is of 90,000 lb. steel with a 75 to 80 scleroscope test. It is carried

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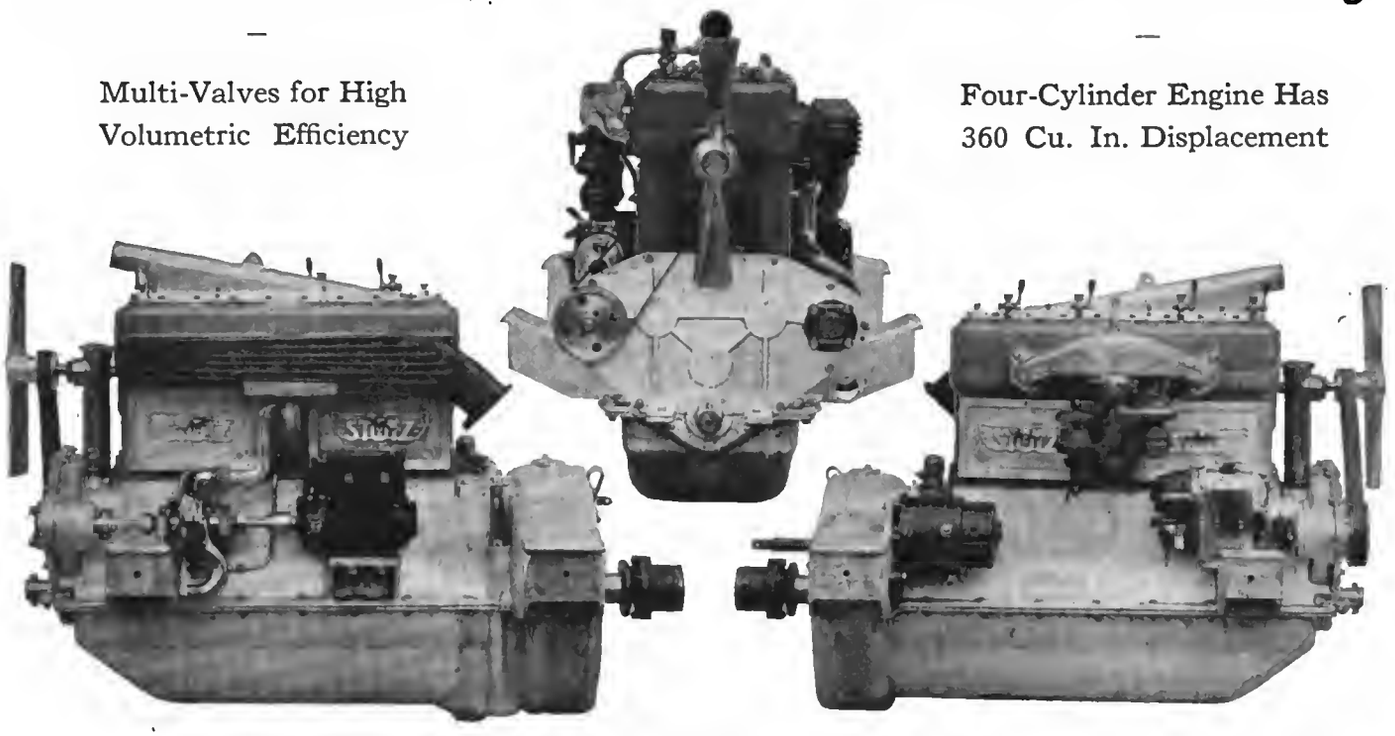
Sixteen-Valve Stutz Roadster Ready

Multi-Valves for High Volumetric Efficiency

Four-Cylinder Engine Has 360 Cu. In. Displacement



FOR some time it has been predicted that the tendency observed in racing toward multi-valve cylinders would find its reflection in vehicles intended for ordinary use. The Stutz company bears out this prediction in announcing a sixteen-valve four-cylinder motor placed in a roadster intended for high speed work.

High volumetric efficiency is naturally the object in the greater number of valves per cylinder and the gain is not noticeable except when the ratio of piston speed to displacement becomes such as to require exceptionally high gas speeds. Therefore, in order for an engine of this type to be of use to the average individual who does not expect to travel over the highways at 90 m.p.h., we would expect a powerplant with large cylinders. This is the case in this new Stutz job which has a displacement of 360.8 cu. in. with its bore of 4⅝ and stroke of 6. This gives a formula rating of 30.63 hp. based on the 1000 ft. per minute piston speed. As the engine is intended for high speed work this rating is exceeded to a very large extent. The cylinders are cast in a single block which is a departure from usual Stutz practice. In spite of the compactness of the casting extra large water spaces surround each cylinder and the exhaust ports are all separated, having eight separate entrances into the manifold.

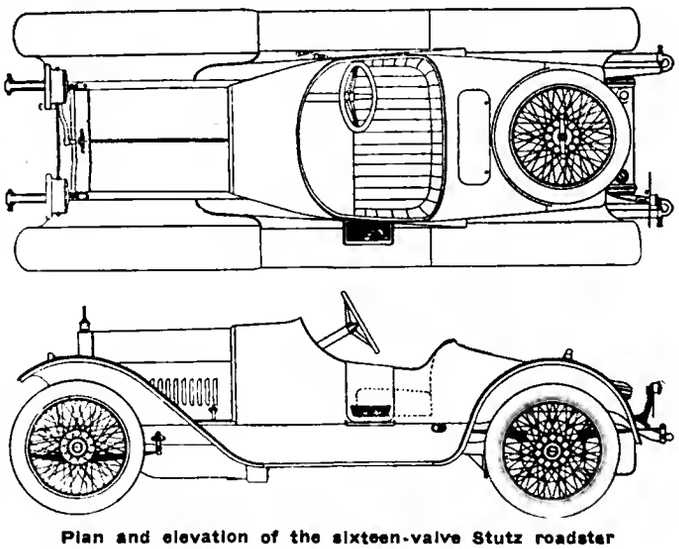
Aluminum alloy is used for the crankcase and this casting is arranged so that the front leg incorporates the breather. This feature has been so arranged to prevent the accumulation of oil vapor over the exterior of the engine, thereby cutting down the collection of dust. The bolts holding the main bearings in place are through bolts with a collar countersunk into the crankcase. They also hold the cylinders in place.

Nickel steel is used for the crankshaft which is supported on three extra long main bearings. In mounting these, the bearing seats as well as the bearings themselves are carefully scraped in so that a solid backing is given the shaft supports. The valves are all operated by roller lifts from the camshaft.

Lubrication is by pressure feed through a hollow crankshaft. Oil is pumped from the reservoir in the crankcase through a main duct cast integral with the crankcase to independent ducts leading to each crankshaft bearing. The stream of oil then passes through the hollow shaft to the lower rod bearings which are fed by a constant flow. The pistons are lubricated from the main and rod bearings, the oil filler is incorporated with the fan bracket and a gage is provided on the side of the crankcase showing the amount of oil in the reservoir.

The fan is a two-blade aeroplane type of an aluminum alloy mounted on an annular ball bearing with an eccentric bearing for adjusting the tension of the fan belt. The intake manifold which is water jacketed is so designed that the carbureter is very close to the cylinder ports and very accessible. Hot air is taken directly from the exhaust manifold by a hot air tube extending between the middle two cylinders.

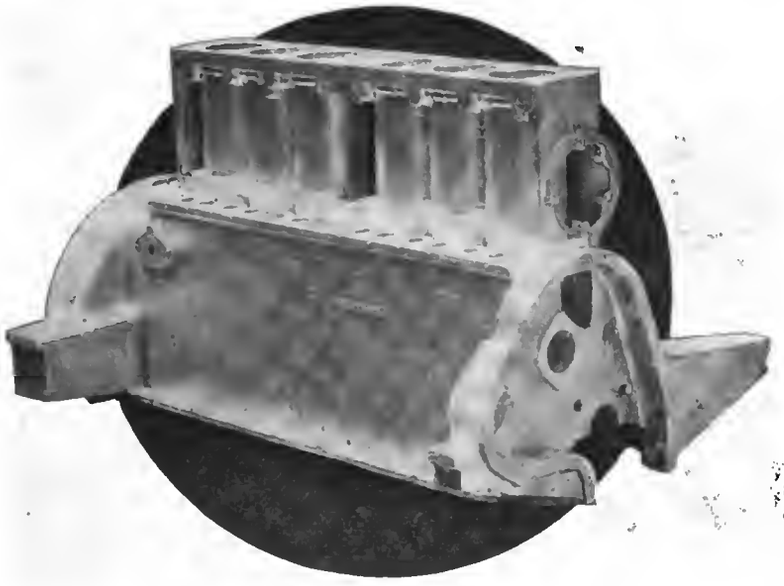
This engine has been in a car for some time and driven several thousand miles. The particular car in which it was installed for trial was a four-passenger job which the makers state has been driven up to 75 m.p.h. fully equipped with the top and windshield up and carrying four passengers. On the same adjustment good fuel economy was secured.



Plan and elevation of the sixteen-valve Stutz roadster

Aluminum Block Engine in New Premier

Two Body Models for the Present — Cutler-Hammer Electric Gearshift Standard



The Premier aluminum engine block

WHEN the Premier Motor Corp. announced this spring that the product of its new factory would be a six-cylinder car with an aluminum engine and magnetic gearshift considerable interest was felt throughout the trade. Now that the full description of the car is available it is seen that the general layout is in every way as modern as the early announcements showed to be the case in these particular details. The new Premier is an entirely separate organization from the old Premier, with a new engineering, production and sales staff and a new factory with new machinery.

A glance at the exterior will show this to be an entirely new car and while unlike anything now on the market it is in many respects a composite of the low-resistance lines of the up-to-date car. From the V-radiator to the rounded stern the entire body gives a suggestion of small resistance and yet roominess. The latter quality is secured to a large extent by the fact that the underhood space that is generally lost to the fan has been utilized for the engine by placing the fan well up in the V-shaped radiator, thus securing so much more room for driver and passengers.

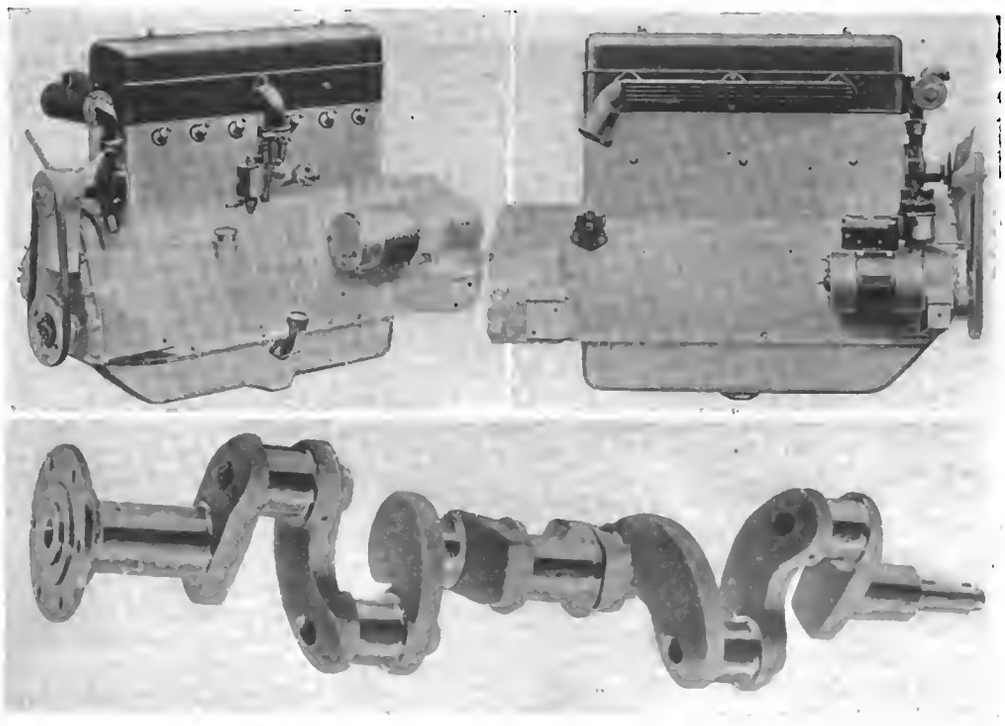
According to present plans between 500 and 1000 of the new cars will be produced during the latter part of this fall. The factory is ample for 20,000 per year production, having an area of 327,000 sq. ft. of floorspace, a complete overhead conveyor system and a plant which is noticeable for its lighting. The buildings and grounds, which cover an area of 40 acres, are in every way suited for the installation of chain or other modern production systems.

Two Bodies at Present

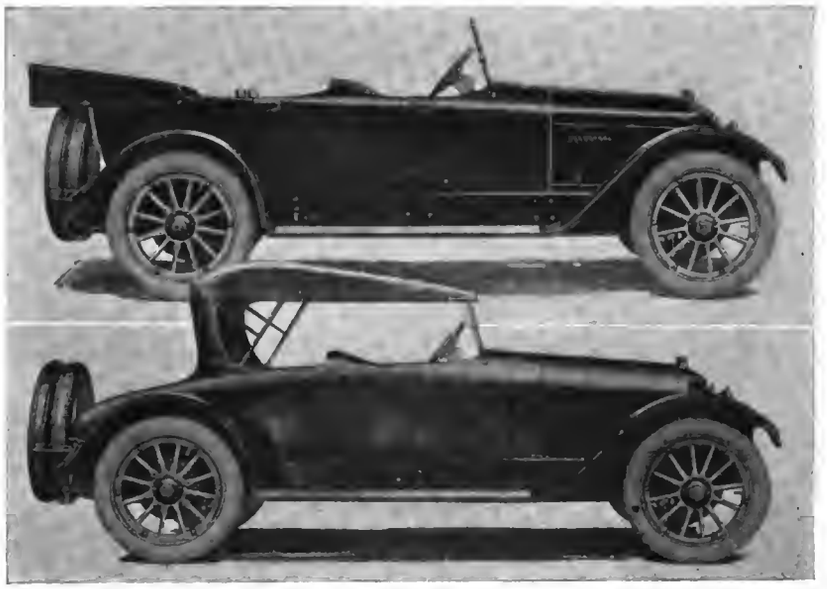
For the present, the line will comprise a seven-passenger touring and a four-passenger roadster selling for $1,685. The principal specifications include the 3⅜ by 5½-in. aluminum motor, single plate clutch, three-speed gearbox, Timken floating axle and a wheelbase of 125 in. with 35 by 4½ tires.

Although incorporating an aluminum block the engine follows standard practice to the extent of being made up in a unit power plant including clutch and gearbox. The power plant is hung at four points, giving a rigid connection to the frame. The six-cylinder aluminum block incorporates the crankcase as a unit. The cylinder head is removable and is of cast iron. With this arrangement valves can be ground and carbon removed directly by simply removing the holding-down studs. The overhead valves are covered by pressed steel cases fitting over the tops of the cylinders. The cylinders are lined with cast iron sleeves which are pressed in the aluminum casting while the aluminum is in an expanded condition due to exposure to super-heated steam. Since the aluminum expands more rapidly than the cast iron the sleeves are held tightly in place on the shrinkage of the cylinder block. When the cast iron sleeve is worn it can be removed by heating the aluminum in the same manner and driving out the sleeve.

Lynite pistons are employed having three rings above the wristpin. The length of the piston is 5⅛ in. which is sufficient to hold to a minimum any tendency toward slap. In the skirt below the piston pin there are two rows of oil holes



Two sides of the Premier aluminum engine with cast iron head and pressed steel valve cover and the counterbalanced curved cheek crankshaft



Illustrating the Premier projectile type touring and four-passenger roadster bodies, which now comprise the line

which will prevent flooding of the combustion chamber. Standard practice is followed in regard to the connection of the piston to the connecting-rod. The pin bearing is ⅞ in. in diameter and has a length of 1 5/16 in. The rod is an I-beam 11 in. long drop-forged from carbon steel. The bearing at the lower end of the rod is 2¼ in. diameter by 1¾ in. in length. The crankshaft is 2¼ in. at the main bearings and is a drop forging from 0.40 carbon steel. The curved-cheek shaft is carried on three main bearings and is counterbalanced on the Wyman & Gordon system. The dimensions of the main bearing are from front to rear 2 3/16 by 3, 2¼ by 2⅞ and 2 5/16 by 3⅝ in.

Fabroil in Timing Gears

Helical gears are used for the camshaft which is carried in the crankcase. The material of the timing gearset is Fabroil, which is the compressed cotton manufactured under General Electric patents. The generator drive is taken off the camshaft which is carried upon three bearings bushed with bronze in the front and die cast in the center and rear. The diameter of the shaft is 1¼ in. It carries the cams integral and these are so shaped as to give the valves a lift of 7/16 in. The diameter of the valve is 1½ in. in the clear, with spring pressures of 40-60 lb. The actual lift of the cam is only 7/32 in. but this is multiplied by 2 in the rocker to give the 7/16 total.

Adjusting the Valves

In making adjustments on the valves there is a nut on the top of the lifter rod. With valves of this size and the overhead arrangement it is expected that the peak of the power curve will be well toward 2800 r.p.m. although no horsepower curves have as yet been submitted. In fact, the engineering department has made a point of good torque at low motor speeds rather than a showy horsepower curve which to the actual owner means little and does not indicate performance at practical speeds.

Combined Pressure and Splash

Lubrication is by a combined pressure and splash system. The oil is forced to the main and connecting-rod bearings and splashed to all the other bearing surfaces. The reservoir is in the lower half of the crankcase and from here the lubricant is taken by a gear pump driven by spiral gears off the camshaft. The pressure is regulated by a by-pass to the timing gears and owing to the fact that the crank cheeks are curved in carrying out the balancing system, oil pipes are placed across the curvature in the cheeks. The spray off the connecting-rod bearings gives all the oil that is considered necessary. The oil capacity of the crankcase is about 8 qt.

A feature of the oiling system which is somewhat different and is the idea of Earl Gunn, who is chief engineer, is in the knurling of the piston skirt. Diagonal lines about 1/32 in. apart are carried across the piston skirt. The lines run at about right angles to each other and provide space for a small amount of oil to work its way along the surface of the piston. It also gives room for the metal on the raised portion to spread out should there be any tendency to stick in case the oil level becomes low. While maintaining the oil film this groove forms an oil trap which tends to make each unit of oil do its work before it is again allowed to drain back to the crankcase. The oil filler and oil level gages are on the left side of the engine while the oil pressure is registered on the dash.

In working out the cooling system the water pump is mounted on the front of the cylinder block, the impeller shaft for the pump and the fan shaft being common and driven by a V-belt off the crankshaft. The reduction between crankshaft and the impeller-fan pulley is 1 to 1½. Another feature of the cooling system which is of interest is the use of a thermostat for maintaining the correct water temperature. With this system the water does not flow from the cylinder jackets until the temperature in these jackets becomes high enough for efficient combustion. The thermostat then permits the circulation. In the meantime the pump simply circulates the water through the radiator. This unit is a honeycomb with a capacity of about 6 gal. including the volume occupied by the waterjackets. The by-pass for the thermostat is located over the water pump at the high water level. There is an opening on the camshaft side of the waterjacket casting which considerably simplifies the foundry work on this casting. Over this opening a cover is bolted on, inclosing the push rods. The fan is really the only exposed moving part. This is a four-bladed aluminum casting 14 in. in diameter and the belt which drives it is mounted in front of the fan in order to take up as little underhood room as possible and to secure full benefit of the V radiator.

Two-Unit Electric System

Electrically, the Premier car is Delco equipped, as this takes care of starting, lighting and ignition. It is a two-unit system in which the generator carries the ignition coil and distributer. This unit is driven from the timing gears while the cranking motor engages through a Bendix gear to the teeth on the flywheel. The battery is 100 amp.-hr. Willard mounted between the engine and frame under the hood, an accessible position, and yet the battery is out of sight. The spark plugs are set into the side of the bolck casting at an angle.

On the rear of the crankshaft there is a flange to which is bolted the 15-in. 60-lb. flywheel. This incorporates the Borg & Beck single-plate clutch. The teeth are cut directly on the wheel and give a ratio of 120 to 13 to the starting pinion.

Gearshifting is accomplished by the use of the Cutler-Hammer magnetic shifter and is now in its improved form. Basically, however, the principle is the same as has been described several times, with the power supplied through solenoid coils operating the selector and shifting units. In installing the shifting arrangement care has been taken in the clutch move-

ment to allow the driver to declutch the engine without shifting gears, the shift being made only on a full depression of the pedal. Aluminum is used for the gearset housing with a sheet steel coverplate.

An S. A. E. bell housing is used but on account of the arrangement of the Bendix gear the holes are differently spaced than the S. A. E. specifications. All through the car, however, S. A. E. standards have been used as closely as possible, especially as regards material.

Frame Is Strong

There are two universals on the propeller shaft and the rear axle is a Timken spiral bevel unit with a ratio of 4 5/11 to 1. This is the standard floating unit. The frame construction is extraordinarily sturdy, having a channel section 8 in. deep with a 2¼ in. flange of ⅛-in. stock. The flange, of course, tapers in different parts of the chassis. The channel section is so arranged that the web forms the splash apron and the stay bolts for the hangers pass directly through the flanges. The springs are semi-elliptic, 58 in. long and 3¼ in. wide. They are a product of the Perfection Spring Co. and take the drive as well as the torque. The steering gear incorporates a worm and full wheel.

Suspended from the rear of the frame is a 24-gal. gasoline tank fitted with a long gooseneck filler opening making filling possible from the side of the curb without using a funnel or clashing with the spare tires. The tank is also so hung that the frame protects it from rear collision. From the tank the fuel is carried to the carbureter by a Stewart vacuum system.

Premier designers have been particularly fortunate in securing a very pleasing combination of body lines. From the radiator, which is a very decided V, the impression is one of a smooth, round, slightly tapered cylinder. The top of the hood is a straight line from radiator to windshield and the sides have the incurve at the top which merges into a cowl behind the front seats. The Premier people call it a projectile type of body and the name seems a particular happy one as applied to the four-passenger roadster. A tilted windshield adds to the effect.

Body room, particularly in the seven-passenger car, is unexpectedly great. An additional 6 in. is obtained so that there is more passenger capacity than ordinarily would be regarded as possible on a wheelbase of 125 in. One feature which will be appreciated by tonneau passengers is the fact that those in spare seats have as much room as those in the tonneau seat proper. This is obtained by cutting deeply into the back of the front seats foot and leg space which is covered up when the spare seats fold in. Front seat passengers are equally well cared for and exit and entrance from the driver's side is made easy by a tilting steering wheel and the abolition of the gearshift lever. The tonneau seats measure 44 in. from upholstering to upholstering. The latter is of the straight, vertical pleat pattern.

Wide doors and comfortable auxiliary seats in seven-passenger touring

The dash instruments are easily seen—note position of electric gearshift control on steering column

The four-passenger roadster is supplied with doors both front and rear and is not so close coupled.

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Dixie Flyer Battery Mounting Changed

(*Continued from page* 359)

on a double row of S. K. F. self-aligning ball bearings. Between the stem gear and the main spline shaft a roller bearing is used. The material in all gears is 3 per cent nickel steel testing up to 120,000 lb. sq. in. and allowing of quite narrow gears and a short case.

The rear axle is floating with chrome nickel-steel shafts and gears. The final drive is spiral bevel mounted on high duty roller bearings with end thrust bearings on either side. A feature of the rear axle is that all gears and bearings are adjustable, thus permitting a continuity of good mesh and a reduction of noise due to wear.

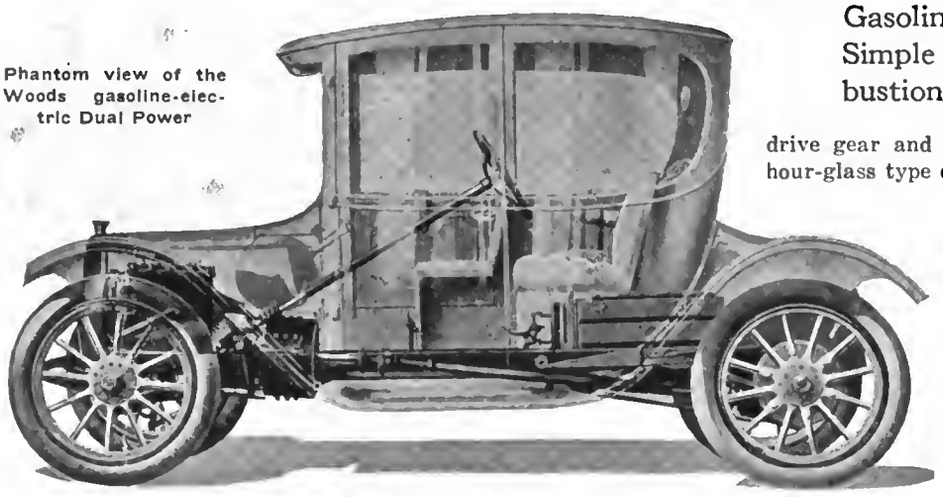
Electrically, the Dyneto two-unit system is used for starting and lighting and the Connecticut system for ignition. The battery is a Willard. Bendix drive connects the starting motor with the engine through the flywheel ring gear. A wiring diagram is placed on the dash of each car and the individual circuits are marked in different colors so that non-technical owners may have a clear picture of the electrical connections. Each individual circuit such as headlights, tail and cowl lights, ignition and horn is equipped with a separate fuse and the block carrying the fuses is on the dash beneath the hood. The generator cuts in at 10 m.p.h.

Structurally, the frame is a straight pressed steel channel with four cross members and a noticeable absence of castings. Where these are used they are of steel in place of the malleable metal. Drop forgings are used wherever possible to secure strength with minimum weight. The wheelbase is 112 in. Steering is irreversible and the wheels are artillery, using 32 by 3½ tires on demountable rims.

The line comprises two separate bodies. There is a five-passenger touring and a four-passenger roadster, the latter having the cloverleaf seating arrangement. The touring car is a straight line design from the radiator to the cowl with a slight curve in the side rail line. Standard finish is Brewster green with highly crowned fenders in black enamel. The roadster follows about the same lines as the touring car and has a sloping windshield. Individual seats are used in the forward compartment with the rear seat wide enough to accommodate two persons. The top is a one-person design with quick-detachable side curtains and the price of $795 includes complete equipment.

Simple Control in Woods Dual Power

Gasoline Electric Incorporates Simple Linkage of Internal Combustion and Electrical Units



Phantom view of the Woods gasoline-electric Dual Power

AN electric car, a gasoline car or a vehicle in which both powers may be utilized at once, with the elimination of the greatest inconvenience in electric cars, namely dependence on charging stations, is the Woods Dual Power car.

In the mechanism of the car there are really but three units, irrespective of the driveshaft and rear axle. The gasoline engine is under the hood and directly behind it is the electric motor, a unit is the same drive line. Located under the front seat is the storage battery set. The connecting unit between the gasoline and electric motors is in the form of a magnetic clutch which is simplicity itself. When the gasoline control lever is raised about an inch from full retard the flywheel of the gasoline motor becomes magnetized. The magnetic force pulls a copper disk against the face of the flywheel and the electric motor and the gasoline engine are connected.

Four-Cylinder Block Engine

The gasoline engine is a block cast four-cylinder, with 2½-in. bore and 3½-in. stroke. Because of its small cylinder sizes and its high speed operation the engine is very smooth running, being nearly as quiet as the electric motor. Lubrication is effected by a gear pump which lifts the oil from a lower chamber to a compartment around the valve tappets, whence it flows by gravity to the various bearings. Ignition is Atwater Kent, with automatic spark advance. Cooling is thermo-syphon through a honeycomb radiator.

A one-piece gasoline tank with a capacity of 9 gal. is under the cowl. The Exide battery is specially constructed for this car and has twenty-four cells with eleven plates each, considerably smaller than the batteries required for driving all-electric cars.

Much of the smooth riding qualities of electrics has been attributed to the heavy batteries suspended low in the rear or center-rear of the car. With a much lighter battery the Woods car is equally as easy riding as the former all-electrics produced by this same company. This, the makers say, is due to the use of liberal-sized cantilevers on the rear. The front is half-elliptic suspended.

The rear axle is semi-floating with the wheels mounted on driving shafts which ride on Bock roller bearings. The axle tubes are of steel tubing, swaged to shape and bolted through the flange to the axle housing which surrounds the drive gear and differential unit containing the Baush hour-glass type of worm gear.

The body is an attractive combination of characteristic gasoline and electric car types. It is aluminum-panel construction and the coupé is the only model offered. The doors are wide and contain windows which may be lowered. The front and rear windows may also be opened. The car will comfortably seat four passengers, the driver's seat being staggered ahead of a spacious seat which will take care of two and in front of which is an auxiliary seat which folds out of the way against the dash.

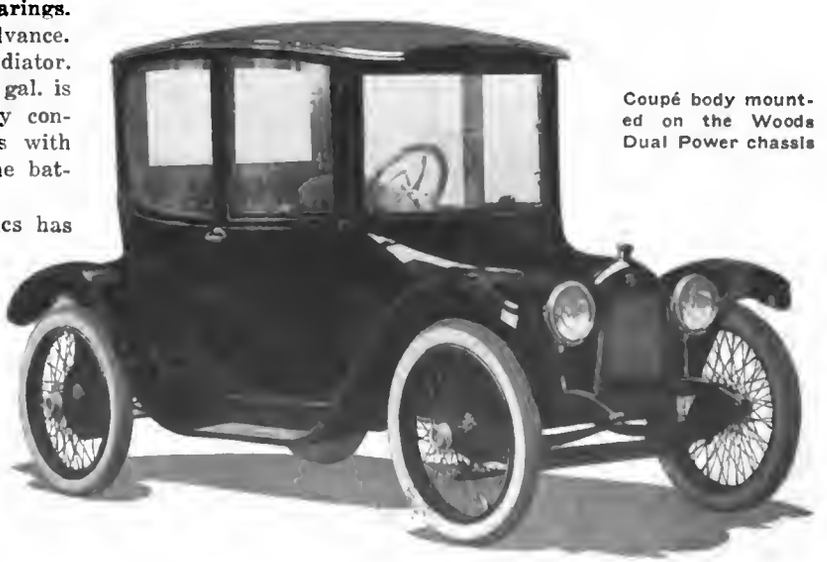
On the instrument board is an ampere-hour meter and ammeter combined and a Stewart-Warner speedometer. There is a three-gang switch for lighting.

The oscillating movement of the pedal is for the purpose of opening and closing the switch of the electric motor. Of course this same operation can be performed with the hand control lever. With the hand lever set at an operating position and the pedal pad oscillated forward there is no current passing to the motor. A movement of the foot and the switch engages and the car starts.

Reverse by Electric Motor

The gasoline engine drives one way only, there being no gearset, and so the electric motor must be called on to run the car backwards. Oscillate the pedal pad forward, place your heel on the small lever against the heel board under the driver's seat, oscillate the pedal backward, the action of the electric motor is reversed, and the car starts backward.

The price of $2,650 includes a power-air pump, mounted on the right side of the gasoline motor; and a motor-driven warning signal. Wire wheels are listed at $25 additional and the same figure will equip the car with slip covers. Cars in special color effects to suit the individual tastes of owners



Coupé body mounted on the Woods Dual Power chassis

will be produced for $100 additional. Deliveries of the new car are already under way.

The controls are simply arranged so that none of the easiness of drive that makes the electric car so popular with women drivers is lost. The absence of complication is marked and a large part of the actual mechanical control is automatic. As in gasoline cars, practically all the driving is done through pedals with very little manipulation to cut into the effectiveness of the hands in steering. There are no gears to shift and all the hill work is simplified by the action of the electric units which take up the work where the gasoline leaves off.

Three-quarter rear view, showing neat lines of the Woods Dual Power

Tourabout Body on Empire Six Chassis

THE latest of the four-passenger body designs is the new Empire tourabout which is fitted on the six-cylinder chassis. The new body was designed to provide a snappy type of vehicle of larger seating capacity than the roadster. In exterior line the body carries out very well the suggestion of a speedy yet roomy vehicle. From the high roll cowl there is a gradual downward taper to the rear deck to curved sides without a break or corner at any point.

It is really a four-passenger car in that there is an abundance of room for four persons to be seated in comfort. The front seats are individual with a wide aisleway which gives easy access to the rear seats.

A roomy rear back department is supplied for luggage and access to it may be had by dropping down the back of the rear seat which forms the door to the compartment. It is large enough to accommodate two suit cases and other touring accessories.

Even with the ample room between front and rear seats, the close coupled advantage of all passengers riding between the axles produces easy riding. The color scheme consists of green for the body proper with black hood, fenders and running gear.

The Empire six chassis has been described before, so it will be enough to say that it comprises a six-cylinder engine 3¼ by 4½ in., 120-in. wheelbase and 34 by 4 tires.

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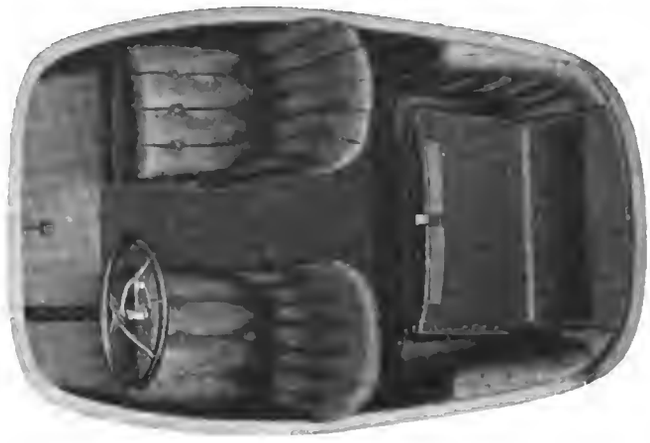
Benzol and Alcohol as Fuel

For several years the Paris General Omnibus Co. ran all its De Dion Bouton and Schneider buses on alcohol carbureted with 50 per cent benzol. Later, and until immediately before the war it used benzol only. The disadvantages of the mixture were difficulty in starting and the necessity of cleaning out the combustion chamber more often than with the use of gasoline. The bus company found that their fuel consumption was at the rate of 0.176 gal. per mile with benzol only; 0.180 gal. with gasoline, and 0.2 gal. for alcohol and benzol. In all the annual French army truck trials held prior to the war, one-third of the total distance had to be accomplished on an alcohol-benzol mixture, one-third on benzol, and one-third on gasoline. Except for the difficulty in starting from cold the alcohol-benzol mixture was as satisfactory as the other two fuels.

Since the outbreak of the war there has been no use of benzol and alcohol in the motor services of the Allied armies, these two fuels being monopolized for the making of explosives.



Above—Seating arrangement of the Empire four-passenger roadster, showing passage between front seats and relative capacity of rear seat. Note fold-down back on rear seat and also amount of leg space in rear

Left—The new Empire four-passenger roadster, showing the low lines which maintain the roadster form and yet give the car the capacity of a small touring body. Note torpedo stern and manner in which top covers rear seat

The Rostrum

Ammeter Not Advisable on Cole 4-40

EDITOR THE AUTOMOBILE:—I have a 1913 model Cole 4-40 touring car that is equipped with a Delco lighting and starting and ignition system and desire to install an ammeter on same. Please give instructions in installing it and what should be the graduations of the ammeter.

I use a 12-cell type SD-3 Exide battery and desire to charge the batteries without taking them off the car. Using a 6-volt direct-current circuit, could I not disconnect the wires from the generator and connect source to them and charge them that way?

Which are the generator terminals and at what amperage should the battery be charged? Please give diagrams of the above.

Senath, Mo. L. A. C.

—It is not recommended that such an installation be made on this particular system because of the fact that on the 6-24 volt system the meter would have to register the cranking current as well as the charge and discharge rates when connected to show the net charging current. The installation would, therefore, fall for an ammeter having about 50 amp. as a maximum on each side, and in view of this fact, it is not believed that the meter would do any good, particularly as the ampere ammeter on this system enables one to get a fair idea of whether or not the battery is being properly charged.

In regard to the charging of the batteries, this is a perfectly feasible thing to do from a 6-volt source by connecting the positive terminal and negative terminals in parallel and then connecting the 6-volt source as shown in Fig. 1.

All terminals of the generator are used when the machine is generating current. Referring again to the diagram, these terminals are numbered 1, 2, 3 and 4. The No. 3 terminal is the negative one which is connected to the negative terminal at the battery through the wire and connections in the controller switch and the No. 4 terminal is also connected through the wiring and connections to the positive terminal of the battery. The No. 4 terminal, however, is one end of the reverse series winding. The 1 and 2 terminals are the positive shunt field terminal and the positive brush lead and when connected to the meter contacts permit the generator to charge the battery. If there are no connections between the Nos. 1 and 2 terminals the generator will not charge in the proper direction.

Olds 1907 Loses Power on High

Editor THE AUTOMOBILE:—I have an Oldsmobile model A roadster, No. 61047 which runs all right on reverse, low and intermediate, but when I shift into high the car comes to a bucking stop, and then if shifted into intermediate it will act the same way. Will you kindly explain as to what causes this trouble and, if possible, publish a sketch of both gearbox and differential?

Pittsburgh, Pa. F. J.

—In a similar case to the one you mention, the balking was found to be due to worn out pistons and cylinders; in other words, the engine had no power, and as soon as it was thrown into high speed it stuck. As this car is a 1907 model, it is very probable that after 9 years of service the pistons and cylinders as well as the valve will be in bad shape.

Efficiency of Final Drive

Editor THE AUTOMOBILE:—Which mechanism delivers the most power to the rear wheels of an automobile, viz., chain drive, carried through jackshaft to sprocket and chain to rear wheels, or direct drive from transmission to the bevel gears in rear axle then delivered to wheels through semi or full floating axle?

Seattle, Wash. W. A. W.

—The entire matter of friction loss depends on the amount of bearing surface as well as in the manner of drive. A table giving the transmission efficiency of different types of mechanism has been worked out by Worby Beaumont and is considered quite reliable. This table is as follows:

Source of Loss of Power	Amount of Loss Per Cent	Efficiency Per Cent 100
When driving direct:		
One chain	3.0	....
One and one-half pairs of bearings	7.5	89.5
With epicylic speed gear in operation, add	15.0	74.5
When driving direct:		
One set of gears	5.0	....
Two pairs of bearings	10.0	....
Partially active bearings	3.0	82.0
With change-speed reduction gear in operation, add	12.0	70.0
One set of gears	5.0	....
Three pairs of bearings	15.0	....
Equivalent of two chains	6.0	74.0
Two sets of gears	10.0	....
Four pairs of bearings	20.0	70.0
Two sets of gears	10.0	....
Five pairs of bearings	25.0	....
Equivalent of one chain	3.0	62.0
Equivalent of three sets of gears	15.0	....
Five pairs of bearings	25.0	60.0

Cannot Change Buick 25 Ratio

Editor THE AUTOMOBILE:—I have a 1914 model B-25 Buick touring car which is geared 13½ on low, 6 on second and 4 on high, which is a little too high a gear for this rough country. I wish to change the gear so I will have a 16 to 1 on low, 8 or 8½ on second and about 5 or 5½ on high. What would be necessary to make the desired change and where could the necessary parts be obtained? Also, about what would the total cost be?

Newcastle, Wyo. L. R. K.

—The Buick company cannot supply special gear ratios for these cars, owing to the fact that there is just room in the differential housing to take care of the present ring gear and there would be great difficulty in fastening a smaller pinion to the shaft.

Eight Cylinders Placed in Line

Editor THE AUTOMOBILE:—What would the crankshaft for an ordinary eight-cylinder engine look like in case all the

cylinders were put in line? Is there any angle other than 180 deg. between the different crankpins?

Milwaukee, Wis. W. F. O.

—The simplest way would be to have all the cranks in the same plane just like two four-cylinder crankshafts both together. An arrangement with cranks at 90 deg. would, however, be possible.

The easiest way to explain it is to say that with eight cylinders in line you have the equivalent of two four-cylinder engines coupled and you can regard the first four-cylinder as one engine and the second four as the other or you can regard cylinders 1, 3, 5 and 7 as one four-cylinder engine and 2, 4, 6 and 8 as the other.

Packard Uses Double Distributer

Editor THE AUTOMOBILE:—Does the Packard company use a separate coil and time for each half of its twin six? Kindly explain how same is timed.

2—Who makes the engines used on Paige, Jeffery, Mitchell, Kissel, H-A-L, Studebaker and Reo cars?

3—What ignition is used on the H-A-L twelve?

Mount Hope, N. Y. T. K.

—No. There is a double distributer, however, and the timing is exactly the same as for two independent six-cylinder engines, each half of the distributer taking care of a set of six cylinders.

2—Paige, Rutenber, small six, and Continental, large six; Jeffery, Buda on the six and own on the four; Mitchell, own engine; Kissel, own; Studebaker, own; Reo, own; and H-A-L, Weidely.

3—Remy ignition.

Rebuilding Haynes for High Speed

Editor THE AUTOMOBILE:—Am rebuilding a Haynes model Y for speed. Have cut wheels down to 32 in. and changed ratio to 2½ to 1. Am cutting aluminum pistons with head slightly crowned.

In your opinion would I gain anything by changing timing of valves, and if so what timing would you advise?

Galion, Ohio. R. W.

—Possibly some speed would be gained by pushing the timing of the exhaust valves ahead about one tooth in the camshaft drive. This would probably affect the low speed running but may increase the power of high speed. The inlet valve timing should be changed to open around 10 deg. late and close from 45 deg. to 48 deg. after bottom center. This being a rather old model, built in 1910, the valve sizes are not sufficiently large to make for high speed and there is a possibility that very little, if anything, will be gained.

It must be remembered that between the years of 1910 and the present time engines have undergone a distinct change in design. One of the factors in this is the falling off in the quality of fuel. The engines of that time cannot burn the present grade of low-grade fuel to the same advantage as the engines of to-day which are designed to have the incoming vapor preheated to some extent.

Making a Racer Out of a Ford

Editor THE AUTOMOBILE:—I want to cut a Ford down to racer type. Do not care for speed of more than 50 miles, but as Pittsburgh is very hilly, must have power enough to climb hills on high. I realize by cutting the machine down it will cut the wind resistance and I figure on changing the gear ratio on high to 3 to 1.

Would the regular Ford engine give me power enough to take stiff hills on high with the gear ratio changed to 3 to 1, or would I have to install aluminum pistons to get additional power?

Pittsburgh, Pa. W. J. G.

—No doubt you would get more satisfactory results if you are looking for high speed with lighter pistons. As far as taking hills on high gear is concerned, it is doubtful if the lighter pistons will make any difference, as the effects of light pistons do not come in until the speeds are quite high. With a 3 to 1 gear ratio and a very light chassis, the Ford engine has a great amount of hill-climbing power.

Installing a Battery for Headlights

Editor THE AUTOMOBILE:—I want to make a change on the lighting system of my Ford car. At present I have a Prest-O-Lite, but my lamps are about shaken to pieces and I have a good pair of electric reflectors, a motor-driven signal and batteries are expensive and not very strong either unless I get about six of them. Taking everything into consideration, I think it would be better if I would trade for a storage battery. I can get a 120-amp. battery charged here for $1.25 and would like to know how many hours this capacity battery would burn three lamps, all consuming 6 amp. I have a house-lighting system handy, of 110 volts, alternating current (Keokuk), and I would like to know about what the cost would be to arrange it to charge my battery, also the instruments needed. My ideas are to have a light, one that is dust and mud-proof and handy.

Would it be necessary to install fuses and the method of placing on the lines, etc., for two headlights and tail lamps, also trouble lamp off and on socket to wire direct from battery, so as not to use all lights when using trouble lamps?

Please sketch a diagram of wiring and where to place fuses, if needed. Would it be a safe place to put the fuses behind the foot or heel board next to the gasoline tank and the switch directly in front—that is, on the front side?

Vandalia, Mo. J. R.

—Probably the best way to take care of your lighting and warning signal would be to install the battery as you suggest. A 120-amp. battery would only support three lamps which consume 6 amp. for a period of 6 2/3 hr., but there is no reason why you should use such large lamps as this. A 6-amp. lamp with a Tungstun filament would give about 36 candlelight power lights and you will find that these are ample and besides will only require about 1 amp. each in current. In fact, the tail light can be smaller than this.

It will not be necessary for you to install fuses, but simply to wire the lamps directly to the battery and switch. The same applies to installing the trouble lamp.

To secure an outfit that will enable you to charge your storage battery from 110-volt alternating current system, would be quite an expense, as it would be necessary to get a rectifier and also to fit up a large complicated switchboard. It would be better to get the small lamps and battery and to have the battery charged whenever it is exhausted.

If you are doing a very large amount of night driving you will probably secure greater satisfaction from the gas lamps, but for a small or medium amount of night driving the electric lights will be very convenient.

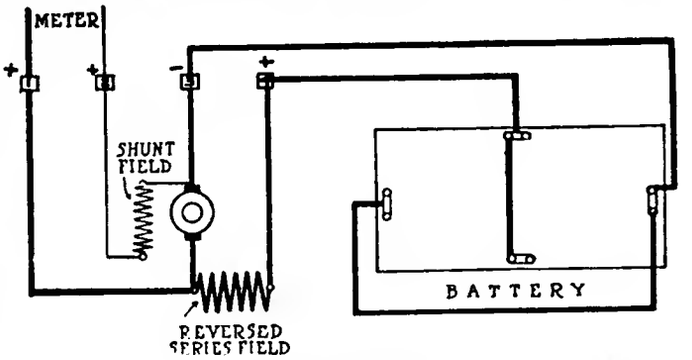
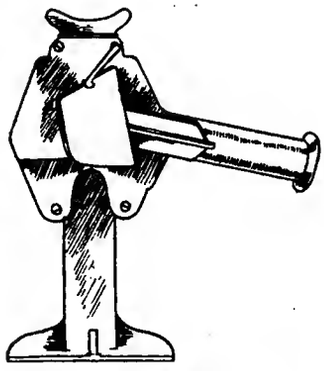


Fig. 1—Terminal connections in parallel for charging 12 cell storage battery

ACCESSORIES

U. S. Jacks

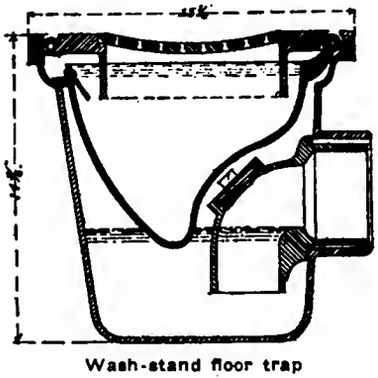
THERE are three styles of U. S. jacks. One is a tire-saver, made in two sizes, the smaller having an adjustment of 11 to 18½ in. for pleasure cars and the larger with an adjustment of 12 to 20 in. for heavy passenger cars or trucks. The lever is so arranged that when the jack is raised it is automatically locked. The unique No. 2 jack is a malleable iron design for heavy passenger cars, and has an adjustment of from 9½ to 17 in. It requires about 30 lb. pressure on the end of the handle to lift a heavy car. No rivets are used in its construction, and screw holes are provided so that it may be mounted on a large block of wood for stability. The unique No. 1 jack is similar in design to the tire-saver, and is recommended for cars weighing up to 2500 lb. It has an adjustment of from 9½ to 17 in.—U. S. Mfg. Co., Mansfield, Ohio.



United States jack

Wash-stand Floor Trap

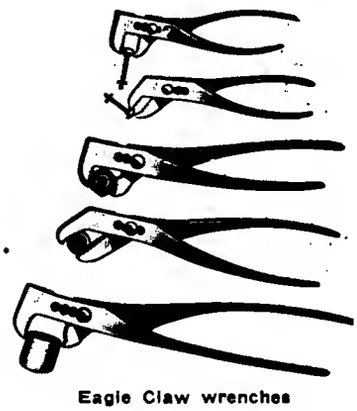
With the ordinary type of trap the sediment washed from the cars is certain to settle in it and gradually fill it up. In the Lynn trap this difficulty is overcome by providng a sediment cup into which the water drains directly from the floor. Most of the dirt remains in this cup and comparatively clean water overflows into the bottom of the trap and thence to the sewer. The cup, like the floor grating above it, is hinged, so that it is but a moment's work to empty the contents of the cup. No. 1 size has 3-in. outlet, No. 2 is similar but with polished brass top grate, No. 3 has twice the capacity of No. 1 and No. 4 is the same as No. 3 but with polished brass top grate and frame. Prices: No. 1, $15; No. 2, $50; No. 3, $30, and No. 4, $70.—Lynn Stall Co., Lynn, Mass.



Wash-stand floor trap

Combination Gasoline Lock

The device is operated from the dash or cowl board and consists of three disks revolving in a chamber and engage with each other in the same manner as the disks of a combination lock. Each disk is pierced by a hole. When the lock is open the holes of all three disks are in alignment and the gasoline flows through unobstructed. The disks are controlled by the numbered dials, but a single turn on the dial throws these holes in the disk out of alignment and positively locks the flow of gasoline. A great variety of numbers may be used, making combinations of either two or three figures, and the owner can set his lock to any desired combination in case of discharging a chauffeur. The combination lock may be opened in the dark by feeling the notches. Inside the device is a strainer and filter cup which prevents dirt from clogging the needle valve seat. The cup also serves in removing water from the gasoline and the impure grease may be periodically removed by unscrewing the cap at the bottom. The price is $3.50 for cars with cowl boards and $3 for straight dashboard equipment.—Turner Brass Works, Sycamore, Ill.



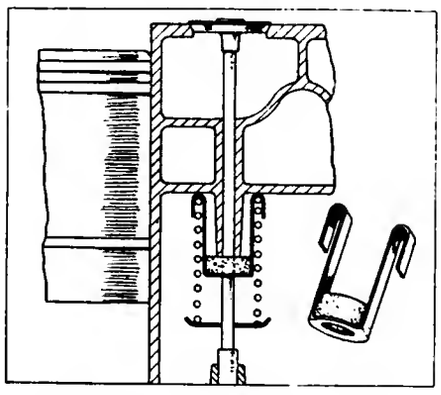
Eagle Claw wrenches

Eagle Claw Wrench

Several styles of Eagle Claw wrenches are made and are designed to handle all sizes and shapes of work. The different sizes are adjustable from zero to 2 in. Prices: 7 in., $7.20 per dozen; up to 13 in., $15 per dozen.—Mechanical Specialties Co., People's Gas Building, Chicago, Ill.

Apco Valve Packing

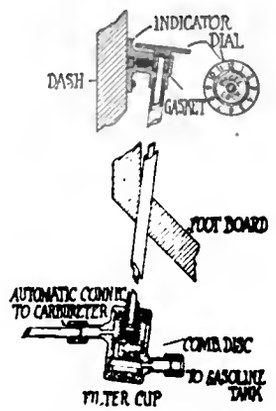
This is a simple device for Fords designed to prevent leakage through worn valve stem guides. It consists of a thick felt washer, which goes around the stem and is pressed closely to the guide by a fitting which is attached to the top of the valve spring. New felt washers should be put in every time the valves are ground. Price, 50 cents; felt washers, 12 cents per dozen.—Auto Parts Co., Providence, R. I.



Apco valve guide packing for Fords

Westinghouse Charging Outfit

This rectifier outfit consists of a transformer-reactance and Cooper-Hewitt rectifier bulb mounted on a cast-iron frame. The transformer is so arranged as to deliver, without the use of extra resistance or reactance coils, the gradually decreasing current best suited for battery charging. Terminals are provided for connecting the alternating-current lines and the battery circuits to the outfit. Fuses for overload protection are placed in both the alternating and direct-current circuits. A simple starting switch, the two link connectors, by means of which transformer connections are changed to suit any particular battery and line voltage within the limits of the outfit, are additional features. This outfit has been designed pri-



Combination gasoline lock

Icy-Hot motor restaurant

marily for the car owner who is not an electrical expert.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Icy-Hot Motor Restaurant

A motor restaurant at a more reasonable price than the wicker baskets used by many owners. The new models, made for parties of four or six, have cases of basswood, a material that shows very little tendency to warp. The box is 12 in. high, 15½ in. wide and 9½ in. deep. The color of the case is black, with a finish like patent leather, and impervious to water. The lining is in Bakst style.

It contains plates, knives, forks, napkins, cups, spoons and jelly jar and a large lunch box. The lower half has three divisions, two for vacuum bottles or jars and the other for fruit, crackers, cake, etc. There is a division above for an Icy-Hot jar or bottle, so that three vacuum containers can be carried. —Icy-Hot Bottle Co., Cincinnati, Ohio.

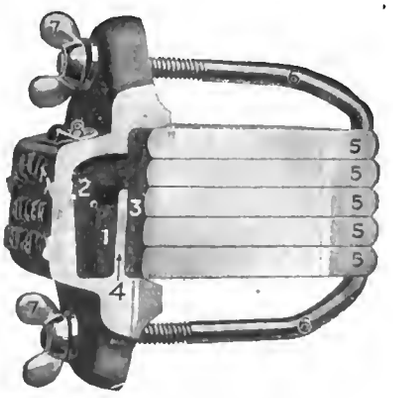
Babbitt Spring Oiler

This is a spring lubricator consisting of a felt whip housed in a metal casing and clamped to the side of the spring. Oil is supplied once a week. Price, $4.50 to $12 per set.—Babbitt Spring Oiler Co., Penn Building, Cleveland, Ohio.

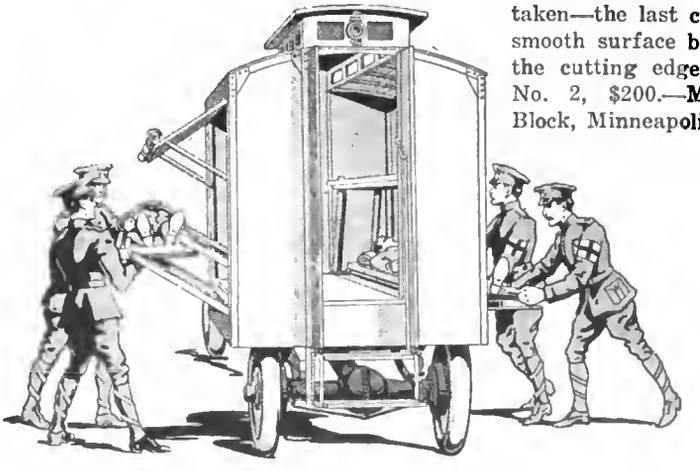
Blackmore Convertible Ambulance

This convertible ambulance body, with side loading feature, is adaptable to any chassis. The sides of the body swing out on pivots and cause trays that are built in combination with the sides to project beyond the body, and upon them stretchers are placed, after which the trays and stretchers are lifted in a horizontal position inside the ambulance. One stretcher may be placed slightly higher than the floor and another above it on the same side, while opposite them another tray may be utilized as a bench or other stretchers may be loaded, as the first two stretchers. These bodies are suitable for military use, hospitals and city police work.—Charles C. Blackmore, Dayton, Ohio.

Westinghouse charging outfit which consists of a transformer-reactance coil and a Cooper-Hewitt rectifier both mounted on a cast iron frame



Babbitt spring oiler



Left—Blackmore convertible ambulance body with side loading feature. It is adaptable to any chassis and is suitable for military, hospital and police work

Instant Back Curtain Light

This accessory consists of a frame designed to fit the back curtains of 70 per cent of all cars. The frame has flexible edges, to which the removable celluloid light is attached by snap fasteners. Price, $2.50. Auto Patent Equipment Co., 216 Post Square, Cincinnati, Ohio.

Universal Night Signal

This night signaling device consists of a blown flesh-colored celluloid hand which fits over a tubular flashlight equipped with a special reflector for the lamp. The Universal signal allows the same well-known method of signaling to be used at night as during the day. The hand may be detached and the flashlight used as a trouble lamp in the garage or on the road. It sells for $2.50. —Yankee Mfg. Co., Milwaukee, Wis.

Steer-Adius for Fords

The Steer-adius is a combination of two devices, one for preventing rattle in the front ball joint and the other for making steering easier. The former is a central radius rod running from ball joint to axle and is adjustable, while the latter consists of two heavy coiled springs fastened to this central rod and with connecting rods running to the tie rod extremities. The device may be attached in a few minutes. It lists at $2.50.—Modern Specialty Co., Racine, Wis.

Perma-Tite Tire Patch

This is a tube and tire patching outfit for all sizes of repairs. The patch is applied cold, a thin coat of the cement being applied and the patch put in place. Permanent vulcanization is said to take place, due to the heat and air pressure of the moving tire. Price, $1.75.—Motor Supplies Mfg. Co., 21 Fifth Street, N. E., Minneapolis, Minn.

Cylinder Reboring Tool

This is a simple, compact tool designed especially for reboring cylinders. It is belt-driven and is provided with three cutting heads, so that three cuts can be taken—the last cut is said to produce a smooth surface because of the width of the cutting edge. Price, No. 1, $175; No. 2, $200.—Machinery Co., Boston Block, Minneapolis, Minn.

THE AUTOMOBILE

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Tractor Trial Wanted

THE automobile arrived at its present stage of development as rapidly as it did largely because of the practice of organizing trials to destruction. Something much the same is now needed if the pace of progress in tractor engineering is to be accelerated to a maximum.

The best way to test a machine is to pit it against the hardest possible task and to increase the severity of the conditions till something breaks. Thus step by step the weak spots are found and can be eliminated. A thousand miles' trial 10 years ago showed more about the weak spots in automobile chassis than would have been discovered in 2 years of normal service.

A properly arranged tractor trial or series of trials held now would settle some of the vexed questions of design outright, questions that will make years to settle if service in the user's hands is to be the only criterion.

The three main needs of a tractor are:

1—Power sufficient to meet all conditions.

2—Efficiency to prevent waste of power.

3—Reliability to prevent delays and expense.

Tractor engineers are not yet satisfied on any of these counts. The proper power is not known, or is not agreed upon. The efficiency of the transmission, the fuel efficiency and the oil efficiencies are admittedly capable of improvement. The most frequent causes of trouble, defeating reliability, are only known machine by machine and not generally.

A competitive trial is the best way to answer the multitudes of questions into which these three main heads can be divided. Not a competitive trial arranged for advertising purposes, a trial intended to show how fine and grand everything is, but a trial to the breakdown point, a trial so drawn that weakness cannot fail to be discovered.

Just to indicate roughly the sort of lines along which a tractor test ought to be arranged, mention may be made of a few of the main things that should be included.

First, make a horsepower test at the flywheel and a drawbar horsepower test, both at full power.

Second, have a long field trial, say 12 hours' plowing at full load.

Third, repeat the flywheel and drawbar power tests to see if there is any falling off in power or efficiency.

Fourth, throughout the fuel and oil consumed should be measured and the number of stops and the reasons for them noted.

Fifth, the time taken in cleaning and oiling vital parts should be observed competitively.

Sixth, ease of control should be a factor in the awards.

Seventh, something should be devised that would show up the advantages of accessibility and of proper inclosure of working parts.

Eighth, protection against weather should be tested in some way and the facilities for replacing such parts as are bound to wear out. For example, where a ring gear is used on the driving wheel, part of the test should be the removal and replacement of the pinions on the driveshafts, against the watch.

At the present stage there should be no need to classify machines. It is just a matter of work done against cost of doing that work; of work done against wear and tear in the doing of it. One trial of a day's duration is, of course, not sufficient or anything like sufficient; a series is needed testing first one sort of service and then another. For example, we have dry weather good for plowing and wet weather good for a hauling test on the road. Everything that the tractor can legitimately be asked to do wants to be done competitively and in a big way.

Mathematical Cycles

IT has now been convincingly proved—by mathematics—that the constant pressure cycle is and is not the answer to many of the constant volume problems. The formulæ of thermo-dynamics have been called upon to advantage by both sides in the argument, and it seems now that the only remaining thing to do is for some of the firm believers in the future of the constant-pressure cycle to step forth with a manufactured engine and let all interested parties see it perform its work efficiently or inefficiently, as the case may be. Mathematical arguments and even blueprints of suggested engines will never tell the story.

Rio Brazil's Business Center

U. S. A. Car and Accessory Makers Should Establish Headquarters in That City

WASHINGTON, D. C., Aug. 28—"If you are contemplating establishing your car or accessory business in Brazil you should establish such headquarters in the city of Rio de Janeiro." This advice is contained in a recent consular letter from the consul-general at Rio. "While Rio may to-day not be so good a market for U. S. A. cars or accessories as the city of Sao Paulo, and while Rio is situated in a federal district surrounded by mountains so that you cannot tour 50 miles to the summer capital, yet Rio is the correct place for Brazilian headquarters of any U. S. A. firm. The reason is simple.

"Brazil is an assemblage of twenty-one states, each of which has a remarkable degree of autonomy, and the capital city of Rio is located in a federal district, just like Washington in the District of Columbia. Articles Nos. 7 and 9 of the Brazilian constitution provide that the Federal Government enjoys the duties from customs and other duties on all imports.

"The duties which may be levied and collected on all exports are the properties of the individual states in which the factories are located, and each of the twenty-one states has its own export tax and can change these taxes to suit its pleasure.

No Export Duty

"It is this export tax situation that makes it infinitely more important for a foreign corporation or manufacturer to establish headquarters in Rio as compared with Sao Paulo or any other Brazilian city. Rio levies no export duty on parts shipped to any of the Brazilian states or to any foreign countries. Thus by establishing headquarters in Rio you can ship to any and all of the twenty-one Brazilian states without fear of an export tax, and you can ship to any of the other South American countries if desired.

"There is a further advantage in establishing headquarters in Rio. The city of Rio de Janeiro occupies practically a monopoly in the distribution of merchandise throughout Brazil. This distribution is chiefly by means of the government-owned railways, the Central Railway of Brazil, which connects the federal capital with the interior, and also by the many coastwise steamers of the Lloyd-Brasileiro Steamship Co., also a government-owned system. This company also has a line of ships running between the U. S. A. and Brazil.

"Further, the importance of Rio as a distributing center for Brazil is shown by the fact that thousands of merchants from the different states visit Rio annually. Rio is the political as well as the mercantile center of the country.

"The American salesman who comes here with a motor car whose merits he is prepared to demonstrate asks, first of all, for an operating license. He is naturally inclined to think that this is due him as a right. Unfortunately, the local law makes no provision for temporary operating licenses, and what he considers as no more than his due must be asked for, as a 'special privilege to a foreign firm,' by the consulate-general. Brazil does not have two forms of licenses, one for the owner or demonstrator of a car and another for the professional chauffeur; nor is an applicant immediately granted an operator's license without examination.

"Once he has obtained a special license the salesman must be prepared to show it on all occasions, and perhaps to submit to a little curious inquiry of a purely personal nature on the part of some good-natured policeman with a thirst for knowledge as to the enterprising methods of foreign firms. The license is not based upon the horsepower of the car, and it is not valid after one has crossed a state boundary. It is to be hoped that within a short time certain ordinances may be passed in Brazil which may alleviate most of the difficulties now encountered in that country.

"There is no class of salesmen who should more carefully remember the requirement of the Brazilian customs laws regarding samples than automobile salesmen. A salesman who has with him cars for demonstrating purposes should remember that he cannot have them enter the country in bond without, before his departure from the United States, obtaining a Brazilian consular invoice declaring them to be samples."

—

1000 Per Cent Increase in Springfield Body Orders

SPRINGFIELD, MASS., Aug. 26—A 1000 per cent increase in orders during the last 12 months has been made by the Springfield Body Co., this city. Those companies which have adopted the Springfield body as standard equipment include: Abbott-Detroit; Cadillac; Cole; Davis; Haynes; Interstate; Marmon; Mitchell; Oldsmobile; Overland; Paige-Detroit; H. A. L.; Reo; Stearns; Studebaker; Velie; Westcott and Winton.

—

Peerless to Build Addition

CLEVELAND, OHIO, Aug. 26—The Peerless Motor & Truck Co. will build an addition to take care of the European order for trucks recently received.

Bearings Service Co. Organized

Will Take Over Timken, Hyatt and New Departure Service Work

DETROIT, MICH., Aug. 26—The Bearings Service Co. has been organized here to handle the service for anti-friction bearings for all types of motor vehicles, and already has contracted with Timken, Hyatt and New Departure to conduct the service operations for these three large bearing manufacturers. The Bearings Service Co. in reality takes over the service operations of these three, and the idea is similar to that of the union railway station, where competing lines enter a city. Instead of a station for each railway, one station takes care of all.

It is pointed out that the Bearings Service Co. is entirely separate from the companies whose product it will care for, and it is interesting to note that the automobile business, which means progress, has taken the initiative in this new industrial move—a union of competitors so that their service to the public may be more far-reaching and effective.

Branches with Complete Stocks

The Hyatt company has service branches in the principal automobile centers, and Timken also has several such branches, but these will all be taken over by the new company, and it is stated that when, in the fore part of September, the Bearings Service Co. begins active operations a union station will be opened in each of nine separate cities. All will carry complete stocks of all of the bearings manufactured by the companies above mentioned.

It is the plan to eventually establish union stations in fifty or more automobile cities, thereby placing this service within reach of most motorists.

The general offices of the new concern are located here. No details as to the men back of the new venture are divulged at this time. It may be said, however, that it is amply financed.

—

Dann to Make Self-Oiling Bearing Material in New Plant

CLEVELAND, OHIO, Aug. 28—The Dann Products Co., Chicago, Ill., maker of the Dann spring insert for lubrication purposes, will build a plant in this city in which it will also make a combination of graphite and metal for bearings which, it is claimed, will not require lubrication. Three acres costing about $17,500 have been bought in East 152nd Street, adjoining the new plant of the Jordan Motor Car Co. The Dann plant will cost upward of $100,000.

Alliance Tire Co. To Expand

Capital Increased from $150,000 to $650,000—200% Larger Output Planned

ALLIANCE, OHIO, Aug. 28—An increase of $500,000 in capital stock from $150,000 and a 200 per cent increase in the output of the Alliance Tire Co. has been voted by its stockholders.

In order to accomplish this, a new company, known as the Alliance Tire & Rubber Co., will be formed, securities in which will be marketed to the general public. The stockholders will take the preferred stock of the new company at par for their present holdings and a 20 per cent stock dividend, payable in common stock of the new company.

The additional capital will be used for the enlargement of the factory, the installation of additional mills, calenders and vulcanizers. A three-story structure closely resembling the original plant, to be built immediately adjoining the present plant, is under consideration.

Cutting, Armstrong & Smith Seek Site for Plant Addition

ROCKFORD, ILL., Aug. 26—Representatives of the Cutting, Armstrong & Smith Products Co., Detroit, Mich. were here this week, looking for a site for a proposed addition to their $3,000,000 automobile engine plant. Other cities of Illinois and the Middle West will be visited before a location is selected. Motors and axles are manufactured. The proposed branch plant will have a capacity of turning out 100 motors per day at the outset.

Sewell Cushion Wheel Co. Adds

DETROIT, MICH., Aug. 28—To care for growth of its cushion wheel business, the Sewell Cushion Wheel Co., maker of a special form of truck wheel with a shock-absorbing rubber portion, has started building operations on an extensive addition to its present plant here. The new building will be of re-inforced concrete and three stories high with dimensions of 70 by 74 ft. If present increase of business continues, the Sewell concern, it is stated, will tear down the old building after the addition is completed, erecting eventually a five-story re-enforced concrete structure by adding two stories to the new part and building five new stories replacing the old part.

$250,000 Plant for Sterns Tire

ST. LOUIS, MO., Aug. 28—The Sterns Tire & Tube Co., a subsidiary of the Efficiency Oil Corp., will build a four-story plant here costing $250,000. The structure, which will have a capacity of 1600 casings and 3200 inner tubes daily, will be 120 by 200 ft., and the site is at Kienlin Avenue and Terminal tracks.

The product will be known as Sternwear and the tubes will be sold under a guarantee of 20,000 miles of service without puncture, blowout, or rimcutting.

Mr. Sterns has closed a deal with Henry Matthews, Trenton, Ont., whereby the latter obtained the manufacturing and selling rights of Sternwear tubes and casings in Canada. Mr. Sterns says the consideration was in the neighborhood of $500,000. Mr. Matthews has organized the Sterns Tire & Tube Co. of Canada, and has begun work on a large plant at Trenton.

Koehler Absorbs Factor

NEWARK, N. J., Aug. 25.—The H. J. Koehler Motors Corp. has been formed here with a paid-in capital of $425,000 to succeed the H. J. Koehler S. G. Co. and the L. E. Schlotterback Mfg. Co. The Schlotterback company was the factor for the Koehler company, which designed and sold the Koehler 1-ton truck. The combination is for the purpose of increasing production.

H. J. Koehler remains the president of the new concern and the product and its price, $895, are unchanged. Mr. Koehler formerly handled the Ford, E. M. F., Buick, Hupmobile and Grant, introducing each of these into the Eastern territory.

Cleveland Makers Using Tents

CLEVELAND, OHIO, Aug. 26—Tents are being erected by several of the local automobile makers to take care of the heavy business this season. The tents are being used for storage and assembling. Among those using them are White, Winton, Jordon and the Baker-Rauch & Lang Co.

Locomobile Lamps Do Not Infringe Massachusetts Regulations

BOSTON, MASS., Aug. 28—Locomobile lamps do not infringe the regulations of the Massachusetts Highway Commission, according to a decision in a test case, just handed down.

Willis Is U. S. Rubber Purchasing Agent

NEW YORK CITY, Aug. 25—R. S. Willis has succeeded C. A. Emerson as purchasing agent of the United States Rubber Co. Mr. Emerson is retiring after 29 years' work with this company.

Tread of the Pennsylvania Bar Circle tire

Acme Truck Doubles Capital

Increase from $100,000 to $200,000—Plant and Output To Be Expanded

CADILLAC, MICH., Aug. 24—The Cadillac Auto Truck Co., this city, maker of the Acme truck, has voted to increase its stock from $100,000 to $200,000. One-half of the new stock will be sold in the near future and the shares, having a par value of $10, will sell for $11.50. No date has been set for the sale of the remaining $50,000 of new stock.

The company will soon start the construction of a new building, which will be 200 by 65 ft. Production is to be increased during the coming year and an other model, a larger truck, is to be added to the company's line.

Firestone to Add

AKRON, OHIO, Aug. 25—The Firestone Tire & Rubber Co., this city, has taken out permits for two buildings, aggregating in cost $105,000. The largest building will be five stories in height and will cost $70,000. This will be used for mechanical devices. The other building will cost $35,000 and will be an addition to factory No. 6.

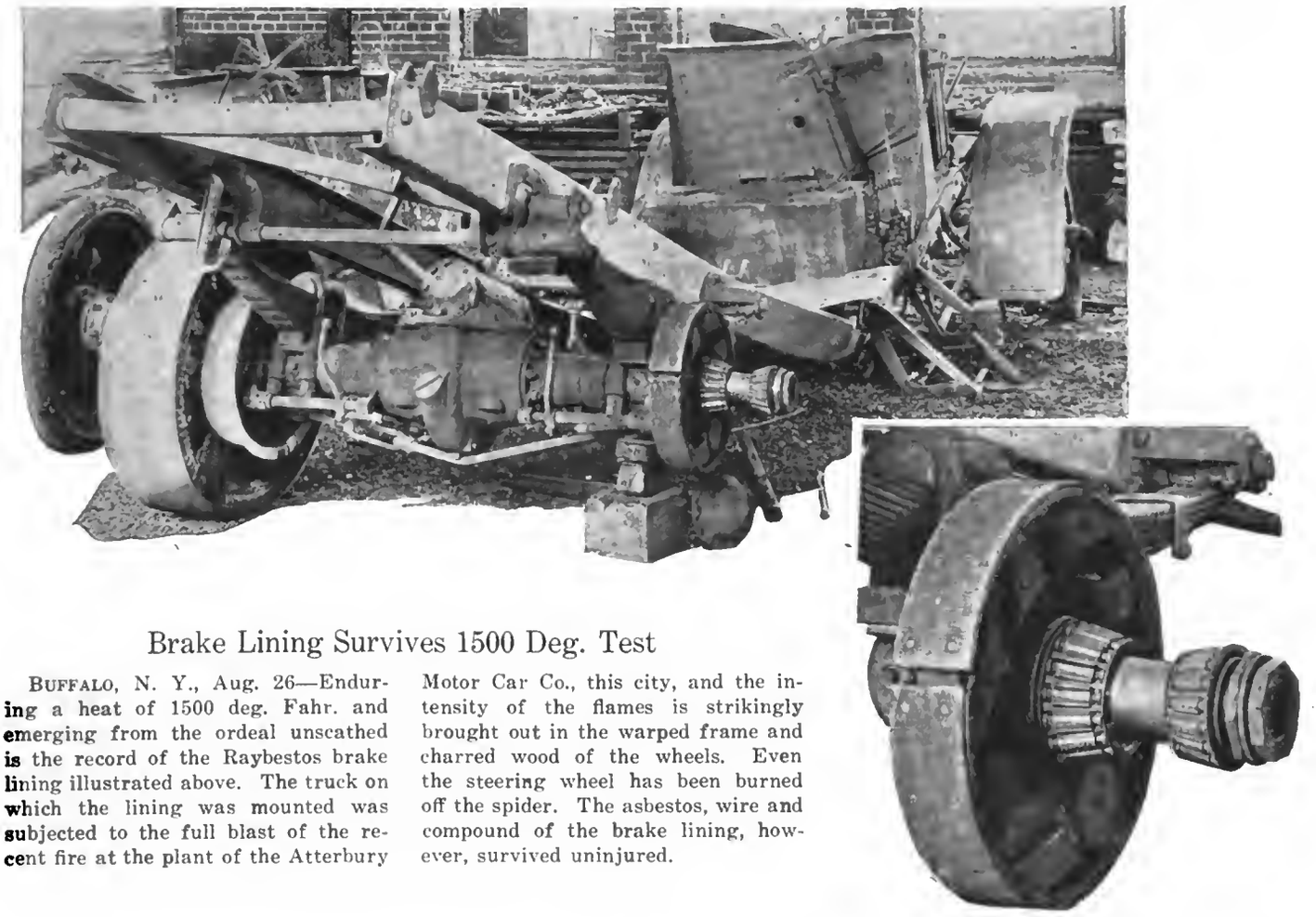
Miller Introduces Adona Tread for Repairing Worn Tires

AKRON, OHIO, Aug. 28—The Adona tread, which is stitched to an old tire carcass much as new soles are sewed to old shoes, has been brought out by the Miller Rubber Co., Akron, Ohio. The new tread consists of a complete new tread, containing fabric, cushion and breaker strip and, unlike retread bands, can be applied to a tire which has been worn down until the daylight shows through, provided the side-walls and bead are in good shape. In fact, it is practically a complete new casing, but without side-walls or beads. Although made with the Miller Geared-to-the-Road tread, these treads may be applied to any other make of tire.

Pennsylvania Has New Tread

JEANNETTE, PA., Aug. 28—The Pennsylvania Rubber Co., this city, has brought out a new tire with a tread of tough black rubber. The design, as indicated by the name Bar Circle, is a combination of heavy bars and circles. A 3500-mile guarantee is given.

The prices of these new tires have been figured on a basis of cost of production plus a modest margin of profit. The 30 by 3 in. is selling at $10.35 and the 30 by 3½ in. at $13.45, both considerably lower than on the Vacuum Cup and Ebony Tread types.



Brake Lining Survives 1500 Deg. Test

BUFFALO, N. Y., Aug. 26—Enduring a heat of 1500 deg. Fahr. and emerging from the ordeal unscathed is the record of the Raybestos brake lining illustrated above. The truck on which the lining was mounted was subjected to the full blast of the recent fire at the plant of the Atterbury Motor Car Co., this city, and the intensity of the flames is strikingly brought out in the warped frame and charred wood of the wheels. Even the steering wheel has been burned off the spider. The asbestos, wire and compound of the brake lining, however, survived uninjured.

Erbes To Concentrate in St. Paul

Waterloo Plant To Be Established in Duesenberg Factory

ST. PAUL, MINN., Aug. 26—L. C. Erbes, owner of the former Duesenberg Bros. plant in this city, is planning to remove to St. Paul the automobile plant he owns at Waterloo, Iowa, and to establish it in the Duesenberg factory.

Mr. Erbes will build automobiles in this plant, and as a result a $75,000 addition will be erected to accommodate from 100 to 150 workmen.

Some time ago Mr. Erbes bought up the Clarke-Carter Automobile Co. and the Cutting Car Co., and has been continuing manufacturing these machines at Waterloo, along with a car bearing his name. He plans to combine these under the name L-C-E, and to manufacture parts for all three cars.

—

Columbus Gear Co. Busy

COLUMBUS, OHIO, Aug. 25—J. W. Graham, vice-president and general manager of the C. A. S. Products Co., formerly the Foster Gear Co., has returned from Indianapolis, where he received a contract for 10,000 gears. Under the direction of Mr. Graham the plant has been placed upon an efficiency basis and the number of employees increased to 130, with a weekly pay-roll in the shop of over $2,000. Orders now on the books of the company will take the increased output of the plant from now until July 1.

—

Teetor-Hartley Doubles Capacity

HAGERSTOWN, IND., Aug. 24—The Teetor-Hartley Motor Co. is doubling its factory capacity at an expense of approximately $22,000. An additional 8640 sq. ft. of floor surface will be completed by Oct. 1 at a cost of $12,000 and machinery to the value of $10,000 will be immediately installed. Fifty more men will be added to the payroll.

—

Stephens Plant at Full Capacity

FREEPORT, ILL., Aug. 26—Orders were issued this week to the various departments of the Stephens Motor branch of the Moline Plow Co., to operate the plant to the fullest capacity. This will enable the company to market fifty to sixty cars a week. A marked shortage of experienced mechanics has affected the output, but the present force will be increased as rapidly as possible. Material is being ordered for next year when it is hoped to turn out several thousand cars.

Bela Body Company Buys Factory

Takes Over Standard Woven Fabric Co. Framingham Plant

FRAMINGHAM, MASS., Aug. 28.—The Standard Woven Fabric Co., which recently moved to Walpole, has sold its plant at Framingham and it is to be occupied by the Bela Body Co., of Amesbury, who will operate the whole property for the production of automobile bodies. The main building is of modern concrete construction, 53 by 224, three stories, having about 40,000 ft. of manufacturing space, and an attached fireproof boiler house, all equipped with sprinkler system and other modern conveniences. There is 108,720 ft. of land bordering on the railroad. Town assessment places $43,550 on the building and $7,570 on the land, making a total of $51,120.

—

Jordan Builds Five Cars a Day

CLEVELAND, OHIO, Aug. 26—Since Aug. 1 the Jordon Motor Car Co. has been producing five cars a day and it is expected that the maximum for this season, ten a day, will be reached early in September. The company has erected a

huge tent adjoining its new factory in order to extend its inspection facilities.

While 2600 dealer applications were received from the first advertisements of this company in THE AUTOMOBILE, *Motor Age* and *Motor World*, only 100 will be appointed for the present.

The Jordon Building Co. has taken formal title to the new plant of the Jordon Motor Car Co. from the Citizens' Savings & Trust Co., the indicated consideration being $75,000.

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Metropolitan Motors, Inc., Organized

NEW YORK CITY, Aug. 26—The Metropolitan Motors, Inc., has been established with a capital of $1,000,000 to manufacture a light delivery vehicle and to take over the business of the White Star Motor & Engineering Co. W. C. Mack, one of the Mack brothers who started the Mack truck, is the moving spirit in the new venture, and it is said to be his survey of present market conditions that impelled the concern to undertake the production of a ½-tonner at a price which will be about $695.

To Continue White Star

The White Star trucks of 2, 3 and 5 tons' capacity will be continued. The stock in the new concern is all common. Production is expected to start between Oct. 1 and 15.

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Dividends Declared

Linde Air Products Co.; 1½ per cent on preferred, payable Oct. 2 and 2 per cent on common, payable Sept. 30, both to holders of record Sept. 20.

Kelly-Springfield Tire Co.; quarterly of 1½ per cent on 6 per cent preferred, payable Oct. 2 to stock of record Sept. 15.

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Redden Increases Capital to $500,000

DETROIT, MICH., Aug. 28—The Redden Motor Truck Co., producing the Redden truck maker, has increased its capital to $500,000 to take care of factory increases.

Rittman Gasoline 6.9 Cents per Gal.

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Twenty Plants in Operation Indicate that Process Is Commercially Practical

WASHINGTON, D. C., Aug. 28—"It costs anywhere from 6.9 to 12.8 cents per gal. to make a gallon of gasoline by the Rittman process. The variation is due to the range of fuel-oil prices between 50 cents and $2.10 per barrel." This is an excerpt taken from a letter by Director Manning of the Bureau of Mines. Up to May 26, there were twenty factories licensed to use the Rittman process and the data is obtained from such of these that have actually been in operation. Summing up the results of the experiments thus far, Director Manning states:

Cost of Plants

"The capacity of a single tube was 1.55 per hr., or 37.2 bbl. per 24 hr., the loss 10 per cent, with a yield of 22 per cent gasoline, the balance being fuel oil. Estimated cost of a five-tube plant, $15,000. Estimated cost of building to house plant, $5,000. Total cost, $20,000. Monthly capacity, 5580 bbl. Deducting 10 per cent for shut-downs, leaves net capacity slightly more than 5000 bbl. Assuming yield of gasoline at 20 instead of 22 per cent, gives 1000 bbl. (42,000 gal.). Loss of 10 per cent equals 500 bbl. Residuum, 70 per cent or 3500 bbl.

Expense, 5000 bbl. fuel oil at $2.10 per bbl, $10,500; labor for one month, six men, $560; fuel, $200; electricity, $100; repairs, $100; 6 per cent interest charge and 6 per cent depreciation on first cost, $200; refining cost at 20 cents per bbl. (Oklahoma refining cost), $1,000; total expense, $12,660. Credit, 3500 bbl. residuum at $2.10, $7,350; net cost of 1000 bbl. (42,000 gal. gasoline, $5,310; cost of gasoline, 12.64 cents per gal.

Estimate based on oil at 50 cents a bbl.:

Expense, 5000 bbl. oil at 50 cents per bbl., $2,500; labor, $560; fuel, $200; electricity, $100; repairs, $100; 6 per cent interest charge and 6 per cent depreciation, $200; refining cost (Oklahoma refining cost) at 20 cents per bbl., $1,000; total expense, $4,660. Credit 3500 bbl. residuum at 50 cents, $1,750; cost of 1000 bbl. (42,000 gal.) of gasoline, $2,910; cost of gasoline, 6.9 cents per gal.

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Gasoline Prices Stable

NEW YORK CITY, Aug. 29—Gasoline prices throughout the country remained, for the most part, unchanged last week. Wholesale prices in this section were stable, though the consumers were paying from 23 to 26 cents per gallon. Gasoline in New York, Long Island, Westchester and Connecticut is being sold by the Standard Oil Co. at 23 cents wholesale. In New Jersey the price is 21 cents. Retail prices there range from 23 to 25 cents per gallon. Texas and Gulf Refining prices remain the same as last week. Texas prices in this territory are 23 cents wholesale and 21 cents in New Jersey. Gulf Refining gasoline is selling wholesale in this territory at 23 cents and in New Jersey at 22 cents per gallon.

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Copper Raised to 28 Cents a Lb.

NEW YORK CITY, Aug. 29—Steadiness marked the quotations on automobile materials last week. Though a few of the metals and oils made changes in prices, there was nothing unusual to change the general routine of the market activities.

Copper sellers and producers are now asking 28 cents a pound for November and December delivery. One large agency is out of the market entirely for all copper before December, stating that it is only receiving inquiries for December or January metal. The copper market is very strong and there is no indication of any let up in demand.

Aluminum 58 Cents per Pound

Aluminum has again reached 58 cents a pound. A report from Milwaukee states that the shortage of pig and sheet aluminum supplies has forced several manufacturers of aluminum goods in Wisconsin to close down temporarily. Stocks are coming very slowly and little is to be had at any price, it is said.

Reports from Pittsburgh claim that the automobile makers are now featuring the steel market there with requests to be permitted to close for their steel requirements over the first half of 1917. The steel makers have refused to consider 1917 steel for the automobile makers before Oct. 1. They are in the market for black sheets, and it is estimated that 1,000,000 tons will be asked by the leading makers.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.57	.57	.58	.58	.58	.58	+ .01
Antimony, lb.	.13½	.13½	.13½	.13½	.13½	.13½	...
Beams and Channels, 100 lb.	2.77	2.77	2.77	2.77	2.77	2.77	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.27	.28	.28	.28	.28	.28	+ .01
Copper, Lake, lb.	.27	.28	.28	.28	.28	.28	+ .01
Cottonseed Oil, bbl.	9.06	9.06	9.07	9.40	9.26	9.25	...
Fish Oil, Menhaden, Brown, gal.	.55	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl.	.23	.23	.23	.23	.23	.23	...
Lard Oil, prime, gal.	1.10	1.10	1.10	1.10	1.10	1.05	— .05
Lead, 100 lb.	6.72½	6.70	6.70	6.70	6.70	6.70	— .02½
Linseed Oil, gal.	.72	.72	.72	.72	.72	.72	...
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.95	.95	.95	.95	.90	.90	— .05
Petroleum, bbl., Pa., crude	2.30	2.30	2.30	2.30	2.30	2.30	...
Rapeseed Oil, refined, gal.	.90	.90	.90	.90	.90	.90	...
Rubber, Fine Up-River, Para	.68	.68½	.68½	.68½	.68½	.68½	+ .00½
Rubber, Ceylon, First Latex	.58½	.57½	.57½	.57½	.57½	.57½	— .01
Sulphuric Acid, 60 Baume, gal.	2.50	2.50	2.50	2.50	2.50	2.50	...
Tin, 100 lb.	38.50	...	38.63	38.63	38.63	39.25	+ .75
Tire Scrap, lb.	.05⅜	.05⅜	.05⅜	.05⅜	.05⅜	.05⅜	...

Firestone Features Securities

1000 Mark Reached in a Gain of 65 Points—A Record High Price

NEW YORK CITY, Aug. 30—The automobile and accessory issues were lower and listless last week. Most of the prices were considerably lower than the previous week, especially on the Stock Exchange. The issues traded on the Curb were quiet at the beginning of the week, but have since picked up and have managed to make their losses smaller.

In marked contrast are the reports from the Cleveland Exchange, where most of the tire issues are traded in. Firestone common sold yesterday at $1,000 a share and established a landmark. That is the highest price at which a rubber stock ever sold in northern Ohio, and probably in the world. The market appreciation of the stock is indicated by comparison with the following figures in former years: In 1914 the high was 305½ and the low 247½; in 1912 the figures were 326 and 200½; and in 1910 127½ and 105.

Outside of the old Standard Oil, still traded here in the East, few issues have achieved Firestone's mark. There is a possibility of a readjustment of capital.

The rest of the tire issues were also strong and in large demand. Goodyear common reached 240, a gain of 5 points. Both the common and preferred of the Portage company rose 20 points.

Two more companies were added to the large list on the securities market, Republic Truck and Fisher Body both being introduced to the public. Two thousand shares of the latter stock were traded in at prices running from $38 to $38½. Republic Truck sold yesterday at 55.

Several of the Curb issues were the objects of aggressive professional selling yesterday and declined as a result. United Motors declined in the early dealings from 62¼ to as low as 60⅛, recovering to 60½. Chevrolet shared this weakness to some extent, selling from as high as 198 to as low as 193½ and closing at 197.

Chalmers, General Motors, Maxwell, Overland, and Studebaker were weak.

McClurg to Reorganize

COSHOCTON, OHIO, Aug. 25—Prior to a reorganization of the McClurg Tire & Rubber Co., a receivership has been asked by J. S. McClurg, L. C. McCurday and Dr. Jesse McClain. The plaintiffs are sureties on notes aggregating $17,500.

Gets 105 Counties in Texas

DALLAS, TEX., Aug. 25—The S. G. Davis Motor Car Co., Dallas, has been organized to control the sales and service departments of the Oldsmobile company in 105 counties of Texas.

$6,000,000 Capital for Pa. Rubber

Increase of $4,000,000 as Co. Is Reincorporated Under N. Y. Laws

NEW YORK CITY, Aug. 28—The Pennsylvania Rubber Co., Jeannette, Pa., has been reincorporated under New York laws as the Pennsylvania Rubber Co., with $6,000,000 capital. The previous capital was $2,000,000, divided into $1,000,000 common, $750,000 of which is outstanding, and $1,000,000 preferred, all outstanding. The incorporators of the new company are: H. W. DuPuy and S. G. Lewis of Jeannette and G. A. McLaughlin, this city.

Rush Motor Truck Co. Formed

PHILADELPHIA, PA., Aug. 26—The Rush Motor Truck Co., of Philadelphia, was recently incorporated for $500,000, to manufacture motor trucks and automobiles. The incorporators are Charles L. Guerin, J. D. Morelli and Emanuel Nageli, Jr.

Dile Motor Co. Petitioned

READING, PA., Aug. 28—A receiver has been asked for the Dile Motor Co., this city, The petitioner declares that the company's liabilities amount to about $15,000, while its assets are about $10,000.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
American Motors (or as named)	..	..	..	..	..
Ajax Rubber Co. (new)	..	..	64	66	— ⅞
J. I. Case pfd	70	80	82	85	—2
Chalmers Motor Co. com	90½	92	150	170	—20
Chalmers Motor Co. pfd	95	97	98	103	—1
*Chandler Motor Car Co	..	..	103	105	—1
Chevrolet Motor Co	..	..	197	202	—1
Fisher Body Corp	..	..	39¾	40	..
Fisk Rubber Co. com	..	..	..	150	..
Fisk Rubber Co. 1st pfd	..	..	..	..	..
Fisk Rubber Co. 2d pfd	..	..	..	..	..
Firestone Tire & Rubber Co. com	525	530	1000	..	+65
Firestone Tire & Rubber Co. pfd	111	..	112	113	..
*General Motors Co. com	219	220½	525	575	—35
*General Motors Co. pfd	109½	110½	121⅝	122	— ⅜
*B. F. Goodrich com	62	63	71¾	72¼	— ½
*B. F. Goodrich pfd	106	108	113⅛	113¾	— ⅜
Goodyear Tire & Rubber com	270	274	240	245	+5
Goodyear Tire & Rubber pfd	108½	110	106¾	107½	+ ½
Grant Motor Car Co	..	..	7	8	+ ½
Hupp Motor com	..	..	6½	7	..
Hupp Motor pfd	..	..	80	100	..
International Motor Co. com	28	30	6	10	..
International Motor Co. pfd	59	60	15	20	..
*Kelly-Springfield Tire & Rubber com.	185	190	73¾	74¼	+1½
*Kelly-Springfield Tire & Rub. 1st pfd.	85	87	95	97	—1
*Lee Rubber & Tire Corp	..	..	44	45	—1½
*Maxwell Motor Co. com	42	43¼	82½	83	—1⅝
*Maxwell Motor Co. 1st pfd	90	92	85	86¾	..
*Maxwell Motor Co. 2d pfd	35	37	54¾	57	—2¼
Miller Rubber Co. com	190	194	220	226	..
Miller Rubber Co. pfd	107½	..	105	106	..
Mitchell Motors	..	..	66	67	+1
Packard Motor Car Co. com	117	..	165	172	—5
Packard Motor Car Co. pfd	100	..	100	104	+1
Paige-Detroit Motor Car	..	..	46	50	..
Peerless Truck & Motor Corp	..	..	24½	25	—1
Perlman Rim Corp	..	..	..	..	..
Portage Rubber Co.. com	46	48	150	152	+20
Portage Rubber Co. pfd	93	94	150	152	+20
Regal Motor Co. pfd	..	..	17	22	..
Reo Motor Truck Co	17	18¾	36	37	+1
Reo Motor Car Co	33	34½	43¼	44	+ ¾
Republic Motor Truck	..	..	55	56	..
Saxon Motor Car Co	..	..	72	73	—5
Springfield Body	..	..	84¾	85	+3⅝
Standard Motor Co	..	..	6½	7½	+ ½
Stewart-Warner Specd. com	65	66	117	120	+13¼
Stewart-Warner Speed. pfd	105	107	..	..	..
Stromberg Carbureter	..	..	42¼	42½	—2
*Studebaker Corp. com	111½	112½	125¼	125¾	—4½
*Studebaker Corp. pfd	103	105	107½	110½	—1½
Stutz Motor	..	..	65	65½	..
Swinebart Tire & Rubber Co	88	90	95	100	..
United Motor Corp	..	..	60½	61	—3½
*U. S. Rubber Co. com	49	51	56½	57	—1¼
*U. S. Rubber Co. pfd	103	105	111⅛	112	+ ⅞
White Motor Co. (new)	..	..	53⅜	54	— ⅛
*Willys-Overland Co. com	182	184	46	46¼	—9
*Willys-Overland Co. pfd	106	106¾	104½	105	+ ½

*At close Aug. 28, 1916. Listed New York Stock Exchange.

Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co	..	..	36¾	38½	..
Chalmers Motor Co. com	89½	..	..	165	..
Chalmers Motor Co. pfd	95	97	..	103	..
Continental Motor Co. com	..	300	35½	36½	..
Continental Motor Co. pfd	83	87	9½	10½	..
Ford Motor Co. of Canada	..	1525	320	340	..
General Motors Co. com	217	221	540	590	..
General Motors Co. pfd	109	111	120	124½	+4
Maxwell Motor Co. com	41½	45	82	85½	— ½
Maxwell Motor Co. 1st pfd	89	92	85	88	— ½
Maxwell Motor Co. 2d pfd	35½	39	54	57	—2
Packard Motor Car Co. com	120	130	165	172	..
Packard Motor Car Co. pfd	100	102	101	103	..
Paige-Detroit Motor Car Co	..	..	45	50	..
W. K. Prudden Co	20¼	22	42½	44½	..
Reo Motor Car Co	..	33½	42¾	43¾	+ ½
Reo Motor Truck Co	17⅜	18	36	..	+ ¾
Studebaker Corp. com	112	115	124	126½	—5½
Studebaker Corp. pfd	102	106	105	..	..
C. M. Hall Lamp Co	..	..	..	80	..

INACTIVE STOCKS

Atlas Drop Forge Co	27	30	30	..	..
Kelsey Wheel Co	205	..	55	60	..
Regal Motor Car Co. pfd	..	21	17	..	..

Street Railways Use Motor Buses

English Lines Find Them Profitable Auxiliaries—American Cos. Adopt Them

NEW YORK CITY, Aug. 25—Several English street railway companies are finding the use of motor omnibuses profitable as feeders or auxiliaries to their rail service, and at the last annual convention of the American Electric Railway Assn., held in San Francisco, it was decided to investigate the possibilities of supplementing the regular street car service with motor buses in this country. Thus, the final outcome of the fight that the street car companies everywhere have made against the jitney bus may be the adoption of regular buses by the companies themselves.

The motor bus section of the Sheffield Corporation Tramways in England earned a gross profit of $26,850 during the business year ended March 25, 1916. The company operated twenty-one buses in regular service on ten routes totaling 30 miles in length, five of which extend for a considerable distance beyond the city limits. More than 500,000 miles were traversed by the buses during the year.

The Birmingham Corporation Tramways earned a profit of more than $50,000 in the year ended March 31. Its forty-one motor buses carried 6,300,000 passengers and covered 938,226 miles, earning a gross average revenue of nearly 25 cents per bus-mile, while operating expenses averaged less than 18 cents per bus-mile.

Other English systems operating motor buses are the York Corporation Tramway Department (four), Oldham county borough (three) and Bournemouth Corporation Tramways.

All of these municipally-owned services are finding that the motor bus is giving them a new lease of life, for without spending large sums on permanent track and overhead equipment, fresh revenue is brought in. The buses, while not always showing profits themselves, increase the traffic on the rail lines.

A year ago the United Railways & Electric Co., of Baltimore, organized the Baltimore Transit Co. and began operating twenty-five twelve-passenger buses to determine their desirability as an adjunct to the regular trolley-car system.

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Making Tractor Cultivator

BLOOMINGTON, ILL., Aug. 25—The Illinois Silo Co., this city, has commenced the manufacture of a new tractor cultivator, patented by W. M. Springer, who for 25 years, was the designer of the Avery Mfg. Co., Peoria, Ill., and who will be in charge of the plant. The various sections of the tractor will be cast at various foundries and the finished parts assembled. The Springer machine will operate with any kind of gasoline or kerosene engine of more than 4 hp. The tractor complete with engine weighs from 2100 to 2400 lb. The frame is adjustable, so that it can be fitted to plows, cultivators, rakes, harrows, planters and other implements which the farmers use in their yearly labors.

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Gehl Bros. Make Tractor

WEST BEND, WIS., Aug. 25—The Gehl Bros. Mfg. Co., West Bend, Wis., a large manufacturer of power and manual farm implements and machinery, is now engaged in the regular production of a new type of general utility farm tractor, propelled by a four-cylinder gasoline-kerosene engine, of 4¼ by 5¾ in. bore and stroke, and rated at 25-hp., at 900 r.p.m.

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Ottawa Is Good Car Market

OTTAWA, ONT., Aug. 24—Ottawa people have been seized with a sort of craze for automobiles, and dealers have found this city is the most profitable field in the country. There are at present about 2500 automobiles and trucks in the city, or one for every forty of the population. Dealers declare that they have sold twice as many cars in July and August this year as in 1915. One dealer stated that his sales for the month of August are about 90 per cent better than last year. About 35 or 40 per cent of the cars sold by this agent were for commercial use.

In the whole Ottawa Valley as well as the city the demand for automobiles has been far ahead of last year. The good roads demonstrations and the prospect of better roads in the near future have awakened many to the desire of owning a car. A dealer who has been canvassing the country for a radius of about 50 miles around Ottawa says that there are very few farmers in that area who are not counting on buying an automobile before this time next year.

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Kansas Expects 300% Sales Increase

TOPEKA, KAN., Aug. 14—Only the failure of the Kansas corn crop can prevent the automobile dealers of Topeka from selling from three to six times as many cars this season as were sold last year, is the opinion of local automobile dealers. The fall sales activity has begun and prospects point toward a wonderful season. Practically every agency is receiving or soon will receive large shipments of 1917 models. A number of dealers have begun distribution of cars.

N.Y.C. 6 Months Fees $1,100,203

116,482 Owners, 770 Dealers and 59,430 Chauffeurs Register from City

ALBANY, N. Y., Aug. 25.—Automobile owners in this city contributed $1,100,203 in registration fees to the State during the 6 months between Feb. 1 and July 31. These fees came from 116,482 owners, 770 dealers and 59,430 chauffeurs. During the month of July alone 5615 owners registered in this city.

Next to New York City, Buffalo turned in more money than any other city in the State, with Albany third. From Buffalo there were registered 85,417 owners, 744 dealers and 14,548 chauffeurs. The fees they contributed amounted to $661,118.

Albany had a registration of 70,263 owners, 803 dealers and 14,613 chauffeurs. Its contribution was $551,277. The total for the three cities was $2,312,599.

Curiously, New York City has far fewer dealers, in comparison with its population, than the other large towns of the State, having only a few more by actual count than Buffalo and considerably less than Albany.

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232,017 Cars in Ohio

COLUMBUS, OHIO, Aug. 24.—W. H. Walker, Ohio registrar of automobiles, in a report covering the present year up to and including Aug. 24 shows that there are 232,017 automobiles in Ohio. Since the first of the year the department has registered 224,700 individual gasoline car owners and 4,443 electric owners. During the same period dealers to the number of 2874 have been registered. Now each dealer has at least one car and many of them have several demonstrators, but counting one car each there are 2874 cars owned by dealers. The total is 232,017.

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7800 Cars in Alberta

EDMONTON, ALTA., Aug. 26—There are 7800 cars in Alberta as compared with 5835 last year, a gain of 1965.

Last year the number of cars bought in the fall months was quite large and these were to quite an extent purchased by farmers. This year the sale of cars to rural communities is large and all the manufacturing companies are receiving good business from country districts.

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42,000 Cars in Georgia

ATLANTA, GA., Aug. 28.—According to records in the office of the secretary of state there are over 42,000 cars in Georgia against 25,000 for all of last year, a gain of 17,000.

36 Cars Entered for Cincinnati

Leading Racing Machines and Drivers in 300-Mile $30,000 Race

CINCINNATI, OHIO, Aug. 28—Thirty-six entries have been received to date for the 300-mile race to be held on the new Cincinnati 2-mile board speedway, Labor Day. The opening race is for $30,000 in prizes and the entries follow:

Car	Driver	Car	Driver
Peugeot	Resta	Sunbeam	Galvin
Mercedes,	De Palma	Chadwick	Victor
Maxwell,	Rickenbacher	Duesenberg	Milton
Maxwell,	Henderson	Adams	Adams
Peugeot.	Mulford	Olsen	(Un-named)
Sunbeam,	Christiaens	Hudson	(Un-named)
Peugeot	Merz	Duesenberg	(Un-named)
Peugeot	Aitken	Omar	Toft
Stutz	Anderson	West Duluth,	Rawlings
Premier	Wilcox	Cino	McNay
Crawford	Chandler	Osteweg	Osteweg
Crawford	Lewis	Hoskins	Hoskins
Crawford	Johnson	Oberting	Oberting
Olsen	MacBride	Premier	(Un-named)
Hudson	Vail	Dans L'Argent,	Muller
Delage	Franchi	Frontenac,	Chevrolet
Delage	De Vigne	Kleinart	Klein
Duesenberg,	D'Alene		
L. C. Erbes	Gable		

Road Race Postponed to Spring

SAN BERNARDINO, CAL., Aug. 22.—The Los Angeles-to-Salt Lake road race which was to have been held in October, has been postponed until next April. The weather has been so hot on the desert that it was impossible to get men to work on the road and put it in condition for the event.

50 Exhibitors at Indianapolis

INDIANAPOLIS, IND., Aug. 28—Nearly 200 products will be shown at the Fall automobile show, which will be given in a large tent close to the Coliseum in the Indiana State fair ground, Sept. 4 to 8. This will be the largest show ever staged by the Indianapolis Automobile Trade Assn., there being more than fifty exhibitors showing products of seventy different factories.

The accessories exhibit, which heretofore has taken up much space, will be quite limited to make room for the new models of automobiles.

38 Cars on Exhibition at Columbus

COLUMBUS, OHIO, Aug. 28—The usual fall automobile show, held in conjunction with the Ohio State Fair, started to-day in South Machinery Hall at the fair grounds in this city and will last for a week. The show is under the auspices of the Columbus Automobile Show Co. Thirty-eight cars and many trucks are being shown.

The following cars are on exhibition:

The cars shown were: Briscoe, Buick, Cadillac, Chalmers, Chevrolet, Cole, Dorris, Dodge, Dort, Detroit electric, Elcar, Elgin, Empire, Franklin, Haynes, Hudson, Jeffery, Kissel, Liberty, Madison, Maxwell, Marmon, Metz, Milburn electric, Oakland, Overland, Owen Magnetic, Packard, Paterson, Pathfinder, Pierce-Arrow, Reo, Roamer, Saxon, Studebaker, Velie, Westcott, Willys-Knight and many trucks.

Receiver for Twin City Speedway

MINNEAPOLIS, MINN., Aug. 25.—The succession of troubles of the Twin City speedway since its opening last fall has finally drawn it into the hands of a receiver. Bids for the sale of the plant in whole or in parcels have been authorized by the court and the sale has been put into the hands of Phil Herzog of St. Paul. No limit as to the date of sale has been given.

The local speedway was America's first concrete oval and cost approximately $603,000. The 2-mile oval finished in August, 1915, did not come up to expectations in regard to structure and public support. The last race on it, July 4, was a loss financially due to lack of attendance. The cement track at that time was just as rough as it was last year, little attempt having been made to improve it.

Hupmobile on Capital-to-Capital Tour for Good Roads

DETROIT, MICH., Aug. 28—A 25,000-mile capital-to-capital tour by a Hupmobile in the interest of good roads was officially started to-day at Washington, D. C. The plan is to visit the capital of each state and to invoke interest nationally in good roads through the state road officials and others having charge of road matters.

From Washington the car proceeds north to Annapolis, Md., and thence to Harrisburg, the capital of Pennsylvania. Following a visit to all of the Eastern and New England capitals, the route then proceeds to Albany and across New York State to Buffalo, where the car swings southward to Columbus and Charleston, W. Va., then back to Indianapolis, Detroit and Lansing. Thence the route goes westward northerly to Seattle and down the Pacific Coast to Los Angeles and back to San Francisco. Then the car is driven eastward via Carson City, Ogden, Salt Lake City and Cheyenne to Denver.

The route zig-zags north and south, taking in all of the capitals until it finally comes up through the Carolinas to Richmond, and thence back to Washington.

The trip is in charge of J. S. Patterson and the car is driven by C. E. Salisbury and George Lipe, both of Detroit, and the fourth member of the party is W. A. Krohn.

The reports to be made by the party are to be both written and photographic.

Races for Fords at Chicago

Five Events, 10 to 50 Miles, for Recent Models for Labor Day

CHICAGO, ILL., Aug. 29—Sanction has been granted by the American Automobile Assn. for a series of races for Ford cars to be held on Labor Day at the Chicago Speedway. The races, which will be open to Fords of 1913 or later manufacture, will be arranged as follows: 10-mile Chicago Championship; 20-mile Cook County championship; 30-mile Illinois championship; 40-mile Tri-State championship for Illinois, Indiana and Wisconsin cars only, and 50-mile Interstate championship for which the greatest number of prizes will be offered, including a Ford touring car.

This is the first time in America that a speed contest on a major track has been limited to cars of one make. Ford races have proved popular on the half-mile and mile dirt tracks of the County Fair Circuit and the promoters of the Labor Day event believe that a series of Ford races on the Chicago speedway will bring out a good crowd of Ford fans. Between 20 and 30 cars have been entered tentatively.

Two Killed at Kalamazoo

KALAMAZOO, MICH., Aug. 27—Jack Peacock and Marion Arnold were killed and eight others injured to-day when eleven of fourteen cars piled up at the first turn during the 100-mile race on the 1-mile dirt track at Recreation Park, this city.

The twelve-cylinder Sunbeam which Peacock drove skidded at the start of the race on the first turn and struck the fence. The car was overturned and thrown squarely across the track, and ten of the other machines plowed into it. The Stutz, driven by Andy Burt, whose mechanician, Arnold, was killed, was the first to strike Peacock's car. Peacock was in partnership with Charles Hanson under the style Hanson-Peacock Corp., Brooklyn, N. Y., National car dealer.

40 Exhibitors at Milwaukee Show

MILWAUKEE, WIS., Aug. 26—Forty dealers are exhibiting eighty-five makes of cars at the second annual automobile show in this city under the auspices of the Milwaukee Automobile Dealers, at the State Fair Park, Sept. 11 to 16. The big Machinery Hall is again being used.

New N. Y. Taxicabs' Rates Lower

NEW YORK CITY, Aug. 25.—Taxicab service at 10 cents a mile lower than the

old rates went into effect here today. Though there are only two of these new rate taxicabs in service at present, there will be 200 by Oct. 1. The Black & White Co., organized by New York and Chicago taxicab interests, owns the cars. The company's garage will be 310 to 326 West 68th Street.

The new rate will be 20 cents for the first one-third mile and 10 cents for each additional one-third mile. Thus, the first mile will cost 40 cents, and all miles thereafter will be 30 cents. The common existing rate is 30 cents for the first half mile and 10 cents for each additional quarter, with an extra charge when more than two passengers are carried. The new charge is regardless of the number of passengers.

The new taxicabs will have electric lighting and will have an electric device on the outside of the car which illuminates the numbers on the houses and assists the driver in readily finding places.

The car presents the appearance of a private limousine. In the winter it will be equipped with heating apparatus and rugs. It was the type of car that has been so successful in Chicago, the same interests being behind the enterprise jointly with the local concern.

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Paris Buses Again Running

PARIS, FRANCE, Aug. 25. — The local motor bus service has been partially reestablished with a single route served by thirteen buses running on a 5-min. schedule. This service was withdrawn 22 months ago on account of the war. The newly established line is over the main boulevards from the Madeleine to the Bastille.

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Electric Vehicles at Electrical Exposition

NEW YORK CITY, Aug. 29—Electric passenger and commercial vehicles, as well as accessories, will hold a prominent place in the New York Electrical Exposition at Grand Central Palace, Oct. 11 to 21. A test run is now being planned to be held during the exposition. The Electric Garage, this city, will have an exhibit representative of the work it is carrying on. Among the pleasure vehicles will be the Baker, R. & L. and Detroit cars. Among the exhibitors of commercial cars will be the General Vehicle Co., Walker Vehicle Co. and Ward Motor Vehicle Co. The Edison Storage Battery Co. and the Electric Storage Battery Co. will have exhibits.

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47 Pathfinders Shipped to Petrograd

INDIANAPOLIS, IND., Aug. 30—The Pathfinder Company,. this city, has started a train load of forty-seven cars, both touring and roadsters, for Petrograd, Russia. These cars are for trade and not for army purposes.

Ideal Army Truck Is Evolving

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Commercial Use of Such a Type Expected Within 2 or 3 Years

WASHINGTON, D. C., Aug. 26. — Military transport experts believe efforts to develop a motor truck capable of meeting the needs of the army campaigning along the Texas border and in Mexico will cause the manufacture for commercial use of an ideal truck within the next 2 or 3 years. The army transport board has been in session here recently considering the preparation of specifications for each type of truck required by the army, upon which truck makers will be invited to bid.

The board found that the tests to which the army trucks were subjected on the border and in Mexico were the most severe that had been had in any part of the world. The conditions of service were quite abnormal, yet the performance of some of the trucks was remarkably good. Experts of the S. A. E., acting on the suggestion of the board, now are on the Mexican border studying at first hand the unusual conditions of weather, sandy grit and alkali existing there with a view to the still further improvement of the army trucks.

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Franklin Roadster $1,850

In the description of the new Franklin models published in THE AUTOMOBILE for July 27, the price of the four-passenger roadster was given incorrectly. This new model, for which the Franklin company is experiencing strong demand, sells for $1,850.

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Durant Interests Back of Big N. Y. Building

NEW YORK CITY, Aug. 25.—Automobile dealers in this city whose leases are about to expire or who are having trouble finding storage facilities will be interested to know that an eight-story building, serving the dual purpose of storage and service, is being planned. Interests identified with W. C. Durant are backing this. The building will provide close to 500,000 sq. ft. of floorspace, and though it is backed by General Motors and Chevrolet interests, it will not in any sense of the word be a G. M. C. proposition, but will be open for all.

This building will occupy the entire plot of ground on Eleventh Avenue, from 55th to 56th Streets, with a 200-ft. frontage on the avenue and on each street.

A modern fireproof building is to be erected of either steel and concrete or steel and brick construction. Though the plan now calls for an eight-story building, it is likely that four more stories will be added.

Special high-speed elevator facilities will be provided. It is planned to divide the 40,000 sq. ft. on each floor into eight units, each unit being designed to provide both storage and service facilities.

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N. Y. White Moves

NEW YORK CITY, Aug. 27. — Another break is about to occur in Automobile Row. The White Co., for 10 years located at Sixty-second Street and Broadway, has leased a large plot at the northwest corner of Park Avenue and Fifty-seventh Street, where it will construct a five-story building to house all the branches of its passenger car and truck departments. The plot has been leased for 21 years.

The impending removal of this company will mark the second important deflection from that district, the first having been that of the Simplex at the beginning of this month, when it located at Fifth Avenue and Fifty-eighth Street.

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Buy Detroit Oldsmobile Branch

DETROIT, MICH., Aug. 28—An important change in local automobile circles has resulted from the buying out of the Oldsmobile factory branch by Wilbur H. Collins, son of R. H. Collins, former Buick sales manager and now a director of the General Motors Co., and F. J. Muellerschoen, who for several years was connected with the Philadelphia Buick branch. The Oldsmobile business will hereafter be conducted as a distributing organization with a territory including all of Michigan and nine counties in Ohio immediately adjacent to Toledo. R. C. Lowrie continues in the Detroit organization in charge of retail sales, and will retain the same selling staff.

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Milwaukee Boosters' Tour Starts

MADISON, WIS., Aug. 28—If the enthusiasm which has marked the first day of the State fair boosting tour of the Milwaukee automobile dealers indicates anything, the 1916 fair should be the best in years.

Thirty-six cars representing the Milwaukee Automobile Dealers left this morning. Seven stops were made over a distance of 105 miles. At each stop the cars were parked in the center of the town and paraded throughout the downtown section. Stops to-day were at Waukesha, Oconomo, Johnson Creek and Jefferson for dinner, Lake Mills, Deer Field and Madison. To-morrow night's stop will be at Green Lake.

Factory Miscellany

Obenberger in New Forge Plant—The John Obenberger Forge Co., recently organized, with offices at 608 Majestic Building, Milwaukee, Wis., has occupied its new plant in West Allis, Wis., where it is turning out forgings for crankshafts, connecting-rods, worm shafts, gear blanks, etc.

To Make Accessories—The American Auto Trimming Co., Cleveland, Ohio, has been incorporated with a capital of $100,000 and will establish a plant in the factory building of the Properties Co. on East Seventy-ninth Street, for the manufacture of automobile accessories. Among those interested are Benjamin Gotfredson and Frank Joyce, both at present engaged in a similar business in Detroit.

Buy Hercules Personal Property—The personal property of the Hercules Motor Car Co., Louisville, Ky., has been sold at auction for taxes amounting to $5,582.42. It was bid in by the H. & P. Machine Tool Co., New York City, for $6,100. The property comprised a large quantity of machinery and office fixtures, but not the real estate.

To Manufacture Tires—G. G. Meeley of the American Auto Tire Co., 154 North Broad Street, Philadelphia, Pa., has purchased the old Patterson textile mills in Chester, Pa. The mills will be enlarged and converted into an automobile tire factory. The structure now consists of a main building, 316 by 76 ft., three stories; a two-story brick building, 188 by 80 ft.; a brick and frame building, 123 by 64 ft.; a brick building, 74 by 33 ft.; a brick boiler and engine house and a two-story brick and stone office building.

Takes Over Dimmer Business—The Auto Light Control Co., care of M. D. Elgin, 224 Charles Avenue, Detroit, has incorporated for $25,000, taking over the business of the Grand Rapids Dimmer Co. It expects to manufacture and sell automobile light controls and specialties.

Allen Co. to Make Trucks—The Allen Street Sweeper & Auto Co., Allentown, Pa., will open a plant for the manufacture of commercial vehicles and street-cleaning machines. H. S. F. Barner, 1421 Munroe Street, Allentown, general manager, was connected for 12 years with Mack truck company.

Wald Machine Adds—The Wald Machine Co., Sheboygan, Wis., maker of automobile specialties, has started work on the erection of its new machine shop, 80 by 100 ft.

Buick Constructing Office Building—Plans for the immediate construction of a four-story office building on the site of the present office structure have been announced by the Buick Motor Co., Flint, Mich., through General Manager W. P. Chrysler. The new structure will be 242 by 50 ft. and will be of fireproof construction of reinforced concrete, to cost $240,000. It is planned to start work between Sept. 1 and 10, with a view to completing the new quarters before the first of the year. A larger building is made necessary because the force of office employees has completely outgrown the present rather large quarters.

Falls Motors Opens Bids—The Falls Motors Corp., Sheboygan Falls, Wis., formerly the Falls Machine Co., has opened bids in the office of Architect A. C. Clas, Colby-Abbot Building, Milwaukee, for the construction of two new buildings, which will materially increase the capacity of the plant before the end of the year. Plans call for a motor assembly shop, 119.7 by 119.6 ft. in size, and a motor repair shop, 72 by 85 ft., of modern reinforced concrete and steel sash construction, with concrete foundations and floors. A motor testing shop, 250 ft. long, and having accommodations for 120 motors at a time, has just been completed. The city of Sheboygan Falls is starting work on extensions of the waterworks system, so that the plant will have adequate fire protection and water service. Several streets are being vacated and opened for the benefit of the industry.

The Automobile Calendar

ASSOCIATIONS

Aug. 28-Sept. 1—Milwaukee, Wis., Booster Tour of Milwaukee Automobile Dealers.

Sept.—Indianapolis, Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.

Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.

Oct. 2-7—Kansas City, Mo., Dealers' Show, American Royal Live Stock Show; Kansas City M. C. Dealers' Assn.

Oct. 13—Flint, Mich., Fall Meeting National Assn. of Automobile Accessory Jobbers.

Dec. 2-9—Electricians' Country-wide Celebration.

CONTESTS

Sept. 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.

Sept. 4—Cincinnati, Ohio, Speedway, Cincinnati Speedway Co.

Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.

Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.

Sept. 9—Indianapolis Speedway Race.

Sept. 9—Newark, N. J., Track Race, Olympic Park, Racing Assn.

Sept. 16—Providence Speedway Race.

Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.

Sept. 29—Trenton, N. J., Inter-State Fair, H. P. Murphy, Racing Sec.

Sept. 30 — New York City, Sheepshead Bay Speedway Race.

Oct. 7—Philadelphia Speedway Race.

Oct. 7—Omaha Speedway Race.

Oct. 14 — Chicago Speedway Race.

Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.

Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.

Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

April, 1916—Los Angeles to Salt Lake City Road Race.

GOOD ROADS

Sept. 1-9—Cincinnati, Ohio, Good Roads Exposition and Convention, Music Hall, Hamilton County Dixie Highway Council of Cincinnati.

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

SHOWS

Sept. 2-9—Cleveland, Ohio, Show, Industrial Exposition and Fair, Edgewater Park.

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.

Sept. 4-8 — Hartford, Conn., Show, Connecticut Fair Assn.

Sept. 4-9—Minneapolis, Minn., Show, State Fair.

Sept. 4-11 — Indianapolis, Ind., Show, Indiana State Fair, Indianapolis Automobile Trade Assn.

Sept. 10-16 — Milwaukee, Wis., Show, Wisconsin State Fair, Machinery Bldg.

Sept. 25-30—Salem, Ore., State Fair, Joseph M. Rieg, manager.

Oct. 14-31 — Dallas, Texas, Show, State Fair.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 13-20 — Montreal, Que., Show, Montreal Automobile Trade Assn.

Jan. 27-Feb. 3, 1917 — Chicago, Ill., Show, Colliseum, National Automobile Chamber of Commerce.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb.—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

TRACTOR

Aug. 28-Sept. 1—Indiana Tractor Demonstration.

Sept. 4-8—Madison, Wis., Tractor Demonstration.

Sept. 11-16 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Week in the Industry

Trade Happenings

New England Trade Items—The Hawley-Cowan Co., Saxon agent, has moved into the building on Commonwealth Avenue vacated by the Cottrell Motor Car Co., that was handling the Pathfinder line.

The Becker-Stutz Co., Boston, Mass., has opened a branch at Providence with N. W. Rogers as manager.

The Worcester, Mass., Buick Co. has been formed, with C. M. Stanley, R. G. Clark and H. K. Noyes as officers. Mr. Noyes is the wholesale distributor of Buicks in New England.

The Drown Motor Car Co., Barre, Vt., that had the Buick agency, has sold its business to the Barre Garage Co. and H. G. Bennett.

D. E. Morgan has been appointed manager of the Metz branch at Providence, R. I.

The Autocar has been taken on by the Stoddard Motor Car Co., Springfield, Mass.

The Walter F. Kelley Co. has been organized at New Haven, Conn., to handle Vim trucks.

S. L. Rochette has given up the Ford agency at Lowell to take on the Chandler for that city, Nashua and Lawrence, in addition to the Dodge Bros. line. Harry Pitts has taken on the Ford.

The Redden Truck Maker has opened a Boston branch to handle the Massachusetts territory, with headquarters at 755 Boylston Street. J. B. McMahon, Jr., former manager of the New York branch, and N. J. Wallis, a Boston business man, are associated in the office.

The Henshaw Motor Co. of Boston has opened a branch at Lynn for the sale of Dodge cars.

C. E. Grimes has been appointed manager of the used-car department of the Cadillac Motor Co., Boston.

The Franklin Motor Car Co. of Boston has opened a branch at Worcester.

Recent Mich. Changes—A. C. Leverton, former general superintendent of the Chalmers Motor Co., Detroit, has been appointed to the position of factory manager of the Briscoe Motor Corp., Jackson. Leverton has had wide experience in his line, and previous to his Chalmers connection was works manager of the Cartercar Co. and before that general superintendent of the Brush Runabout Co.

W. F. French, a newcomer to the automobile field but a man who is thoroughly conversant with the purchasing end through mercantile experience in Chicago, has been made purchasing agent for the Bour-Davis Motor Car Co., Detroit.

New Jordan Dealers—The new Jordan Motor Car Co., Cleveland, has appointed the following distributors: John G. Dale, 240 West Fifty-ninth Street, New York City; Motor Car Sales Co., Milwaukee; Chicago Motor Car Co., Inc., Chicago; Decrow Motor Sales Corp., Buffalo, N. Y.; R. W. Immasche & J. A. Johansen, St. Louis.

Burd Issues Double-Utility Book—The Burd High Compression Ring Co., Rockford, Ill., has issued to dealers a book giving the piston ring sizes of all cars, and at the right-hand side of each page columns for reporting the stock of rings carried by the dealer. The book is unusually complete.

Meyrick Succeeds Brussel—L. Meyrick, formerly of the Lavine Gear Co., Racine, Wis., has succeeded J. M. Brussel as general superintendent of the Ferro Machine & Foundry Co., Cleveland, Ohio. The latter has taken a similar position with the Delco company, Dayton, Ohio.

Kansas City Changes—The Bond Motor Co. has resigned the agency for the Oldsmobile and will add the territories of Kansas and northern Oklahoma under the Saxon agency.

The Marion-Handley Sales Co. was incorporated at Jefferson City, Aug. 25, with a capital of $20,000 and the following officers: L. C. Cadenhead, president and manager; F. A. Britton, sales manager; Glen Bruner, counsel and director. W. B. Harrison will be city salesman. Other offices will be established at St. Joseph, Missouri, Lawrence, Topeka, Emporia, and Tonganoxie, Kan.

The Hiatt-Buick Co., Kansas City, Mo., handling retail sales of the Buick in Kansas City, is established at 1715 McGee Street. LeRoy Simons will be sales manager and J. B. Durkee will be outside salesman, traveling Jackson County. O. W. Hiatt, head of the company, was formerly manager of the retail sales department of the Buick Motor Car Co., Admiral Boulevard and McGee Streets, which hereafter will handle only the wholesale business of the territory. The used-car department of the Buick is also under the management of the new retail company.

The King Motor Sales Corp. has been organized and will take over the agency for King Eight, formerly handled by the Donnelly-Campbell Motor Co. The new company will move from 1706-1708 McGee to 1901-1903 McGee, where a building is being remodeled for the purpose.

Ohio News Items—A. G. Fischer, general manager of the Fischer Auto & Service Co., Columbus agent for the Chalmers, has leased the first floor of a large building at Third and Rich Streets, in which a modern service station will be operated.

The Cornelius-Browning Auto Co., Toledo, has taken the agency for the Liberty in northwestern Ohio in conjunction with several other makes of cars.

The Campbell-Gilchrist Sales Co., Columbus agent for the Empire, is now quartered in a large storeroom at 15-17 North Fourth Street. Richard Cott has been placed in charge of the service station.

The Falls Rubber Co. has leased space at 1844 Euclid Avenue, Cleveland, and will open a branch for the sale of its product.

The Torbenson Gear & Axle Co. has purchased the three factory buildings of the Samuel Austin Co., 152nd Street and Nickel Plate Railroad, Cleveland, which it will use as its own factory with the addition of another building. The site contains 4½ acres.

The Mutual Auto Supply Co. has taken a 5-year lease on a double store in the Keystone Building on Chester Avenue, Cleveland, Ohio, to which it will remove from its present location on Euclid Avenue.

St. Louis Items—The Byerly Auto Co., East St. Louis, Mo., has been incorporated to handle Oldsmobile and Mitchell cars. It succeeds to the business of J. H. Byerly, who also is a shoe merchant. A. L. Perkins is manager of the automobile company and the showrooms at Tenth and State Streets have been remodeled.

The Packard Missouri Motor Co. has leased 1801-1807 Pine Street, formerly Donnelly Automobile Co., showrooms, as used-car salesrooms.

The Park Automobile Co. is showing the twelve-cylinder H. A. L. cars, for which the company has been named agent.

Barker Joins Kentucky Wagon Co.—J. M. Barker, for a number of years identified with the I. H. C. truck line in Alabama and the South, has joined the Kentucky Wagon Mfg. Co., Louisville, Ky. He has enlisted in the field force of that company and will cover Alabama and Georgia.

The Automobile

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No. 10

NEW YORK, SEPTEMBER 7, 1916

Ten cents a copy
Three dollars a year

Watch the 1917 Automobile Announcements

See the long list of automobile manufacturers who have adopted as standard equipment and are featuring the Stewart Vacuum System.

We believe that in a very short time, every automobile will leave the factory equipped with the Stewart Vacuum System.

"It will pay you to see that the car you buy is equipped with Stewart Products"

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Stewart

Vacuum System

$10

The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, SEPTEMBER 7, 1916—CHICAGO NO. 10

18,254 Carloads in August

N. A. C. C. Joins Chamber of Commerce of U. S.—Good Roads Courses in Colleges

CARLOAD SHIPMENTS OF AUTOMOBILES

Month	1916	1915
January	18,054	8,369
February	21,502	11,273
March	28,600	16,442
April	28,000	17,112
May	24,000	13,642
June	23,879	15,325
July	18,079	12,517
August	18,254	16,959

NEW YORK CITY, Sept. 6—Shipments of automobiles in August amounted to 18,254 carloads as against 16,959 in the corresponding month last year and 18,079 in July, 1916. Reports from the National Automobile Chamber of Commerce which held its monthly meeting to-day show that though there are 10,000 more automobile cars in service than last year, there still seems to be a shortage of freight cars. There will be a meeting of the traffic officials to-morrow to consider this.

The Chamber has become a member of the Chamber of Commerce of the United States, Washington, thus giving it more scope in national affairs.

Road Engineering Courses

R. D. Chapin, chairman of the Good Roads Committee, reported to the directors to-day that a movement has been started to encourage the universities and colleges of the country to provide specialized courses in highway engineering with a view to meeting the growing demand for trained road engineers.

As a result of inquiries to the various state highway commissions, it is found that there is a decided lack of sufficient men with technical training and practical experience in road work to meet the requirements.

Out of seventy-five universities and colleges heard from, which provide civil engineering courses, less than half provide for any specialization by students in highway subjects. Only four have special highway engineering courses leading up to degrees or certificates in this particular branch.

The committee is endeavoring first, to create a demand by students for such specialized instruction, and second, to encourage the colleges and universities to provide it.

A Mississippi Centennial Celebration is being promoted, to be held from December, 1917, to April, 1918. The Director-General of the celebration advises that about $1,000,000 will be invested in the event and that the exposition is ready to co-operate in a good roads campaign throughout the South in the hope of bringing 100,000 automobiles to the Mississippi Gulf Coast during the celebration. He asks for the co-operation of the automobile industry through the Chamber of Commerce and for suggestions regarding how to make this the greatest good roads and automobile event of the South.

—

Foote Becomes H. A. L. President

CLEVELAND, OHIO, Sept. 5.—A. Ward Foote has succeeded H. A. Lozier as president of the H. A. Lozier Co. Mr. Lozier resigned last week on account of ill health. C. C. Homan has been elected vice-president; E. J. Tilliton, treasurer; F. H. Ginn, secretary; and G. H. Bowler, general sales manager.

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Abbott Buys 6 Acres in Cleveland

CLEVELAND, OHIO, Sept.1—The Abbott Corp., which recently moved to this city from Detroit, has purchased a 6-acre factory site on East 152d Street. The corporation plans to erect a $150,000 building.

$59,994,118 Profits for Ford

508,000 Cars Made in Fiscal Year—$100,000,000 Surplus —$52,550,771 in Banks

1916 FORD FINANCE FEATURES

Gross business	$206,867,347
Profits	59,994,118
Cash in banks	52,550,771
Merchandise and supplies	31,895,434
Invested in plants	17,293,293
Capital stock	2,000,000
Liabilities	18,127,312
Surplus	111,960,907

DETROIT, MICH., Sept. 4—Over $1,000,000 per week was made by the Ford Motor Co. during the fiscal year ending July 31, 1916, according to the financial statement just issued. The profit for the year amounted to $59,994,118, resulting from the sale of 472,350 Ford cars and parts. A total of 508,000 cars was manufactured for the fiscal year, but 35,650 machines, representing about 2½ week's output, were in transit and at the branch assembling plants at the close of the year.

$111,960,907 Surplus

Some stupendous figures are contained in the balance sheet of the corporation, which is capitalized at only $2,000,000 and has over $100,000,000 surplus at the present time. The assets include cash in the bank amounting to $52,550,771, merchandise and supplies valued at $31,895,434, accounts receivable of $8,292,778, and other lesser items. The liabilities amount to only $18,127,312, leaving a surplus of $111,960,907, after deducting $2,000,000 for the capital stock. The aggregate of the business done for the year reaches the staggering figure of $206,867,347.

The report also shows that the Ford

(*Continued on page* 417)

50% Stock Dividend for Paige

Applies to Stock Having Par Value of $10—Now Selling Around $55 in Detroit

DETROIT, MICH., Sept. 6.—The Paige-Detroit Motor Car Co. has declared a stock dividend of 50 per cent to holders of present stock of record on Sept. 9. This is the second stock dividend paid by that company in the last four months.

On May 13 the company gave a stock dividend of 80 per cent, and increased the capital from $1,000,000 to $2,000,000. At the same time the par value of the stock was cut down from $100 to $10 a share.

The present dividend applies to stock having par value of $10, which is now selling at about 55 on the Detroit Stock Exchange.

Peerless Starts Plant Expansion

CLEVELAND, OHIO, Sept. 1—The Peerless Motor Car Co., is planning the construction of several additions to its plant. The two three-story additions and one entirely new building are contemplated. Work will begin immediately.

Kissel to Add 14,000 Sq. Ft.

HARTFORD, WIS., Sept. 2 — Approximately 14,000 sq. ft. of floor space will be added to the plant of the Kissel Motor Car Co., Hartford, Wis., at once. Contracts have been let for the enlargement of the sheet metal and body building shops, and work is well under way. The new buildings are 77 by 123 ft. and 40 by 100 ft. in size. The improvement was projected earlier in the year, but work could not be undertaken because of the shortage of contractors' labor. The Kissel company is preparing an extensive building program to be undertaken within the next month and carried on throughout the winter.

Repair Work 85 Cents an Hour in Boston

BOSTON, MASS., Sept. 1.—Following a meeting of the Board of Directors of the Boston Automobile Dealers' Assn. held this week a uniform rate of 85 cents an hour for repair work will be charged in practically all of the service stations of the members beginning to-day.

Big Payrolls in Lansing

LANSING, MICH., Sept. 2 — Business conditions are far ahead of 1915 in this vicinity, according to payroll figures made public by the leading industries of the city. Reo has 1000 more men on its payroll now than it did a year ago and the Reo motor truck thirty-four more. The Auto Body Co. is employing practically double the number of men as compared with a year ago and would take more if the space were available for the many men needed. W. K. Prudden is employing 200 more men than a year ago and the Olds Motor Works, Auto Wheel Co., Bates & Edmonds have from fifty to 250 more men than last year. Actual figures of the Reo company show 3645 now as compared with 2652 for 1915.

American Tire Buys $90,000 Plant

PHILADELPHIA, PA., Sept. 2 — George G. Meeley, of the American Auto Tire Co., Inc., 154 North Broad Street, Philadelphia, Hugh B. Turner, secretary and treasurer of the company, and several others have purchased the old Patterson textile mills in Chester, Pa., which will be improved and enlarged on for the manufacture of automobile tires. The price given for the mills is $90,000. There are two main buildings, 76 by 316 ft.; a two-story brick building, 80 by 188 ft.; a boiler and engine house and an office building.

N. Y. Traffic Violations Decrease

NEW YORK CITY, Sept. 6—Speeding as a result of the several fines and imprisonment given violators during July has somewhat abated in this city. Arraignments for violations of traffic rules were less in August than in July, there being 1,219 as against 1,280. Speeding cases during August numbered 371 as against 461 in July. The total amount of fines paid to the Traffic Court was $13,567.

Herschell-Spillman Enlarging

NORTH TONAWANDA, N. Y., Sept. 2—The Herschell-Spillman Co. is building an addition to its already large motor manufacturing plant.

Seagrave Finishes Addition

COLUMBUS, OHIO, Sept. 2.—A new addition to the plant of the Seagrave company, manufacturer of motor-propelled fire department apparatus of all kinds, has been completed in the form of an added story, which will be used for offices. The offices which are being vacated on the first floor will make room for an addition to the paint shop.

$500,000 Additions for Goodrich

AKRON, OHIO, Sept. 1.—The B. F. Goodrich Co., this city, will erect new buildings costing $500,000 in the next few months. One new factory building, south of the present factory No. 10, will cost $415,000. It will be six stories in height, and will be used for general factory purposes.

An addition to factory No. 9 will cost $44,000 and another addition to No. 10 will most $38,000. Both are one-story additions.

Torbensen Axle Co. Formed

Organized with $1,750,000 Capital—To Take Over Gear and Axle Co.

CLEVELAND, OHIO, Sept. 1.—The Torbensen Axle Company, this city, has been formed with a total authorized capital of $1,750,000, to take over the Torbensen Gear & Axle Co., with its main plant now in course of completion on East 152nd street, this city.

Of the authorized capital $1,000,000 is preferred and $750,000 common, but only $500,000 of preferred and $395,000 are to be issued at this time. The $395,000 of outstanding capital will cover the taking over of the old company and will also provide $400,000 of new capital. This has been practically all disposed of at private sale and there will therefore be no public offering of the securities.

This company has been located in Cleveland about one year, originally on East Seventy-second street, but more recently a 4-acre site was acquired on East 152nd street, on which a large plant with 60,000 sq. ft. of floor space is now being completed.

Ohio Rubber Plants Contribute 61% of Wages

AKRON, OHIO, Sept. 4.—Of the $29,030,965 paid out in Summit county in wages during the past year, 61.1 per cent, or $21,733,088, was paid out by rubber plants. The second largest payroll in the county is given by foundry and machine shops, much of which is connected with the automobile industry.

In Lucas county, where Toledo is located, $10,089,214 out of a total of $35,343,043 is paid out by automobile factories.

Goodyear Employees Get More Land for Homes

AKRON, OHIO, Sept. 5.—An addition of 350 acres has just been made to Goodyear Heights, a tract of land laid out for workmen in the plant of the Goodyear Tire & Rubber Co. The home building plan for employees has been in operation for 3 years, the original plot being 100 acres. On this land employees of the Goodyear company can build their own homes on the basis of rent without any large first payment.

Zimmerman Joins Milwaukee Engine Co.

MILWAUKEE, WIS., Sept. 6—B. D. Zimmerman has been elected secretary and treasurer of the Milwaukee Auto Engine & Supply Co., this city.

Saxon Co. to Build New Plant

Buys 38 Acres of Land—Work on New Plant to Start About Oct. 1

DETROIT, Sept. 4—Positive confirmation of the report that the Saxon Motor Car Corp. is to build a new plant was obtained to-day with the information that a tract of land 38 acres in extent has been procured. It lies on the western side of the city and just outside of the present city limits in what is known as Spring Wells. It is a block north of Michigan Avenue along the railroad.

Work on the new plant is to start about Oct. 1, and according to President Harry W. Ford, the new home will be about four times the size of the present quarters, having about 600,000 sq. ft. of floor space. It is the aim to be in the plant by Jan. 1, to take care of next spring's production rush. The exact size of the buildings has not been determined, but it is known that they will be of modern factory design of brick, concrete and steel. Two manufacturing buildings, one two stories high, and the other one-story will run the entire length of the property along the Belt Line railroad.

Other industries have recently located on the west side of the city, the chief advantage of this side being that the shipping of products is quickened about 24 hrs., as is also the receiving of shipments. It takes a day to move them across the city to the eastern end, it is stated. The Springfield Body Co. is building a plant in this district also.

—

Covert Gear Co. Is Incorporated with $1,000,000 Capital

LOCKPORT, N. Y., Sept. 1.—The business of the Covert Motor Vehicle Co., this city, was recently reincorporated as the Covert Gear Co., and its capital stock was increased to $1,000,000. It is erecting an additional factory building at a cost of over $50,000, and on completion about Oct. 1 will devote it to the manufacture of transmissions.

—

Chandler Plans Additions

CLEVELAND, OHIO, Sept. 1—It is reported that plans are now being drawn for several large additions to the plant of the Chandler Motor Car Co.

—

Victor Motor Co. to Build Automobiles Near Wilmington

WILMINGTON, DEL., Sept. 4.—The Victor Motor Co. has been formed with a capital of $2,000,000 to take over the business of the Victor Car Co., of Philadelphia, and has bought twelve acres of land on the Delaware River at Grubb's Landing, north of Wilmington, to build a plant for the manufacture of moderate-priced automobiles. This company expects to build about 5000 cars a year.

The officers of the new company are C. P. Grandfield, president; C. V. Stahl, vice-president; H. H. Skerrett, treasurer; Regnault Johnson, secretary; and W. H. Bischoff, director.

—

Star Motor Co. To Build Automobiles and Trucks

CINCINNATI, OHIO, Sept. 2.—Steps have been taken for the incorporation of the Star Motor Co. with a preliminary capital of $200,000 for the purpose of manufacturing and assembling automobiles and trucks. The incorporators will be Louis Tyroler, W. Rudisill, J. A. Finn, W. Cayce and William Fischer. It is planned to locate a factory in Cincinnati, the location to be announced later.

—

Rubber Products Capital $500,000

AKRON, OHIO, Sept. 1—The Rubber Products Co., Akron, has increased its capitalization of $300,000 to $500,000. In the three years since the company has been formed, eleven per cent has been paid in cash dividends and recently a 20 per cent stock dividend was distributed.

A stock dividend of 10 2/3 per cent is anticipated with the issuance of more paid-in stock at par.

—

Wooler Designing Light Six

CLEVELAND, OHIO, Sept. 1—Ernest Wooler, automobile consulting and designing engineer, has opened an office on St. Clair Ave., this city.

It is rumored that he is designing a light six which will be placed on a production basis this winter. Cleveland capital is supposed to be back of this proposition.

—

Boston Dealers Back Jordan Agency

CLEVELAND, OHIO, Sept. 1.—The Jordan car manufactured in this city has secured a Boston agent, which is rather unusual, in that those back of the company handle other makes of cars. These include: J. H. Macalman, Stearns dealer and president of the dealers' association in Boston; J. W. McGuire, Pierce-Arrow agent, who is treasurer of the association; and J. H. Johnson, Buick, who is a director. F. A. Hinchcliffe, who has been manager of the Winton agency in Boston, has resigned to take the management of the Jordan agency.

Other Jordan dealers just appointed are: Chicago Motor Car Company, Chicago; Motor Car Sales Company, Milwaukee, Wis.; George R. Bentel, San Francisco, Cal., and the Decrow Motor Sales Corporation, Buffalo, N. Y.

Howard Car on Market

Buggy Co. Capitalized at $500,000 to Assemble Car—Starts Work

GALION, OHIO, Sept. 6.—The A. Howard Co., this city, has been formed to take over the buggy business of Adam Howard and also to manufacture automobiles. The company is capitalized at $500,000, divided into $300,000 common and $200,000 preferred. A. Howard has been made president and general manager, R. W. Johnson vice-president, and A. W. Monroe secretary and treasurer. These parties, with F. E. Garn, Plymouth, Ind., will constitute the directorate.

The new company will take over the entire plant, stock, etc., of Adam Howard, who established his buggy business thirty years ago.

The automobile will be an assembled product, and will be known as the Howard. The style of the bodies has not been definitely decided, but the car will have a 112-in. wheel base, equipped with a 35-hp. motor.

Operations will be started at once. The company will start without a penny of indebtedness, and will practically have $500,000 with which to begin operations.

—

Paige-Detroit Roadster on Transcontinental Run

NEW YORK CITY, Sept. 6.—A Paige-Detroit roadster started to-day at 2.35 p. m. on a transcontinental run to San Francisco via the Lincoln Highway. The car was checked out by the Automobile Club of America. There will be four drivers. Joseph Nickrent and Robert Evans started the trip.

—

$750,000 Goodyear Plant for East Toronto

EAST TORONTO, ONT., Sept. 6.—The Goodyear Tire & Rubber Co. will build a plant in this city at a cost of $750,000.

—

General Tire to Increase Capital

AKRON, OHIO, Sept. 1—The General Tire & Rubber Co. is contemplating an increase in its present investment of $196,000 to an outstanding capitalization of $300,000 common and $200,000 preferred stock.

—

Dealers To Exhibit at Maine Fairs

AUGUSTA, ME., Sept. 2.—Automobile dealers in Maine are planning to take advantage of the county fairs throughout the state by placing exhibitions at some of the larger ones. There are fifty-four fairs scheduled and they all run for 3 and 4 days.

ACCESSORIES In South America

No. III

Goods Must Be Properly Packed—Business Methods Required —Custom House Broker Indispensable

By David Beecroft

IN doing business direct with South America, every attention must be given to the proper packing of goods and also to mailing the bill of lading, so that these will be in the hands of the purchasers as soon as the goods arrive. Much trouble is occasioned by bills of lading not arriving until weeks after the goods have arrived in the custom houses.

How to Pack Goods

With regard to packing goods, it is essential that you keep in mind the supreme importance of weight, as 99 per cent of the duties are paid according to weight. To simplify this you should pack all goods of the same kind together, and give the stated weight, in order to lessen loss of time in the customs.

There are three weights in connection with sending goods to South America. They are the net, legal and gross weight, defined as follows:

1. Net weight, the exact weight of the article.
2. Legal weight, the weight of the article and the wrapping you sell it with. In case of a spark plug it is the pasteboard box. With a carbureter it may be a similar box.
3. Gross weight, the weight of the article, its wrapping, and lastly the large wooden box or crate in which the shipment is sent.

You always pay duty on the legal weight, that is, the article and its immediate wrapping.

Be careful to give weight of the different groups of arti-

General view of the coffee country in the State of Sao Paulo, Brazil. This State, which is larger in area than all of New England, is the greatest coffee-growing area of the world. In parts of the State coffee takes the same place that corn takes in Southern Illinois. As far as the eye can see are endless rows of coffee. The soil is reddish colored similar to that of parts of New Jersey or in parts of Georgia. This soil is declared to be the best for coffee culture of any soil in the world

cles you are forwarding. Thus, if your entire shipment is made up of

10 doz. screwdrivers
12 doz. spark plugs
100 sets Weed chains
60 hammers

weigh each of the groups separately, and so enter them on the bill of lading with the weight opposite.

The reason is that on each of these groups you pay a different custom rate. For example, the Argentine custom house values a hammer at 20 cents per kilo (2 1/5 lb.) and you pay a 25 per cent duty on this valuation. On screwdrivers valued at 60 cents per kilo you pay a 25 per cent duty on this valuation.

Spark plugs are valued at $1.10 per kilo, and you pay 10 per cent on this valuation.

So all through the car and through the list of accessories you find different schedules of values and different rates of duties. On steering gears valued at 60 cents per kilo the rate of duty is 10 per cent. On motor parts the valuation is $1.10 per kilo, and the rate of duty 10 per cent. The rate on axles is the same as on steering gears. To all of these duties is an extra war duty of 2 per cent, put on some years ago, and which the government has apparently forgotten to take off.

Numbering Crates

In crating goods for shipment by steamer, number each crate in sequence. If you have four crates, number them No. 1, No. 2, No. 3, and No. 4.

Be sure, on your bill of lading, to use this same numbering scheme. If you do not, trouble will follow. We know of one Argentine supply house that was put to an expense of nearly $70 solely because there were five different cases marked on the bill of lading, but only four cases shipped. The error was due to the shipping room crating packages No. 3 and No. 4 together. The custom authorities could not understand the situation. The supply dealer lived in Cordoba, and, as there is no custom house there, he had to make the trip to Buenos Aires to get the matter right. The total expenses totaled $70.

Tardy Bill of Lading

If the bill of lading does not arrive with the goods there is danger that the buyer will have to pay a 2 per cent fine to the custom house. To avoid this the custom house demands a valuation of the goods at the end of 8 days. The receiver of the goods may present a petition asking for 30 days' grace, which is granted.

These are only a few of the troubles that the receiver of the goods meets with in the custom house where necessary bill of lading and other documents do not arrive.

You must pay for storage in the custom house at the rate of 30 cents gold per cubic metre per month for 6 months.

If the goods have to be moved in the custom house, you pay at the rate of 60 cents per cubic meter.

You pay a statistical charge at the rate of 20 cents per $100 value.

If a crane has to be used in unloading, you pay for that.

There is custom house stamp paper, cartage, lighterage, and lastly, the commission to a custom house broker.

Get Custom House Broker

The custom house broker question is an imperative one to any concern going into the South American business and establishing your own agents in any of the countries. It is practically impossible for your agent to get goods through the custom house alone. You must employ a broker. No firm doing business in Buenos Aires or other cities tries to do otherwise. These custom house brokers are the "open sesame" to the custom house. They know exactly what to do and how to do it. You pay them a stipulated sum and they look after all of your customs. You hand the bill of lading and other documents over to them and they deliver the goods to your door. They do it quickly. You save the cost in time in a few months. Get one of the best available brokers for this work.

If each of the 30,000 automobiles in Argentina used six

This general view of the coffee country in the State of Sao Paulo, Brazil, gives a good conception of this most fertile section of the great country of Brazil, as this is the premier State of the country. It is in this State that more U. S. A. automobiles are being sold than in any other part of Brazil. This is a greater market than Rio de Janeiro. This State is wealthy and has a very high-class business sentiment. Not only is there a good market for our cars but also a big motor truck market

This scene shows coffee picking time in the State of Sao Paulo, Brazil. Wide avenues or roads cut through the great coffee areas, these roads being wide enough for a team of horses or oxen drawing the wagons which carry the coffee to the house and barns of the owner. In coffee picking time the country is literally filled with coffee pickers. The small bean does not grow in a pod like beans or peas, as is generally imagined, but the halves of the bean are inclosed in a single globular husk. These husks are pressed off by squeezing between the thumb and first and second fingers. The husk falls to the ground, no effort being made to prevent it falling on the ground, in fact, that is the way coffee picking is carried on. The coffee bushes are often 12 or 15 ft. high and short step ladders are needed in the picking. Coffee picking is naturally one of the big industries

tires in a season, it means 180,000 pneumatic tires. But the pneumatic tire business is not ours. France used to have the big hold, but since the war the French Michelin has naturally lost heavily, but the U. S. A. Michelin factory has fortunately taken up a large percentage of this. Italy has jumped heavily into the tire business in the last 2 years, Perelli being very active in all South American countries.

Our own U. S. A. tire people have been more alert than all of the other accessory people put together. As previously stated, Goodrich has been there for several years; Goodyear just got under way in Buenos Aires a few months ago and now has a fine establishment in the heart of Buenos Aires; Fisk has made particularly rapid progress in many parts of South America within the last 8 months and is doing a fine business. Firestone has been opening agencies for several months. United States Tire Co. has just got well under way in Rio and is doing the biggest business of any of our tire houses in the Brazilian metropolis. Republic has been well established in Chile for nearly a year, but has not yet got under way in Brazil, Argentina or Uruguay. A few other tire concerns have had their representatives there during the past 8 months. It can be said that to-day the U. S. A. tire concerns are on the job in South America and that in nearly every case they are making good.

Use Tire Signs

That we are not so good merchandisers of our wares in foreign lands as England, Germany, France, Italy and Belgium is well shown in the tire business. You cannot go into an automobile supply house in any of a score or so of cities in Brazil, Argentina, Chile and Uruguay without coming face to face with Michelin tire signs. You meet them in every garage, and I visted several score. You meet them in many of the car agencies. You meet them in little towns of 10,000 population, where there is not a garage in the place but where you can buy gasoline and Michelin tires. Perelli has equally good signs, but they are not so widely distributed. Dunlop tires are well advertised. You meet roadside signboards with huge Dunlop ads just as we see many brands advertised in the U. S. A.

The Michelin garage signs are not elaborate. They are plain, very clean and businesslike. They are white and blue enamel. Those for the outside of garages just have the words "Michelin Tires." They are generally round and have large letters. For the inside of garages you will see these signs, perhaps two or three of them in one place. They are ornamental. You may also see other blue and white enamel Michelin signs with the celebrated Michelin twins. These signs are not of billboard size but of conventional poster size, so that it is possible for the garageman or the supply house to hang them in a conspicuous place.

Enamel Signs Best

Our U. S. A. tire people are hopelessly behind in signs of this kind in South America, and if the signs have been sent they are not being used. We heard of one place where one of our large tire makers sent a supply of billboard signs 18 or 20 ft. long and 8 or 10 ft. high. Such signs are useless. You cannot use them in a garage or salesroom. The dealer will not rent a signboard for them.

Send clean-cut enamel signs to Argentina, Brazil, Chile and Uruguay and to the other countries in South America that you are doing business in. Get good-looking signs. The Latins of these countries have a strong artistic temperament. They know a sign that has been made by a cheap painter and one that has been designed by an artist. Send the artistic sign. It must not be elaborate. Make it plain, simple art. It will prove a good seller.

A word of advice to tire makers in the U. S. A.:

Look carefully into every agency you place in South American countries. Do not imagine that because you are signing up with the biggest firm in the city you are getting the best

representative. Some serious errors along this line have been made. Here is one: We know one place in Brazil where one of our largest tire makers signed with the largest concern in the city in question. That concern also handles a leading make of European tire. The understanding was that the U. S. A. tire was to be pushed and the European one sidetracked. I happened into that place and asked for tires. I was shown the European brand; in fact, two European brands. I then asked if he did not handle a U. S. A. tire, and he said he just had a few but was not stocking them heavily. I looked around for European tire signs and saw three facing me. There were more of them in the stockroom and there were others in the office. I looked for the U. S. A. tire sign, but there was not a sign of any nature any place. I asked for literature, and the manager was not able to give me any. That is one way not to get into the South American tire field.

I will cite a parallel that happened a few years ago in the motor car field in a South American city. The agent in question had the Pope-Hartford agency and was doing a fair business. He was about the strongest agent in the city. Hearing that the Cadillac was looking for an agent, he got it also. For several years he pushed the Pope-Hartford and smothered the Cadillac. He took the Cadillac agency solely to keep it out of the hands of other dealers. He did not want it to become a rival of his. This is not a hearsay story but one that the agent tells himself, now that the laugh is on him in that he used poor judgment in smothering the Cadillac.

Smothering Our Tires

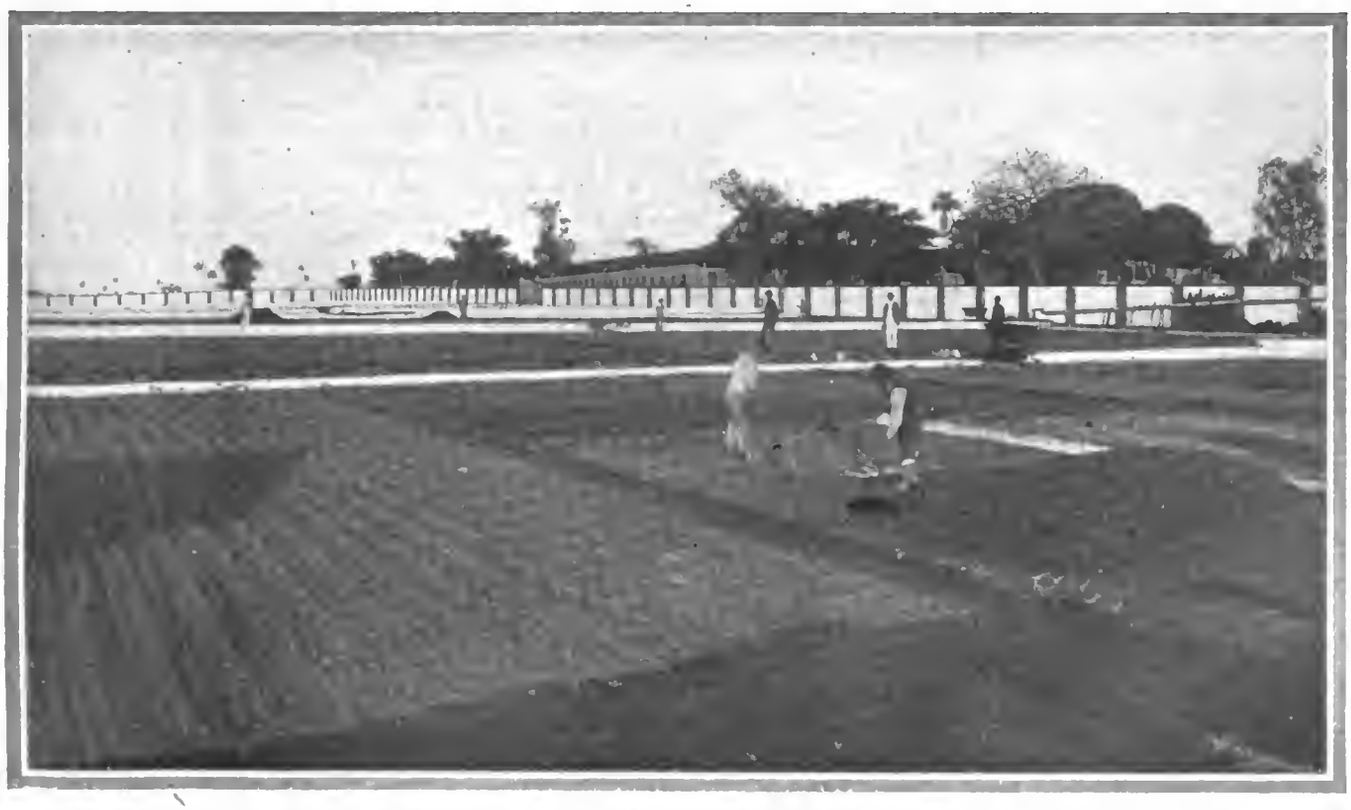
This smothering program is being carried out with some of our tire people, and it is also being carried out with a few of our automobile concerns. There are three or four makes of U. S. A. cars that are in the hands of very powerful agents whose national patriotism for European countries is so strong that they prefer to suffer themselves rather than see some of our cars get in ahead of certain European makes. Our makers have in a few cases prided themselves on getting such excellent connections, but they have only been hoodwinking themselves.

The tire business in South America is to-day a business worth having. We are getting it so easily that we scarcely know we have it. But, bear in mind, we are getting it due to the misfortune of European countries. Perhaps after the war we cannot only hold what we have but can keep on gaining. We hope so. But to do that we must quote our best prices. A few of our companies are taking orders at rather high figures. They say, "We can get the prices; why not charge them?" True, you can get them to-day, but it is questionable if you will get them when the war is over. The South American dealers must have tires. They cannot get them from Europe and must get them from the U. S. A. But if we overcharge to-day they know we are overcharging, and will not buy from us to-morrow when the Europeans come back into the market.

One large supply house admitted to me that it was not making a single cent out of its U. S. A. tires. In response to a question as to why carry them when they were not making money out of them the answer came promptly, "We cannot get interest on our money in the banks. We must give our customers service, and our money might just as well be circulating in tires as in anything else." This is the statement you hear in many places. They are all living to the end of the war, when they hope for a more or less return of old conditions. What will then happen is a mystery.

In the meantime the tire demand must be met. The cars in use require tires and those on the ground are reaping the profits. The natural resources of Brazil are such that there is bound to be a large export business to Brazil in the future. At present our trade relations with Brazil are of the pleasantest nature and there is no time better than the present to make a start in getting properly established there.

(To be Continued)



This is a common view at the home of one of the coffee growers. This is a large brick, cement or hard dirt area on which the coffee is spread out for drying. The magnitude of these areas appears in this illustration. In many places acres are so occupied. The coffee is handled in various ways while on these drying grounds. On every large coffee farm these drying areas are as much a part of the plantation as are the house or barn of a modern Wisconsin farm

S. A. E. Talks Trucks and Engines

Discussion of H. L. Horning's Paper on Truck and Tractor Engines Brings Out Troubles with Vehicles on Mexican Border, Due to Rivalry and Carelessness of Drivers

MILWAUKEE, WIS., Sept. 2—Inside facts on the operation of war trucks with the Villa punitive expedition in Mexico came to light to-night in the third quarterly meeting of the midwest section of the Society of Automobile Engineers in Milwaukee.

It was stated that a great deal of the trouble with all makes of trucks operating between the base at Columbus, Tex., and the head of the column in Mexico, was due to the fact that some of the trucks were driven by civilian chauffeurs from the factories who were paid three times as much as the soldier drivers, called sergeant chauffeurs.

Naturally there was much hard feeling on the part of the soldier drivers and they did not take much trouble to care for the trucks properly. Several weeks on the border brought about instances in which the trucks were deliberately wrecked by the disgruntled sergeant chauffeurs, according to Jerry Decou of Jeffery, who expressed the belief that much avoidable trouble came through rivaly between drivers of different makes of cars.

This caused drivers to attempt to get to the bases first and instead of driving at the specified speed of 14 m.p.h., speeds of 24 miles were made. This fact, together with the work of the alkali dust, 2 ft. deep in places, made the operating conditions particularly bad.

Decou stated that he saw more than ½ in. of mud in the crankcases of some of the trucks at the U. S. Government service station. Sometimes the trucks came in without a drop of oil in their engines and some with only a thimbleful.

Decou added these statements on the mud and oil in confirming some statements of H. L. Horning of the Waukesha Motor Co., whose paper, Trucks and Tractor Engines, was the feature of the meeting.

Owing to the fact that many of the engineers were unable to attend the meeting on account of fear of the impending strike, the attendance was not as great as expected. After the paper and its discussion were heard, the engineers inspected the electrical and automobile laboratories of the Central Continuation School, in the auditorium of which the meeting was held.

The purpose of the paper the first installment of which follows, was to illustrate the differences in demands on engines for use in trucks and tractors, to state the most serious problems the engineers face in fulfilling the demands and how they have been met.

Truck and Tractor Engines—Part I

By H. L. Horning

Engineer and General Manager Waukesha Motor Co.

HISTORICALLY speaking, the prevalent truck engines of to-day are a development of the old type of passenger-car engine. It may be said with certainty that the engine for the light agricultural tractor, the demand for which has developed so rapidly in the last 2 years, is developing from our best types of truck motors.

It is the purpose of this paper, first to make a statement of the demands made on the modern truck and tractor engines; secondly, to state the most serious problems the engineer meets in fulfilling the demands and how they have been met; thirdly, what lines the development of the future likely will take.

Character of Service

For the purpose of clearly illustrating the differences in demand on engines a horsepower-speed diagram has been laid out illustrating the application of a 4 by 5¾-in. four-cylinder motor to a passenger car, a truck and a tractor. In each case the engine of these dimensions is assumed to be designed with the proper characteristics to handle the demands of the particular service.

An unbiased observer will admit that experiences have taught the all-around usefulness of four-cylinder motors in truck and tractor service, and wherever reference is made to an engine in this paper it will be considered a four-cylinder poppet valve engine.

Keeping in mind that a passenger car engine will turn over 20,000,000 revolutions in going 10,000 miles; a truck engine will turn over 60,000,000 revolutions in covering a distance of 14,000 miles, while a tractor during a period of 6 months will cause its engine to turn over 70,000,000 in plowing 600 acres with some road work and belt work.

Summing up, then, we may tabulate the results as follows:

The most interesting conclusion that can be drawn from the analysis of the above table is that, while the tractor demands of its engine in every respect more than a truck, nevertheless a well-built truck engine will meet the demands of tractor service, and in the interest of good engineering it must be said that a truck engine which will not stand tractor service is not an example of good internal combustion engineering.

Before passing on let it be understood that there are several important differences in the conditions under which truck and tractor engines operate, which are enumerated as follows:

(1) Trucks are stopped and started many times during a

TABLE I

	Average Road Speed	Motor Speed—Aver.	Motor Speed—Max.	Average Power Required	Season's Revolutions of Engine	Per Cent of Time Motor Is on Average Speed or Less	Per Cent of Time Motor Is on Maximum Speed
Pleasure car...	18 mi.	775	2,200	6½ Hp.	20,000,000	95	1
Truck	8-15 mi.	700	1,150	12½ Hp.	60,000,000	77	23
Tractor	2-3 mi.	1,100	1,100	22 Hp.	70,000,000	99½	100

day and operate with considerable variation in speed; in fact, sudden changes in speed and in power demands. A tractor demands a steady though heavy output from the engine at approximately governed speed, the variation being from 50 per cent to full load and overload. The steadiness of a tractor power demand is much more favorable to long life than the frequent changes of speed in the truck motor.

(2) A truck requires a maximum speed governor to keep the engine from the evils of racing and may be operated with profit with a maximum and constant speed governor combined. A tractor requires a constant speed governor to operate all the time.

(3) It is not essential to strain the dust out of the carbureter air in a truck or to pay particular attention to dust entering the breather, but it is absolutely necessary for long life of the tractor engine to see that every possible particle of dust be removed from the air before it enters the carbureter and great pains must be taken to see that no dust can enter through the breather. Two days of carelessness in these respects in some parts of the country will result in worn out rings, pistons, cylinders and bearings.

(4) Tractor engines should have flywheels with an average of double the stored energy of truck motors in order to satisfactorily meet the sudden peak loads of service.

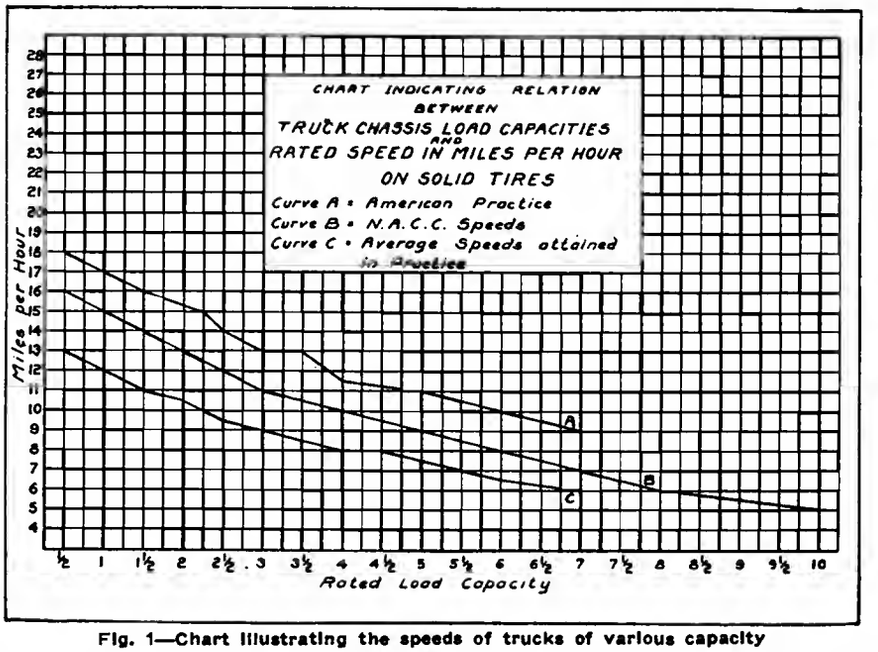


Fig. 1—Chart illustrating the speeds of trucks of various capacity

Statement of Commercial Requirements

Truck and tractor engines briefly stated are medium speed engines capable of producing a maximum torque continually at a minimum complete cost. Broadly speaking, they must fill some commercial service without undue thought, expense, trouble or care. Their true importance lies in the fact that they are the means to end and as such must be forgotten by the average user in pursuit of that end.

It is well in considering truck and tractor engines to keep foremost in mind that in the last analysis truck and tractor builders are selling transportation and it is the ability of the engine to deliver the torque, which through the mechanism of the truck or tractor, produces economical transportation that determines the engine's usefulness.

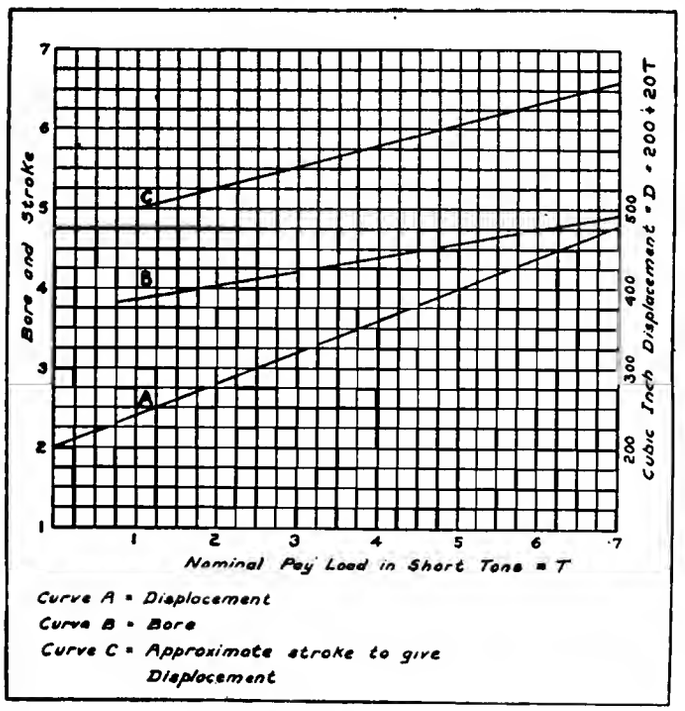


Fig. 2—Cubic inch displacement for various sizes of trucks

Engine speeds in American trucks are established by the practice of limiting piston speeds to 1000 ft. per min. Recent Government specifications of 1½- and 3-ton truck engines limit engine speeds to maximum of 1300 r.p.m. Truck speeds as established by the National Automobile Chamber of Commerce may be considered official, while maximum actual speeds are established by service conditions and are generally higher than the N. A. C. C. Average truck speeds (or miles traveled divided by hours taken) are generally much slower than the maximum.

Herewith appears a chart, Fig. 1, indicating the speeds of trucks of various capacity. The curve *A* represents maximum truck speeds as taken from the specifications of a large number of American truck makers. The curve *B* represents the maximum speeds adopted by the N. A. C. C., while the curve *C* represents an attempt at a speed representing the average speed at which trucks operate. The U. S. Government specifications for 1½-ton truck call for a maximum road speed of 14 m.p.h., while the 3-ton truck is specified at 12 m.p.h.

American practice calls for rear tire sizes as follows: 34-in. for ¾-ton; 36-in. for 1- to 3½-ton, inclusive; 40-in. for 4- to 7-ton, inclusive.

Having the engine speed, wheel diameter and maximum truck speed established, the matter of gear ratio reduces down to the most obvious one for general service and the engine size to one of ability. Starting with very large engines years ago the development seems to be toward higher engine speeds, smaller engines and lower gear ratios.

Piston displacement of American truck motors has been found to conform to the formula

$$D = 200 + (40\,T) \qquad (1)$$

in which D is piston displacement in cubic inches and T is nominal pay load in short tons.

Since an investigation of American truck engines indicates the ratio of bore to stroke as 1:1.3, therefore

$$D = 0.7854\ B^2 \times 1.30\ B \times N$$
$$D = 4.1\ B^3 \qquad (2)$$

Where B stands for bore of cylinder and N number of cylinders,

$$B = \sqrt[3]{\frac{200 + (40\,T)}{4.1}} \qquad (3)$$

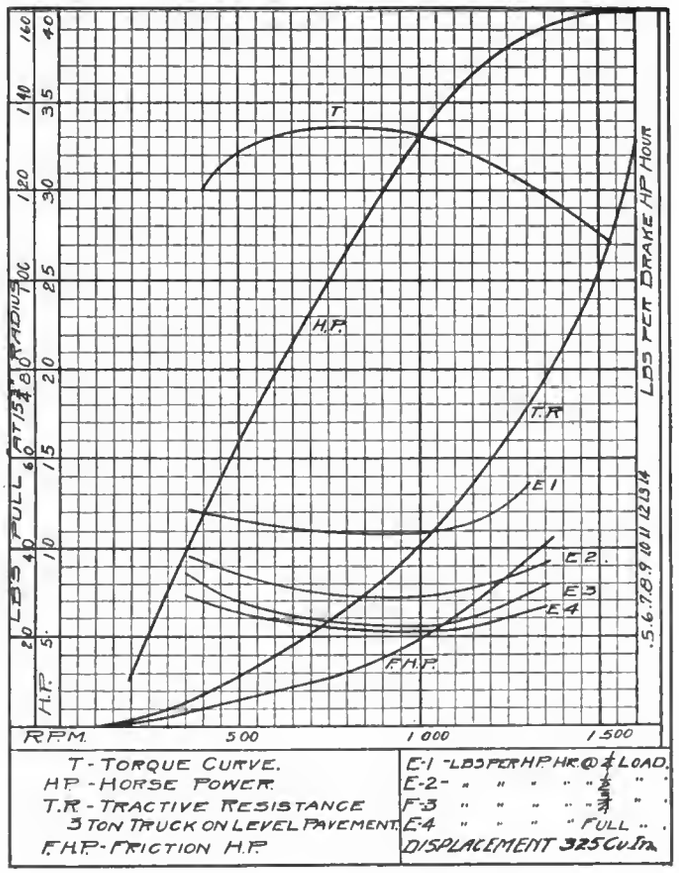


Fig. 3—Power curves of a well-known truck engine

Below will be found a chart, Fig. 2, which gives the cubic inch displacement for various sizes of trucks, also bore and stroke in which the ratio of 1.30 would give the proper displacement with the above formula.

It is important to call attention to the fact that many of our American trucks are assembled from standard units of which the engines and transmissions have been rapid adaptations from passenger-car practice. This, together with the inability to get correct worm-gear reduction to fit the engine and transmission combination, have produced gear ratios which do not fit the range of American or European requirements.

The transmissions are faulty in having a touring-car ratio between first and third, where a greater ratio is required for truck service. Some transmission builders are correcting this. Truck builders have been forced by inability to get a low first speed ratio to accept too low a ratio on third.

Conditions of service, manufacture and necessity of holding engine sizes down for sake of economy make it very desirable to have a gear ratio between first and third speed, three-speed transmissions, of at least 5 to 1.

Gear ratios are so important in the attainment of satisfactory service from the pulling standpoint and an economy in fuel that it may be well to pass to the consideration of engine characteristics as a fundamental consideration in determining gear ratios. This procedure has been too often neglected in the application of engines to truck service, principally, no doubt, from the fact that so many passenger-car engines have been used whose characteristics are not suitable for truck service.

Below will be found a diagram, Fig. 3, of a well-known truck motor. A study of this diagram shows that there are three speeds in the curves at which peaks occur, which are of vital interest, as follows:

(1) Speed of maximum torque, 783 r.p.m.

(2) Speed of maximum horsepower, 1450 r.p.m.

(3) Speed of maximum economy, 1044 r.p.m.

Obviously it would be ideal if all these speeds were identical and that the truck motor could operate at all times at the one best speed. This is impossible both because of correlative influence of each characteristic on others and because truck service calls for variable engine speeds. The engineer must, therefore, so apply his engine that each characteristic is available under running conditions.

The speed of maximum torque is established by combined influence of cylinder cooling, flame propagation, volumetric efficiency, carburetion, compression leakage and mechanical losses. At the speed of maximum torque the influence of cylinder walls in cooling the charge is on the decline, though it is never at its minimum. Turbulence of the charge and flame propagation is on the increase; volumetric efficiency is dropping; while carburetion is improving with speed.

Compression leakage is declining, while mechanical losses such as fluid friction of the lubricating oil, water and oil pumps, fans, etc., are absorbing power approximately according to a parabolic law.

At the speed of maximum torque, the highest M.E.P. figured from the brake horsepower is developed regardless of the cost.

The speed of maximum economy which always occurs above the speed of maximum torque is established through the combined influence of favorable carburetion, by the better atomizing of the nozzle, through increased flame propagation resultant from increased turbulence and good, though decreasing, volumetric efficiency. The time element as affecting the radiation losses, together with the decreased unfavorable influence of waterjacket temperature on economy and torque seems to combine for very favorable thermo-dynamic condition at the speed of maximum economy.

The above influences derive their value through the influence of motor design and assume a theoretically correct carbureter from the standpoint of furnishing the proper proportions of fuel to air. Of all the influences affecting economy, carbureter setting has the greatest actual effects. Of all the influences favoring torque and high speed of maximum horsepower, engine design has the most influence.

The speed of maximum horsepower is established by the favorable influence of violent turbulence and declining cylinder wall cooling effects, and by the declining volumetric efficiency and rapidly rising friction losses. It is impossible to consider here the full importance of these influences or to put forth the means adopted to compromise one characteristic with another—except to say that great torque per cubic inch displacement is seldom obtained with great economy without also sacrificing the smooth running of the engine over the range of speeds usually adopted on trucks.

In diagram Fig. 3 we find the speed of maximum torque at 783 r.p.m.; the speed of maximum economy 1044; speed of maximum horsepower, 1450 r.p.m. Using this motor for a 3-ton truck according to Fig. 1 and 36-in. wheel traveling 13 m.p.h., as per diagram, Fig. 2, with a gear ratio of 8.75-1, a common ratio with worm gear axle builders, we have a combination in which the governed speed is at the speed of maximum economy and the speed of average running 730 r.p.m.

Referring to curves for economy we note that as far as engine speeds are concerned we have chosen a good range for economical operation. This is only obtained by motors particularly designed for truck service. Passenger car motors of the four-cylinder type never have their torque or economy curves so favorably placed.

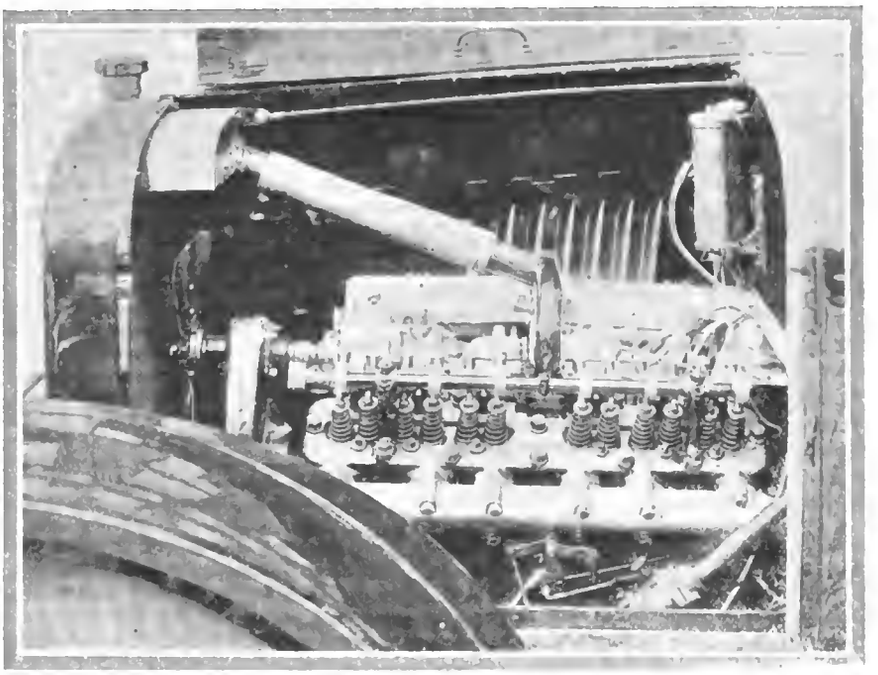
Referring to economy curves for one-fourth and one-half loads, we note a great difference in economy. It is this fact that makes trucks very uneconomical in fuel when equipped with over-sized motors and is the point on which eventually will be decided the question of higher motor speeds, smaller motors and higher gear ratios.

(*Continued on page* 411)

Enger Twelve Convertible to Six

Shifting Fuel Economizer Lever Cuts Off One Block of Cylinders Which Serves, However, as a Compensator for the Other

AN innovation in conventional automobile construction is found in the Enger Twin-Unit twelve for 1917, made by the Enger Motor Car Co., Cincinnati, Ohio. Through the shifting of a lever the Enger may be changed from a twelve to a six. This is the first time that such has been found possible in a stock car. The Schebler, one of the early twelve-cylinder experiments, used some such similar device, but no cars were ever marketed, only one having been built, as described in THE AUTOMOBILE for March 25, 1915.



Power plant of the Enger Twin-Unit twelve. The engine has a bore of 2⅜ in. and a stroke of 3½ in., giving a piston displacement of 186.04 cu. in.

Cutting Out Six Cylinders

The principle involved in changing the motor from a twelve to a six is extremely simple. A rod having six cams is placed over the push rods of the exhaust valves on the left block of the V and by throwing a lever placed on the steering post and under the wheel, this shaft with the cams is turned sufficiently to act upon the push rods and open the exhaust valves and hold them in an open position until the lever on the steering wheel is thrown back. At the same time the cams open the exhaust valves the turning action of the shaft carrying the cams closes a butterfly valve in the intake manifold to the left block. Thus the six cylinders are cut out, but they act as a compensator for the other six, which of course are off center.

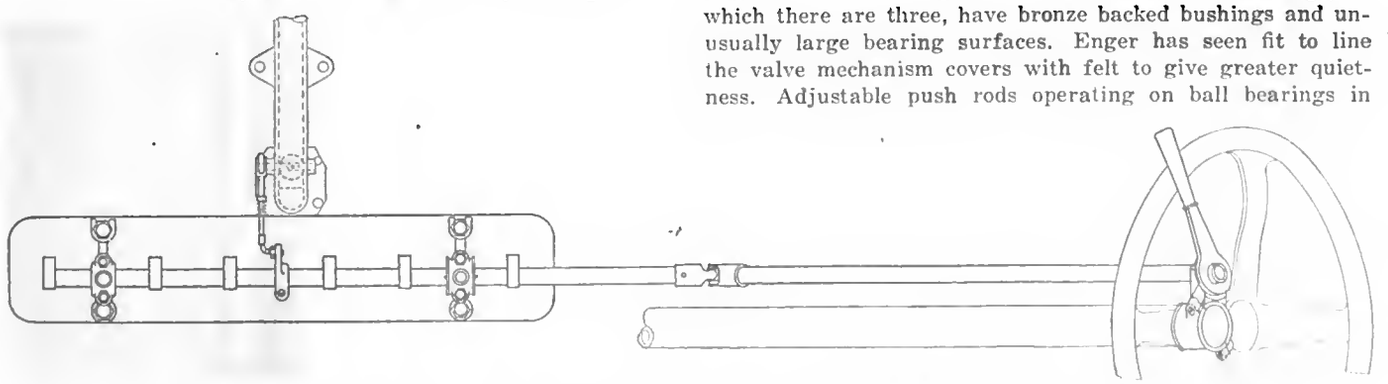
Displacement and Economy

The engine, which is of Enger's own construction, has a very small bore and stroke, being 2⅜ by 3½ in. This gives it a formula horsepower rating of 27.07, and a displacement of 186.04 cu. in. Enger's claim for great economy when the car is used as a six seems well taken since it stands to reason that with six cylinders having a total displacement of 93.02 cu. in., the engine may be more economical as to fuel than the car with a much larger displacement. The Enger has the smallest piston displacement of any twelve on the market to-day and from a flexibility standpoint it may be said that all speeds from a point where the speedometer rests at zero up to 60 m.p.h. are possible in high with the twelve cylinders in action.

A representative of THE AUTOMOBILE rode in the car over hills and on level stretches and found 40 miles per hour possible with the use of six cylinders and up to 60 with the twelve cylinders in action. On level ground starting was easy with the gearshift lever in high and under the same conditions, with the clutch in and the gears in high, a touch of the starter pedal was sufficient to start the engine and accelerate to 40 miles within a city block. There was no bucking of the engine when starting in high.

Valve-in-Head Engine

The engine is of the valve-in-the-head type and the cylinders are of semisteel. The main crankshaft bearings, of which there are three, have bronze backed bushings and unusually large bearing surfaces. Enger has seen fit to line the valve mechanism covers with felt to give greater quietness. Adjustable push rods operating on ball bearings in



Layout of economy device on Enger Twin-Unit twelve for 1917. The shaft has six cams that push the exhaust valves open. It is operated by a lever on the steering post. Turning the shaft also closes a butterfly valve in the intake manifold to the left block

ball socketed rocker arms with felt oil retainers also make for quietness. Three thousand revolutions a minute is the maximum engine speed and at this point it is said to develop 55 hp.

But one chassis is being built and this, a five-passenger touring type with streamline body and hood and double cowl, sells for $1,295. This is an increase of $200 over the previous twelve of last year, but the 1917 model is greatly improved in appearance over its predecessor. With a wheelbase of 116 in. and cantilever springs in the rear the car rides well. The rear axle is of the floating type with double row of ball bearings throughout and the drive is taken through spiral bevel gears.

A Stromberg carbureter placed in the V takes the fuel by gravity feed from the tank in the cowl, while the ignition is Remy and the electrical equipment two-unit Westinghouse. Lubrication is by pump, the oil being forced through the hollow crankshaft to the connecting-rod bearings. This pump is located at the bottom of the oil pan and it is in this pan that another departure from regular practice is found. Longitudinal tubes are cast in the lower half of the crankcase, which is the oil reservoir and the air rushing through these tubes help to keep the temperature of the oil lower. It also is contended that the oil passing into the cylinders not working is further cooled, since these cylinders are doubly cooled through the absence of explosion and the fact that the water from the radiator is not syphoned to that block as it becomes cold.

The clutch is a multiple disk, Raybestos lined and the housing is partially open to keep it cool. The clutch and gearset run on double annular ball bearings with the exception of the counter gears, which have bronze bearings. Two universals are used in the final drive.

Brakes are of the internal expanding and external contracting type. Tires are 32 by 4, non-skid in the rear.

The 1917 Enger is offered in two colors, a light cream and a black and green combination, the latter having the hood, fenders and chassis black and the body and wheels dark green. Other colors can be had at small additional cost. The upholstery is leather over curled hair and coil springs. The running boards and floorboards are linoleum covered and aluminum bound.

There is a remarkable absence of square corners in the Enger. The body rolls in a little at the top and the doors have a new design of fastener. When they are opened and the small lever pulled up sufficiently to allow the door to open, a spring-operated stud projects from the door toward the jam and holds the catch up. As the door is closed the jam strikes this stud, which releases the catch and it springs into place. The catches are set inside the door.

Equipment Is Complete

Equipment includes motor-driven horn, speedometer, robe rail, foot rest, one demountable rim and carrier, mohair one-man top and Jiffy curtains, rain vision ventilating windshield set on a slant, tools, etc. There is ample leg room both in front and rear compartments and the cushions are lower in the back than in the front to give better riding qualities.

150,000 Cars Registered by Texas Counties

AUSTIN, TEXAS, AUG. 30.—The Dallas *Morning News* has taken a census of the number of automobile licenses that had been issued in each county of the State during the period up to April 1, 1916. It shows a total of 139,013 licenses. It is estimated that since April 1 additional licenses have been issued which would make the total at this time approximately 150,000. The figures for each county were furnished by the county clerk. The census follows:

County	Cars	County	Cars	County	Cars	County	Cars	County	Cars
Anderson	424	Coryell	560	Harrison	510	Marion	40	San Patrico	380
Andrews	34	Cottle	149	Hartley	58	Martin	90	San Saba	269
Angelina	180	Crockett	161	Haskell	427	Mason	216	Scurry	356
Aransas	104	Crosby	200	Schleicher	140	Matagorda	508	Shackleford	215
Archer	146	Culberson	57	Hays	494	Maverick	254	Shelby	171
Armstrong	213	Dallam	245	Hemphill	199	McCulloch	444	Sherman	144
Atascosa	189	Dallas	12,715	Henderson	98	McLennan	3,480	Smith	480
Austin	248	Dawson	132	Hidalgo	537	McMullin	28	Somervell	59
Bandera	68	Deaf Smith	362	Hill	1,525	Medina	540	Starr	85
Bastrop	410	Delta	358	Hood	143	Milam	597	Stephens	140
Baylor	288	Denton	1,013	Hopkins	368	Menard	148	Sterling	110
Bee	371	DeWitt	883	Houston	162	Mills	237	Stonewall	177
Bell	1,525	Dickins	122	Howard	426	Midland	390	Sutton	182
Bexar	8,975	Dimmitt	166	Hunt	1,123	Mitchell	380	Swisher	340
Blanco	188	Donley	325	Hutchinson	54	Montgomery	88	Tarrant	7,003
Borden	63	Duval	75	Irion	90	Montague	425	Taylor	1,169
Bosque	688	Eastland	358	Jack	187	Moore	63	Terrell	45
Bowie	558	Ector	130	Jackson	231	Morris	66	Terry	83
Braoria	351	Edwards	113	Jasper	140	Motley	130	Throckmorton	155
Bailey	...	Ellis	2,182	Jeff Davis	92	Nacogdoches	273	Titus	117
Brazos	261	El Paso	5,694	Jefferson	2,862	Navarro	1,471	Tom Green	1,244
Brewster	264	Erath	559	Jim Hog	31	Newton	93	Travis	2,838
Briscoe	165	Falls	721	Jim Wells	173	Nolan	494	Trinity	101
Brooks	94	Fannin	815	Johnson	950	Nueces	1,157	Tyler	28
Brown	701	Fayette	652	Jones	774	Ochiltree	182	Upshur	159
Burleson	232	Fisher	432	Karnes	540	Oldham	182	Upton	24
Burnet	386	Floyd	413	Kaufman	813	Orange	61	Uvalde	515
Caldwell	629	Foard	208	Kendall	309	Orange	340	Val Verde	430
Calhoun	138	Fort Bend	378	Kent	102	Palo Pinto	574	Van Zandt	303
Callahan	268	Franklin	46	Kerr	263	Palona	92	Victoria	520
Cameron	832	Freestone	257	Kimble	125	Parker	649	Walker	89
Camp	106	Frio	280	King	30	Parmer	146	Waller	138
Carson	255	Gaines	88	Kinney	82	Pecos	224	Ward	74
Cass	156	Galveston	2,836	Kleburg	180	Polk	107	Washington	480
Castro	126	Gara	156	Knox	342	Potter	1,182	Webb	8
Chambers	136	Gillespie	416	Lamar	1,082	Presidio	181	Wharton	520
Cherokee	289	Glasscock	71	Lamb	66	Rains	62	Wheeler	213
Childress	458	Goliad	245	Lampasas	337	Randall	250	Wichita	1,834
Clay	488	Gonzales	566	La Salle	167	Reagan	40	Wilbarger	625
Coke	144	Gray	303	Lavaca	560	Real	23	Willacy	10
Coleman	455	Grayson	1,919	Lee	148	Red River	434	Williamson	2,048
Collin	1,389	Gregg	230	Leon	119	Reeves	282	Wilson	359
Collingsworth	245	Grimes	216	Liberty	164	Refugio	...	Winkler	4
Colorado	390	Guadalupe	796	Limestone	742	Roberts	158	Wise	350
Comal	475	Hale	843	Lipscomb	264	Robertson	275	Wood	217
Comanche	336	Hall	504	Live Oak	71	Rockwall	326	Yoakum	47
Concho	183	Hamilton	617	Llano	228	Runnels	763	Young	321
Cooke	547	Hansford	118	Lubbock	516	Rusk	120	Zapata	37
		Hardeman	444	Loving	...	Sabine	112	Zavalla	124
		Hardin	404	Lynn	156	San Augustine	72		
		Harris	9,240	Madison	73	San Jacinto	13	Total	139,013

No Magic in Spring Design

All Types of Spring Can Give Equivalent Results—Semi-Elliptic, Cantilever, Etc., Suit Different Circumstances, But May Ride Equally Well

By A. Ludlow Clayden

THE idea that a spring had some special virtue *because* it was a cantilever or *because* it was a three-quarter type and so on, has been fairly well exploded. Apart from theory, experience teaches that taking any type of spring from the simplest to the most complicated, cars can be found using the same essentials and yet giving opposite impressions as to quality of suspension. There are, however, reasons for choosing different sorts of springs, and there are a few rules of a rough and ready order which apply throughout to spring design.

The mathematics of springs is a very complicated study to the average man. Mathematical experts usually claim that any given spring problem is perfectly simple, but engineers are apt to observe that the deductions of the theorists often disagree. The explanation is probably that in spring calculations it is necessary to make certain assumptions, and those assumptions are largely guesses. It is also noteworthy that engineers with really high scientific ability have usually been able to combine theory and experience and make cars with especially satisfactory suspension. Many engineers may lack the mathematical ability; many theorists certainly lack the practical experience.

Effect of Spring Type

To take a few of the debated points, one of the first is the effect of length of spring. Now, a semi-elliptic spring 60 in. long is roughly the equivalent of an elliptic 30 in. long or of a three-quarter with the two pieces 40 in. and 20 in. each, and it is equivalent for this reason. Suppose the maximum movement of the axle relative to the frame of the car is 6 in., this deflection is taken up throughout the length of the spring. A semi-elliptic 60 in. long will, when deflected 6 in., take a form like Fig. 1. An elliptic 30 in. long deflected 6 in. will bend as shown in Fig. 2. In the second case the total deflection is divided between the halves of the spring.

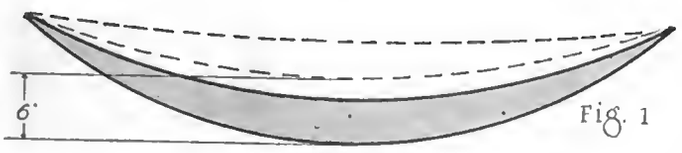


Fig. 1

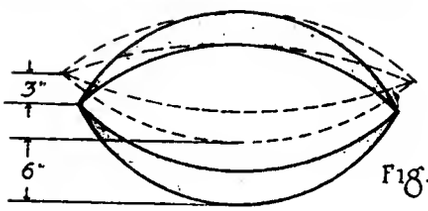


Fig. 2

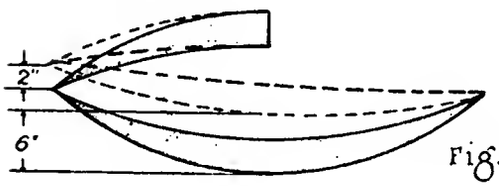


Fig. 3

Now take two points 10 in. apart on either the 60-in. semi-elliptic or the 30-in. half spring in Fig. 2, and it will be found that the relative displacement between the ends of the 10-in. section is the same in either case. In other words, each leaf is bent to the same extent by a 6-in. deflection whether the spring is a 60-in. semi-elliptic or a 30-in. full pattern.

This argument, of course, assumes that the upper and lower halves of the elliptic spring are the same strength. So with the three-quarter spring, it is necessary to proportion the strength of the 40-in. part and of the 20-in. part, so that the resistance to deflection is in proportion, we want, in the case of the three-quarter, two-thirds of the deflection to take place in the long portion and one-third in the short piece, Fig. 3.

This argument regarding length cannot be extended to cover the cantilever design, without some modification. That is to say the 60-in. semi-elliptic cannot be merely turned over and mounted as a cantilever without a change in detail and give the same effect.

In Fig. 4, suppose a weight of 100 lb. applied at *A* causes the frame to sink 1 in., then 50-lb. pressure on each end of the spring brings the frame 1 in. nearer the axle and the pressure required to cause this deflection may be regarded as 50 lb. on each end of the spring. Now take the cantilever in Fig. 5. Suppose the spring is just the same, then if we apply 100 lb. at the center it can be resisted by 50 lb. at each end as before. Under these circumstances the spring will be bent just as if it were a semi-elliptic, but the frame will have come 2 in. nearer the axle instead of 1 in., because point *B* is attached to the axle instead of to the frame. This is merely a matter of leverage. If we hang a weight from the middle of a bar we can lift it 1 in. by lifting *both* ends of the bar the same amount, but if we lift only one end of the bar we shall have to raise this 2 in. to obtain the 1 in. lift for the weight. This means that a cantilever spring which deflects, say, 1 in. for each 100 lb. of load on the car frame, would deflect only ½ in. if mounted as a semi-elliptic. This is only true in a rough way, as other considerations may affect the problem; it is merely to show what is the essential difference between the half-elliptic spring mounted either in the conventional way or as a cantilever.

Advantages of Long Springs

A long spring will obviously alter its curvature less for a given amount of deflection than a shorter spring, since the tangent to a large circle approaches more closely to the periphery than does a tangent to a small circle. This means that the metal of the long spring is less acutely bent or that the fiber stress is lower if the plates of the spring are the same thickness in both long and short springs. The life of a spring, or the time it will last before taking a permanent set depends upon the fiber stress; the smaller this is the longer the life will be. Thus a long spring is better for durability. Another reason for a long spring is that it causes less variation in the fore-and-aft movements of the rear axle relative to the frame.

With drive through the springs, which is almost universal practice to-day, and alteration in the curvature of the front

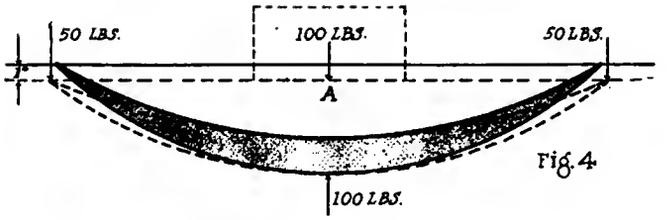


Fig. 4

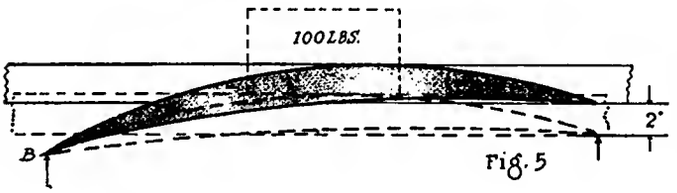


Fig. 5

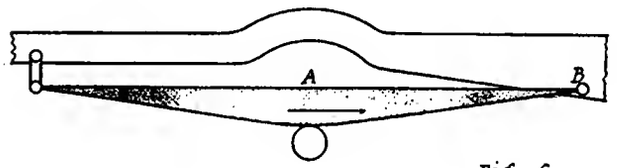
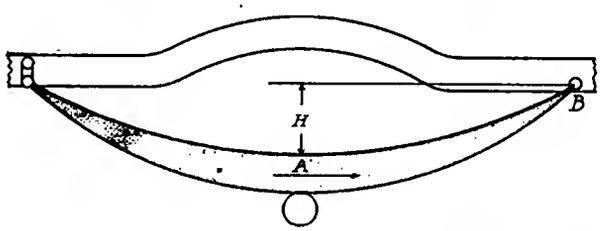


Fig. 6



portion of the rear spring will pull the axle forward or push it back. The longer the spring and so the smaller the degree of bending caused by a given total deflection, the smaller will be the disturbance in the relationship of the axle to the propeller shaft and the smaller the work thrown upon the universal joints in consequence.

Effect of Flatness and Camber

Engineers frequently call attention to the fact when their cars have springs which are nearly flat with the normal load. This is an advantage for two reasons, one when the drive is taken through the springs, and another however the driving effort is accommodated. Regarding the driving effort, consider the two springs shown in Fig. 6. The axle *A* applies a push to the middle of the spring which the latter transmits to the frame. If the point of attachment of the spring to the frame is normally in line with the middle point (if *A* and *B* are both on the same horizontal line), the drive has no tendency to distort the spring, but if the spring is curved so that there is a vertical distance *H* between the horizontal planes of *A* and *B*, then the force of the drive tends to increase the curvature of the spring, since the point *A* has a leverage *H* over the point *B*. Obviously this means that a flat spring does not have its "springiness" affected by the additional duty of taking the drive, while the curved spring must have extra strength to resist the bending tendency of the drive; over and above the strength required for supporting the weight of the car.

Next, a flat spring of the semi-elliptic type is better able to resist side stresses, and so is less liable to allow the body to roll on taking a curve at speed. This is explained by Fig. 7, which supposes a side stress equal to *x* lb. is acting at the spring eyes, then it is resisted entirely by the top plate of the spring which it tries to bend in the direction of its width; the opposite to the way spring action bends it. Obviously it has enormous strength to resist such bending. Now imagine the spring has a camber *h* so that the middle of the top plate is *h* in. below the spring eyes; then the side stress has a twisting leverage *h* over the middle point of the top plate. In other words, the side stress tends to twist the spring instead of merely trying to bend it laterally. That the spring is much more able to resist the bending than the twisting action is obvious. Of course, this is considering only side pressure and is not a complete analysis of the forces acting, but it suffices to show why a flat spring is stiffer sideways than a curved one.

This is a good place to mention width of spring and its effect, for from the argument above it is at once appreciated that the lateral stiffness of a spring with wide leaves is greater than that of one with narrow ones.

In considering driving stresses and torque reactions as well as in regard to sideways stiffness, it is the top plate of the spring that is most important. The other plates merely support the top plate from beneath. For example, in the case of driving through the springs, suppose the top leaf was too thin; then the push applied by the axle could cause the top plate to buckle and the other plates would have no power to prevent it. Every force passing between the axle and the frame of the car must go *via* the spring eyes and so *via* the ends of the top plate, which is why the top plate cannot be less than a certain thickness, however thin the other plates may be.

Effect of Number of Leaves

The reason for the multiple leaves in a spring is to provide friction to damp the free movement or bounce of a spring. We could carry a car on coil springs or on springs with but one leaf, but such springs would be too lively for actual use. Now we can make a spring of a given strength from a few thick leaves or from many thin ones; some springs in use on automobiles have as few as seven leaves and some as many as thirty-two. If a spring consisting of one leaf is compressed and then released it will oscillate till the molecular friction within the steel brings it to rest again, just as the friction on the pivot of a pendulum will stop its swinging after some lapse of time. If the spring consists of two leaves there will be less molecular friction within the steel, but friction will occur between the plates each time the spring is flexed, it is as though the pendulum in swinging was touching something lightly. The amount of friction is not directly proportional to the number of leaves, of course, but it increases as the number is raised.

The action can be regarded another way. Suppose the spring is such that a load of 100 lb. will compress it 1 in., if the load is applied instantly a spring with no friction will compress instantly. By virtue of this compression the load applied acquires kinetic energy which carries the spring beyond the 1-in. compression, the spring then rebounds and the action continues indefinitely. If the spring has several plates so that there is frictional resistance to flexion, but is still of the same strength so that 100 lb. will compress it 1 in., the kinetic energy of the movement during the compressing action is absorbed by the friction. If the friction is enough the kinetic energy will be absorbed entirely during 1 in. of movement so that there is no rebound till the load is removed; such a spring is said to be "dead beat" in scientific jargon.

Reaction when the load is removed has just the same effect on the spring as does the application of the load, so a multi-leaf spring which is dead beat, or partially so, on compression, is also dead beat on rebound.

There is another beneficial action due to the use of a large number of thin leaves, and this is that the life of the spring is increased. A flexible cable made up of many strands of wire can be bent tens of thousands of times, perhaps, while a single solid wire of equal strength might not

be bendable at all without breaking. So with the spring leaves, the length of the spring determines the arc to which it will be curved by a load put upon it. In Fig. 8 two pieces of material are shown bent to the same curve, with an outer radius R and an inner radius r. The normal length of each plate when flat is equal to the length of the bent plate measuring along the center line of the plate, otherwise along the arc midway between R and r marked S in the sketch. This is equivalent to taking the straight strip and pulling out the top while compressing the under part as shown in Fig. 8. The normal length is L, the length of the top when pulled out or bent is $L + x$ and the length of the underside $L - x$, we have, by bending the plate stretched half of it x in and compressed half of it x in. Now with the thin plate the difference between R and r is much less. If the thin plate has a normal length L as before its upper and lower sides when bent will be $L + y$, and $L - y$, and y is obviously much smaller than x, meaning that the material is much less strained in the thin plate than in the thick one by being bent to the same arc of a circle. This means that the thin leaf spring will take much longer to "tire" than the thick leaf, that it will retain its strength longer, other things being equal.

The limitations in making thin leaf springs are mechanical. Firstly, as explained before, the top plate must be thick for reasons unconnected with its spring action. Also the thin leaves are more troublesome to make than the thick ones, as they cool more rapidly between the time they are taken from the furnace and the time they are bent and plunged in oil to cool. This process is conducted very accurately, but it is only possible commercially to handle leaves of appreciable thickness. One could not, for example, make a motor car spring with 100 leaves, though about a third of this number is possible.

Another drawback is that a multi-leaf spring of a given strength is heavier than one with few leaves. Because the metal is less severely strained by bending, ten thin leaves of equal weight to five thick ones will not make as stiff a spring. The extra weight and the extra number of operations in making a thin-leaf spring cause it to be more expensive than a spring with thick leaves. At present the thin-leaf type is only a little more than experimental. Springs with thirteen or fourteen leaves are not unusual for heavy cars, but whether twenty or thirty leaves will become common cannot be decided yet.

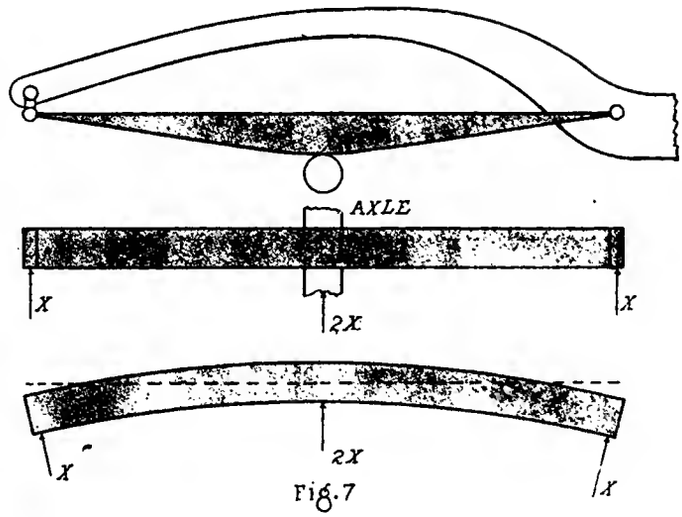


Fig. 7

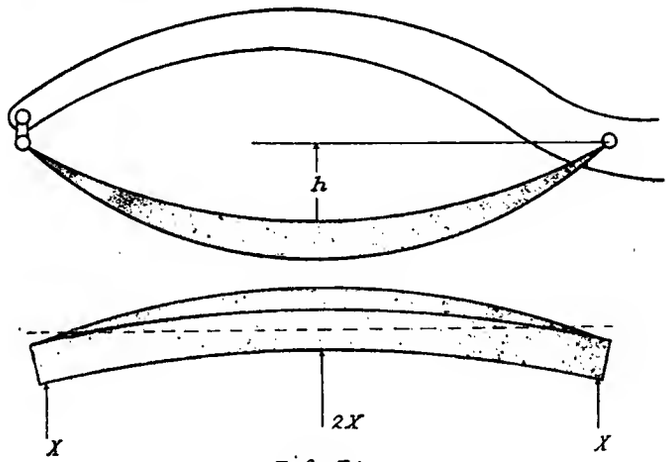


Fig. 7A

Why Axle Weight Is Important

Despite many arguments in the past, it is now generally agreed that a small unsprung weight improves the spring action of a car if everything else is unchanged. This can be explained by following along the line of argument used in connection with the effect of many leaves. Suppose the axle is lifted by a bump in the road a distance of 6 in., the ideal spring will absorb all the force of the blow and will not allow the body of the car to be raised at all. Now, if the spring has a strength of resistance equal to 100 lb. per inch of compression, a force of 400 lb. is necessary to compress it 6 in. Now, 6 in. is half a foot, so that the amount of work put into the spring by the lifting of the axle is 200 ft. lb. If the bump is merely a ridge leading up to a higher level on the road, the 200 ft. lb. will be partly absorbed by friction in the spring and partly used up by slowly lifting the body of the car till its distance from the axle has become normal again.

Now, if the bump is followed by a drop, as usually happens, no part of the 200 ft. lb. should be absorbed by lifting the body of the car, instead it must be used up completely. The compressed spring, when the wheel is at the top of the bump, contains 200 ft. lb. of energy which must be dissipated somehow, and the only way to absorb it is to use it up in friction within the spring or in some shock-absorbing device.

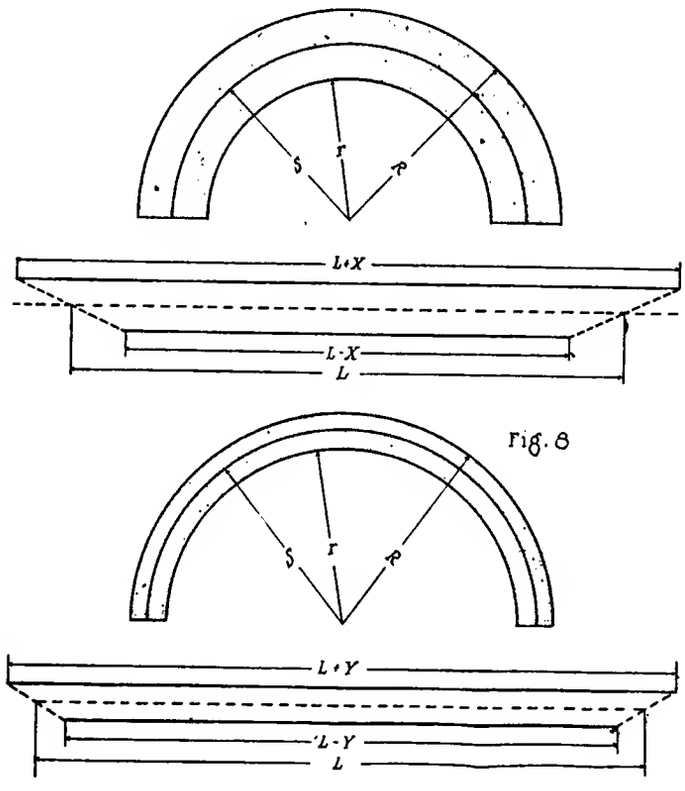


Fig. 8

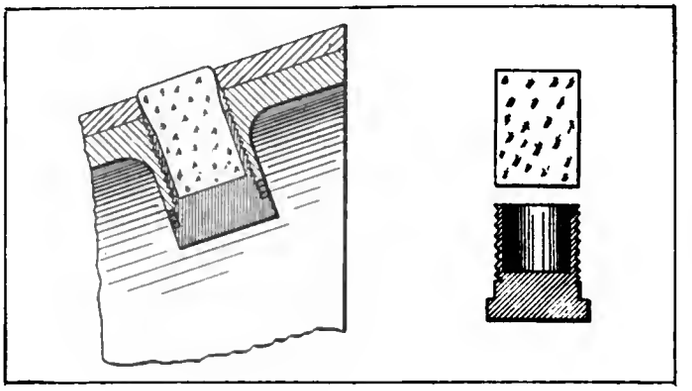
(This, like several other illustrations chosen, is not strictly true scientifically, but the error does not affect the point which it is desired to bring out.)

So far, an amount of energy equal to 200 ft. lb. has been considered because this is the amount of work necessary to compress a 100-lb.-per-inch spring a distance of 6 in., but actually the amount of energy put into the spring is greater than this. In rising up the 6-in. bump, the weight of the axle has been raised half a foot, so, if the axle weighs 200 lb., an amount of work has been done equal to 100 ft. lb. This does not affect the spring, but something which arises from it does. In running up the bump the axle acquires an upward velocity, and, if the bump is very sharp, the kinetic energy stored up in the axle by the time it reaches the top will be sufficient to make the tire leave the ground. In order to prevent the wheel from lifting, the spring must absorb the kinetic energy of the axle in addition to absorbing the 200 ft. lb. due to its own compression. Kinetic energy is a product of mass and velocity, so if the bump is the same size and the speed of lifting the same, a heavy axle will have more energy stored in it on reaching the top of the bump than will a lighter axle. Since this energy has to be absorbed by the spring it will be apparent that the spring has less work to do when the axle is light than when the axle is heavy.

Device for Increasing Security in Shipping Cars

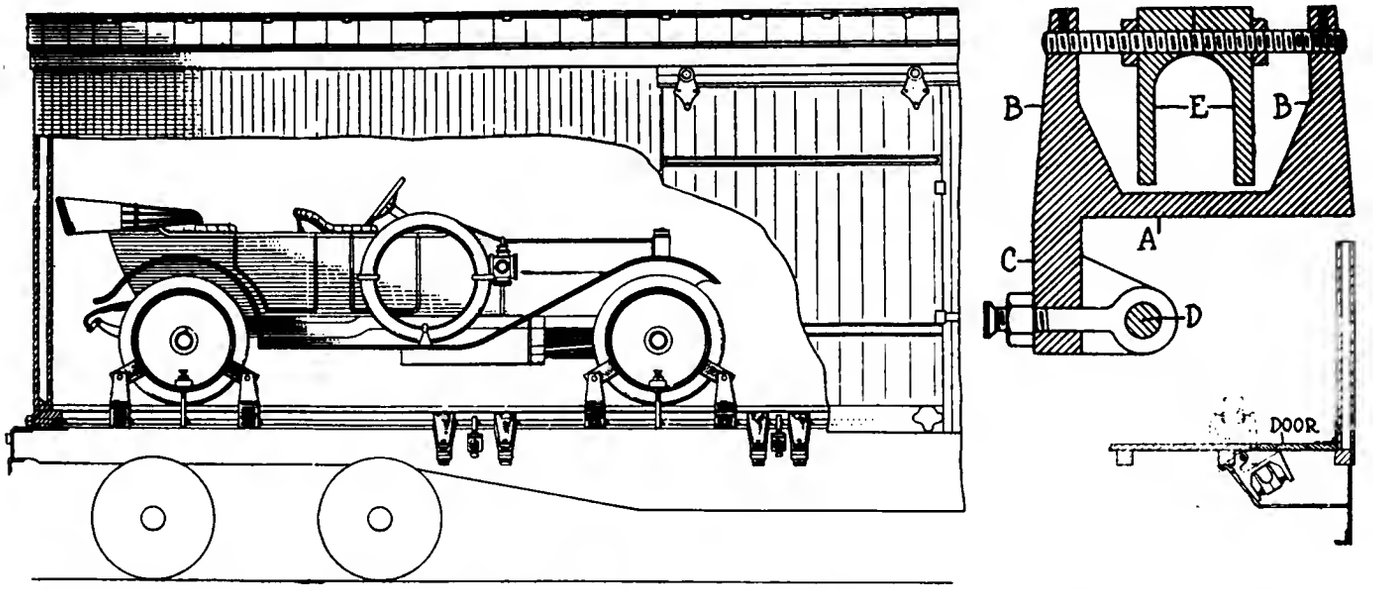
AN interesting device for securing an automobile during shipment in a freight car has been invented by E. F. Martin of New Orleans, La., patent No. 1,102,773. The attachment is fitted in the automobile freight car and is designed to prevent the car from movement either longitudinally or laterally in the freight car and also to prevent any undue wear of the tires or dents in the rims while in transit. The mechanism is also so arranged that it can be moved out of operative position below the floor of the car to prevent interference with other freight when it is carried.

The freight car is provided at each side of the floor with a longitudinally extending opening and these openings are normally closed by a series of doors which swing upward against the inner face of the side of the car or downwardly against the floor. These doors are closed under normal conditions and when they are closed the car does not differ from the ordinary freight car and may be used for other purposes than for automobiles. The supporting and clamping mechanisms for the four wheels of the automobile are connected with a rod which is located lengthwise in the car and held in fixed position. The supporting mechanism swing about these rods and when raised into position to hold an automobile each one comprises a substantial U-shaped support consisting of a body *A* with arms *B* and a lug *C* which hold the members supported to the rod *D*. In addition there is a U-shaped part *E* which swings upward and around the tire holding it firmly in position.



Slade Devises Adjustable Clutch Inserts

The invention illustrated above has recently been patented by Marshall P. Slade, Mount Kisco, N. Y., its idea being to provide a cork cushion for a cone clutch in which the corks can be renewed easily. Each cork is mounted in a sheet metal "cartridge" which can be screwed into place from the inner side of the cone. Shims can also be provided in the form of washers to allow the cork to be adjusted without renewal. The advantages of such a device as this are manifest, from the standpoint of both economy and convenience.



Martin device for adding to the security of automobiles in shipment on freight cars. This clamps the wheels and holds the car against stress in any direction

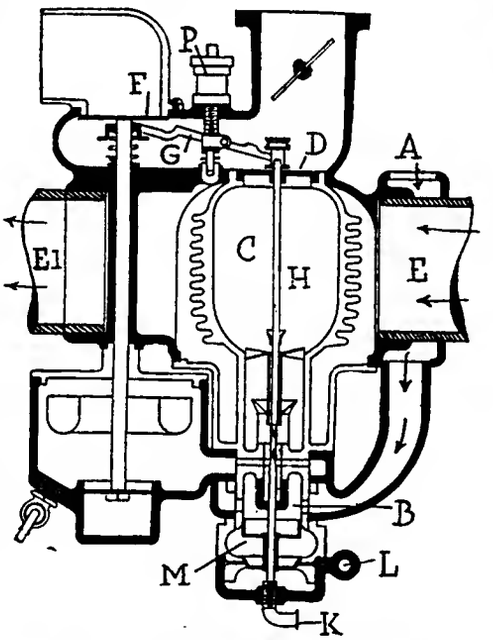
Kerosene Standard Tractor Fuel

Bennett Carbureter One of the Most Successful in Use and Fitted to Many Tractors—Design Based Upon Correct Principles

THE AUTOMOBILE for March 30, 1916, contained an article in which the major difficulties in carbureting kerosene were described, and it was pointed out how the various requirements for proper vaporization conflicted, making the design of a carbureter vastly more difficult than that for a gasoline instrument. One of the difficulties which have been among the troublesome ones is that more heat is required for vaporizing when running the engine at low throttle than running at full power. This means that when we have the greatest amount of exhaust heat available we want least, and vice versa.

Heat at Two Places

The Bennett carbureter, made by the Wilcox-Bennett Carbureter Co., Minneapolis, Minn., is now being used on a great number of tractors as standard equipment, and this instrument is constructed to take care of the peculiar heat requirements of kerosene. Briefly, heat is applied at two places. The main air has a variable temperature, decreasing as the load increases. The sprayed kerosene, mixed with the main air, then passes through a chamber which is kept at a fairly constant, high temperature by the exhaust, and after this cold air is added in quantities depending upon the suction prevailing at the moment.



Section through the Bennett carbureter, which is designed for the use of gasoline, kerosene, alcohol and distillates

Referring to the sectional drawing, the air enters at *A*, passes around the pipe *E*, which is the outlet for part of the exhaust of the engine, and gets beneath the nozzle through the holes *B*. Then the air passes upward through vertical holes around the jet and up into the chamber *C*. This chamber is surrounded by the exhaust gas entering at *E* and passing out at *E*1. *D* is not a valve, but merely a bridge piece, so the air mixed with the sprayed kerosene goes from *C* directly to the throttle.

As soon as the suction increases, as when the throttle is opened, the flat valve *F* begins to lift. This operates the lever *G* and raises the spindle *H*, thereby enlarging the kerosene nozzle, which is adjustable for permanent setting by the threaded needle valve *K*.

A Dashpot Feature

Now, right at the bottom of the carbureter there is a small hole *L* which lets in air under the little double piston *M*, and when the suction is strong enough, the double piston lifts and so closes the holes *B*. When the piston has risen high enough to close the holes *B* the hot air is cut off altogether by the rim of the upper part of the piston, but enough cold air to spray the fuel enters through *L* and gets to the nozzle through holes in the head of the upper part of the double piston. It will be noticed that the air valve *F* has its stem carried down into a kerosene well at the bottom of the float chamber, this acting as a dashpot. Also adjustment of the amount of expansion of the fuel jet in proportion to the air valve lift can be made by the screw *P*.

The effect of these different mechanisms is that, at low speeds, the hot air starts the vaporization of the kerosene, which is completed by contact of the mixture with the hot walls of the chamber *C*. When the engine is running hard, the chamber would get so hot that cracking might occur, therefore the hot air supply is cut off to allow the original mixture to enter *C* while cold. Actually in normal working it is stated that the gas leaves the carbureter at the throttle at 230 deg. Fahr. when idling and at 110 deg. Fahr. when at full load.

Automobile Possibilities

So far this carbureter has not been applied to automobile work, but exclusively to tractors, where it is in use on engines with two and four cylinders. Of course, the idling speed of a tractor engine is higher than that of an automobile motor, and the maximum speed is much lower, which means that the range is smaller, but the principles of the Bennett carbureter seem so closely in accord with theory that it should not be difficult to design a modification which would suit automobiles.

For starting purposes gasoline is fed to the carbureter instead of kerosene, a small tank of the lighter grade fuel being carried for this purpose. With most engines a few minutes running heats the vaporizing chamber sufficiently to allow a change over to be made to kerosene.

Kerosene Increases Heat

Mr. Bennett states that he finds the power of the kerosene explosion is sufficiently greater than that of gasoline to make it advisable to use a compression for kerosene rather lower than would be right for gasoline. The compression ratios to give definite explosion temperatures and pressures with gasoline are fairly well known, and kerosene needs a little less compression to keep the explosion pressure the same as with gasoline. The effect of introducing a small quantity of water with the gas is equivalent to reducing the compression, as the steam which is formed on explosion abstracts some heat from the charge and so lowers the maximum pressure at ignition.

In operation on tractor engines the Bennett carbureter gives full flexibility and there seems to be no smoke at low speeds, the engine idling just as well, when warm, on kerosene as on gasoline. On opening the throttle there is no hesitation or choking, the engine gets away without any symptom to show that the fuel is of heavy grade.

New Eight To Lead Jackson Line

48-Hp. Valve-in-Head Engine in Chassis Offered with Four Body Styles—Other Three Models Continued

THE new eight announced in THE AUTOMOBILE for Aug. 31, with a 48-hp. valve-in-head Ferro engine, and supplied in four attractive open-body styles will lead the Jackson line for next year. Outside of the change in power plant, the car is characteristic, and has the well-known full elliptic springs. The wheelbase is 118 in., and tires are 34 by 4 non-skid rear.

The three present models, two eights and a four, will be continued without change.

The price of the new model is in between that of the other two eights. It sells for $1,295 as a two or five-passenger. The four-passenger is $1,395, and the seven-passenger $1,370.

These figures are slightly higher than the five-passenger eight, which is continued at $1,195, and considerably below the seven-passenger eight at $1,685. The four-cylinder model lists at $985.

The bodies for the new chassis are decidedly modern and are attractively painted, the color combination being light maroon with black running gear and fenders.

Wire Wheels on Four-Passenger

All have tilted windshields, five and seven-passenger cars have a double cowl and the body rim is rolled in. Divided front seats and a sloping deck characterize the four-passenger, which has wire wheels as standard equipment.

The chassis is built of standard parts and the design is mainly conventional. The motor is combined with a Borg & Beck plate clutch and a three-speed Covert gearbox. The clutch is a departure in Jackson construction in that the other models have leather-faced cones.

The motor is a 3 by 3½ in. and develops its maximum of 48 hp. at 2400 r.p.m. The formula rating is 29 hp. and the piston displacement is 198 cu. in., which gives 0.246 hp. per cu. in. of piston displacement.

Intake Manifold and Water Outlet Combined

Both blocks of cylinders and the upper half of the crankcase are cast in one piece and the cylinder heads are detachable. Intake manifold and water outlet header are combined, the latter forming a jacket around the former; this not only gives a simpler construction, but also provides heat for the mixture. The manifold is arched and the carbureter is suspended from the center. Condensation cannot settle in the manifold but must run to one cylinder block or the other, thus loading is prevented. The generator is placed at the front of the V, and the ignition distributer at the rear. The exhaust pipes are on the outside.

Generator Is Belt-Driven

A feature of the design is that, although the valve-in-head construction is used, the valves are completely inclosed, yet they may be adjusted or the rockers may be oiled without removing the covers. This is due to the peculiar valve construction. The rocker is a steel pressing and has a cup at its center which fits over a ball-ended stud mounted in the head, which is adjustable from the outside, and by moving it in or out, the proper clearance between the rocker and the valve may be obtained. The ball joint is oiled by a wick which is placed in a hole drilled in the center of the stud.

Carbureter is a Zenith duplex, to which gas is delivered by the Stewart vacuum system. Starting and lighting are supplied by Auto-Lite units and ignition is by Remy distributer. The generator is driven by a 2-in. flat belt from a pulley on the crankshaft and adjustment is obtained by raising the hinged platform which carries the generator.

A two-blade fan is mounted on the front end of the generator shaft, and cooling is by thermo-syphon in conjunction with a vertical tubular radiator.

The crankshaft has three main bearings of 1 9/16 in. diameter, the lengths varying from 2¼ to 3 in., and connecting rod bearings are 1 9/16 in. diameter. The forked type of connecting-rod is used. The wristpins are bronze bushed.

Pistons are cast iron and have three Wasson rings. The pistons are slightly relieved on the wristpin sides. The wristpins are held in place by a setscrew and cotter pin. The clearance between piston and cylinder is 0.003 in.

The camshaft carries an independent cam for each valve and is mounted on three bronze bearings. It is driven by helical gear, and roller valve lifters are used. Valves have a mean diameter of 1⅜ in. with a total lift of 0.326 in.

Pressure and Splash Oiling

Lubrication is combined pressure and splash feed. The crankshaft and connecting-rod bearings are pressure fed. The gear oil pump mounted at the front of the motor pumps the oil through a regulator and thence through the hollow crankshaft to all the bearings. The suction line of the pump is on the right side of the motor and feeds the oil through a screen in the bottom of the pan directly to the pump.

The pipe line on the left side of the front engine gear cover leading to the oil regulator is the main oil pressure line. In order to prevent excessive pressure in the system a relief valve is interconnected with this line, which starts to open at a comparatively low pressure and throws the oil on the engine gears. This valve is placed on the top of the gear cover, and in case the oil gage does not register it may be found that dirt is interfering with its operation.

Hyatt roller-bearings are used throughout the gearbox. The shifting lever is a ball and socket type mounted in the gearcase cover. Carried on one side of the gearcase is a single-cylinder Stewart air-pump which may be thrown in action by a lever in a pocket in the floorboards. This pocket also carries the air-holes.

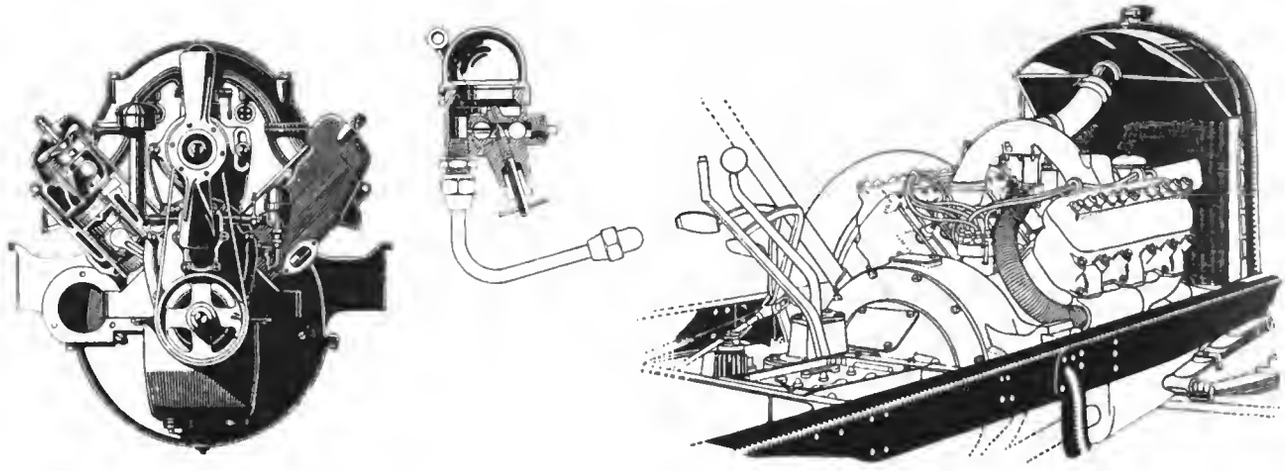
The driveshaft has two universals and both torque and driving strains are transmitted through the springs.

The rear axle is a Salisbury floating design with spiral bevel drive giving a 4¾ to 1 ratio. Brakes are internal and external 12 by 2 in. Bearings are Hyatt, New Departure and Gurney. The front axle is an I-beam made by the same concern.

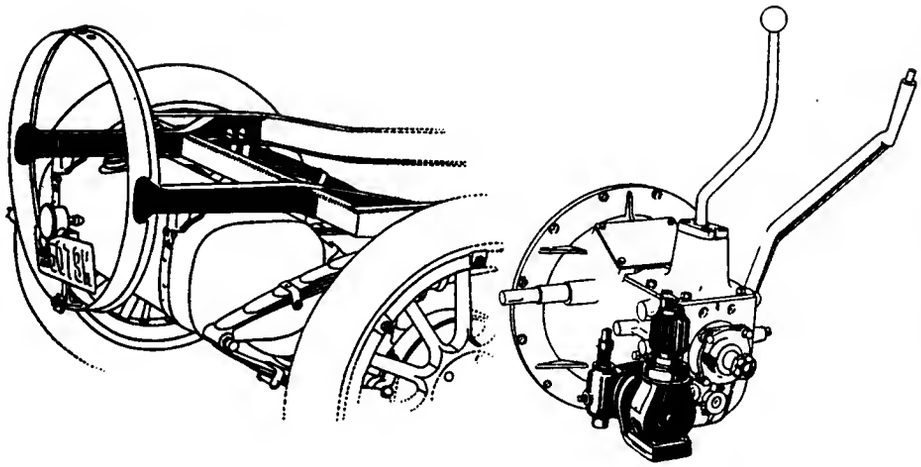
New Tire and Tank Support

A new support for the spare rim and gasoline tank has been devised. It consists of two horizontal channel members overhanging the rear cross member. The tank is suspended from these and the rim carrier is bolted to their ends. They are solidly anchored in the frame, extending forward to form diagonal reinforcing or gusset members for the frame.

A new door-lock has been designed which is extremely easy to operate under all conditions and yet is simple in construc-



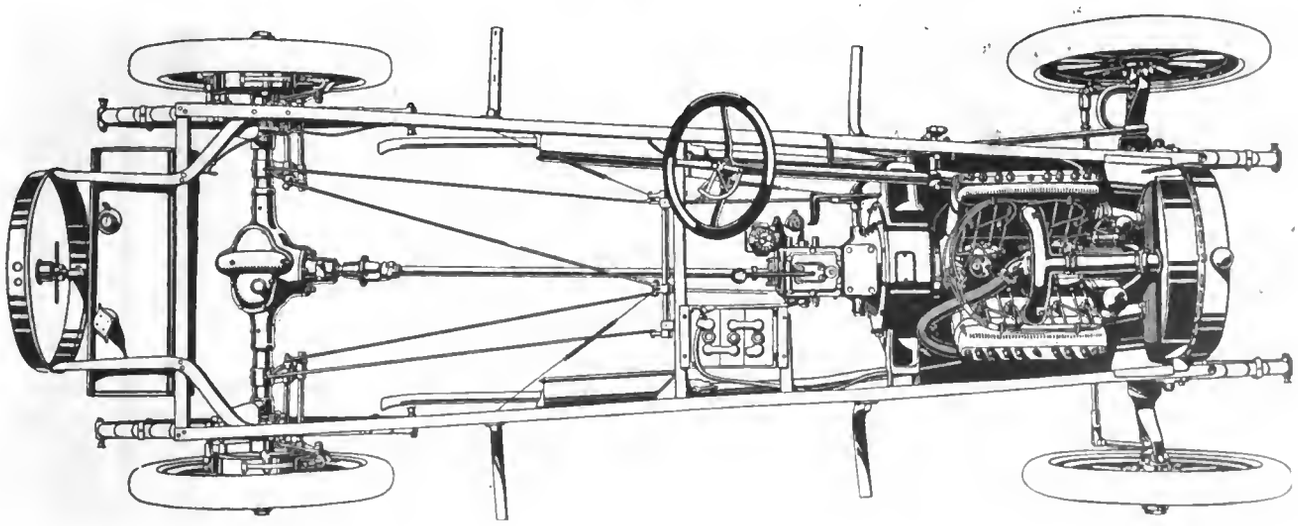
Details of the New Jackson Eight

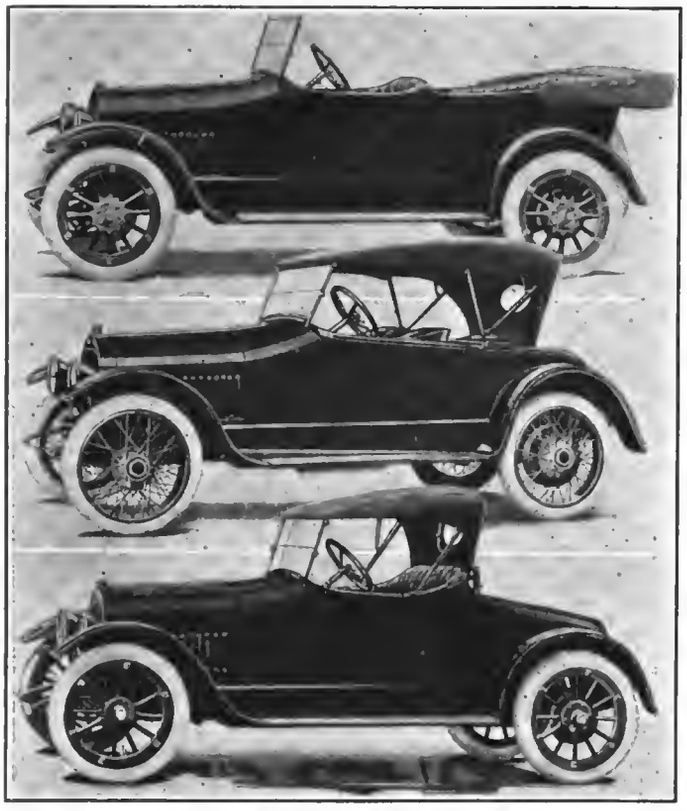


ABOVE at the left is the engine with the right block in section. Note the oil regulator with needle valve control mounted in front of the left block. This is illustrated in detail in the center. At the right the olean design of the power plant is brought out. The cylinder heads are detachable and the intake manifold and water outlet header are combined.

At the left are illustrated the substantial rear construction, tire carrier, fuel tank, etc., with the power tire pump mounting immediately to the right.

Below is the chassis in plan view, showing taper frame, compact power plant and mounting of storage battery.





Upper—Touring body on the new Jackson eight chassis selling at $1,295. Middle—The four-passenger cloverleaf at $1,395. Lower—Two-passenger roadster at $1,295. All have tilted windshields and rolled-in body rim. Wire wheels are fitted as standard equipment on the four-passenger

tion. It is operated by a button which is flush with the upholstery and consequently cannot catch the clothing of passengers getting in or out. An advantage is that pushing the button and opening the door is one movement, and it takes very little pressure to operate the button. The catch on the lock rotates instead of sliding, as is usually the case. It is pinned to a short rod and the position of these two members is such that they are just over dead center and the catch cannot be moved. When the button is pressed these two members are thrown off dead center and the catch opens.

The four-cylinder car known as model 34A is made as a five-passenger touring or two-passenger roadster. It has a unit power plant consisting of a 3½ by 5-in. L-head block engine, cone clutch and three-speed gearbox.

Schebler carbureter and Stewart vacuum system are used; ignition is supplied by a Connecticut distributer and starting and lighting are Auto-Lite units. A centrifugal pump is used for circulating the cooling water. The wheelbase is 112 in. and tires are 32 by 4, with non-skids in the rear.

The smallest eight is also made with a two or five-passenger body and the largest eight with a seven-passenger body. The former has a 2⅞ by 4½-in. engine and the latter 3½ x 4½-in. The specifications are the same as for the four except that the largest eight has 124-in. wheelbase and 34 by 4½ tires.

The stock color for the four is Brewster green with black-enameled hood and fenders. The smallest eight is dark green and the largest eight dark blue, both with black enameled hood and fenders.

The equipment is complete, consisting of one-man top, Collins curtains, with curtain openers on the doors, rain-vision windshield, Stewart speedometer driven from the transmission shaft, etc. All three eights are equipped with a tire-pump and the four is designed so that a pump may readily be attached.

Red Cross Truck for New York Militia

CAPABLE of traveling 72 hr. in a desert without replenishing its supply of gasoline, oil or water the special 2-ton Jeffery Quad shown in the illustration was recently presented to the New York National Guard by Mrs. Cornelius Vanderbilt of the American Red Cross Society. The vehicle has been shipped to the Mexican border by express, together with six Trailmobiles, each of which is fitted with stretchers to accommodate four wounded men. The vehicle will be manned by two drivers, six nurses and two doctors. The cruising radius of the outfit will be more than 400 miles, the additional gasoline necessary being taken along in steel barrels slung from the body platform on both sides of the truck, as illustrated. In all, 134 gal. of gasoline, 20 gal. of lubricating oil and 300 gal. of fresh water are carried.

Eynon Heavy-Fuel Carbureter Uses Electric Heat

No More Parts Than in the Conventional Gasoline Type of Instrument—Complete Gasification Claimed Even with Alcohol or Heavy Distillates

ALTHOUGH gasoline prices are lower now than they have been in some time, there is no lull in the activities of inventors all over the country who are working on a feasible scheme for burning the heavier grades of fuel in automobile engines. In all of the carbureters intended for this purpose, now coming through, there are two tendencies which are distinctly observable. These are the positive preheating of fuel and air, and a well-defined means of breaking up the fuel into globules.

Electric Heating a Feature

One of the latest of these, the Eynon carbureter, to be made hy the Kerosene Carbureter Co., Cleveland, Ohio., exhibits both these tendencies to a remarkable degree. The heating feature is particularly interesting because it is electric. This is not the first time that electricity has heen applied to the vaporizing medium, but it is one of the first attempts to make the electrical feature a unit part of the carbureter itself and to be a factor in producing the explosive mixture. The use of electric heating is, of course, due to the fact that it is independent of the engine. Where the engine is started on gasoline and then operated on kerosene, the exhaust heat is naturally available.

In starting on the heavier fuel, as is intended to be done with this instrument, electric heat is immediately available. It is simple, and since the passages to be heated are small, only an unimportant amount of current need be consumed. The total number of parts in the Eynon carbureter number about fifty, or about the same as in the ordinary gasoline instrument.

The electrical device consists of an ordinary spark splug inserted in the upper part of the mixing chamber and attached to the battery which operates the spark plugs in the engine. The spark plug heats an electrical resistance wire which is wrapped around an asbestos wicking saturated with kerosene. The vapor from the kerosene in the wick is ignited immediately when the current is passed through the spark plug, thus providing for the instant starting of the car.

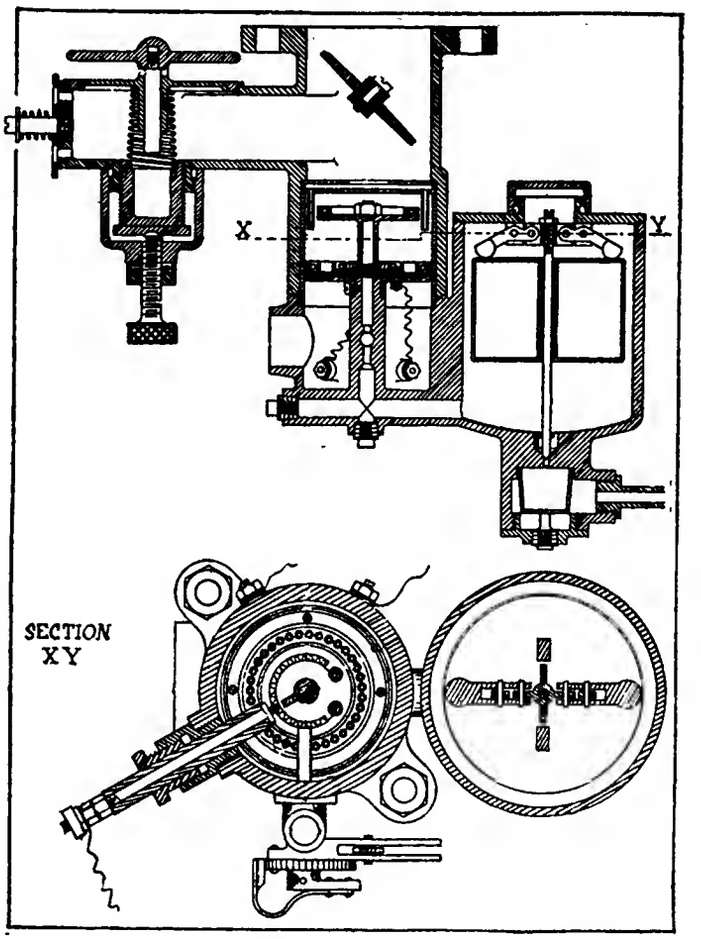
When the engine is effectively started this electrical heating element is discontinued, combustion in the mixing chamber continuing because of the air and finely divided kerosene passed in. By a system of choke plates similar in operation to the gauze of a miner's lamp the flame in the mixing chamber is prevented from extending beyond the carbureter into the engine. Only about 4 per cent of the vapor is consumed in the mixing chamber, it is claimed, due to a limited supply of oxygen and the speed with which the vapor passes through the carbureter, the rest passing the baffle plates in the form of a hot gas. The gasified oil is then mixed with air drawn through an auxiliary valve with a constant opening, and is then passed into the cylinders. Combustion is said to be clean with practically no carbon formation.

Breaking Up the Kerosene

The method of breaking up the kerosene is interesting. The kerosene passes through the ordinary type of float mechanism, flow being regulated by the suction of the cylinders at atmospheric pressure, and spreads out in a thin film between horizontal plates, around which air passes. These plates are pierced by numerous small holes, the upper plate having holes of a larger diameter than the lower one, which gives a pulverizing effect to the fuel. The inventor says:

"This method of carburetion secures complete gasification not only of the lighter distillates of petroleum but also of the heavy distillates, such as all grades of alcohol, kerosene and crude oil. The true gas I obtain from the heavier distillates is secured at atmospheric pressure and is a gas of a different character than is produced by any process with which I have heretofore been acquainted in that for a long period it will not condense at the ordinary atmospheric temperature.

"This gas when further mixed with air is highly explosive and leaves little or no carbon deposit in the cylinders. By use of the heating step in connection with the preliminary mixing it is not necessary to use the light distillates for starting the engine to raise the temperature of the working parts. Gasoline and other light distillates may be gasified without the use of the heating step."



Sections through the Eynon heavy-fuel carbureter, showing connections for electrically heating the fuel

U.S. Trucks in Mexico

A White truck train with the troops in Mexico, traveling in characteristic single file along a road paralleling the railroad

Above—Riker tank truck adopted by the War Department for carrying water and gasoline

Below—Mexican assisting U. S. officers who are stuck in a mudhole

By J. Edward Schipper

MEXICO is doing the automobile industry a good turn. Even the activities of the pernicious and elusive Villa have boomeranged to the benefit of a business which has seized some odd stepping stones in its upward climb. It remains for Mexico, however, to put the finishing touch by showing us very clearly what the limitations of our trucks are, and just what they can do with the odds all against them.

Every once in a while a story leaks through which shows that things are not as rosy for our motor transport on the Southern frontier as some of the more interested parties would like all hands to believe. Stories of broken wheels, broken springs, discarded engines and destroyed chassis are mingled as a piquant sauce with other stories of remarkable accomplishment, showing that smiles are being well mixed with tears along the Rio Grande.

The Governor Problem

To give an idea of the problems which confront those in charge of a truck company, nearly every one along the line is wishing for an invention which would govern a truck on a smooth road and take the governor off when it came to rough going through mud holes, etc. In the early days along the line, the main idea which possessed those in charge of the trucks was to conserve the vehicles as much as possible. Naturally some very strict regulations were made regarding governors and it meant a man's job if he were caught removing or tampering with the device.

Speeding on Good Roads

It is not difficult to picture the chagrin of a man who is stuck in a mud hole a great many miles from camp, unable to get through simply because he could not pull the pin out of his governor. They are being removed now, and the result is that human nature, or at least human nature as always shown by a driver, especially in khaki, is asserting itself along the better highways. The cars are being driven too rapidly in a great many instances.

How to employ momentum scientifically and with

Note the alkali dust thrown up by the wheels of the truck. This is a White truck train

Field generator and tractor with searchlight used by the U. S. Marine Corps

skill is the first lesson that is learned by all the rookie drivers. If a car stops in a difficult position, the difficulties are infinitely more than if the car kept going. The result of this is a great tendency for the driver to enter a bad stretch with a rush and dash, to carry the car through.

In some parts of the country where trucks have been used the stresses have been extraordinarily severe. This has been shown in frame distortion which has had its reflection throughout the entire car. Trucks which stand up on the roads in ordinary commercial practice, soon suffer from the extraordinary duties imposed in a country where the roads are roads in name only. The distortion of the frames has resulted in loose bodies and very often it occurs that the engines have become loose in the frame. Yet with all this difficulty and terrific stress, the trucks have done the work which they were sent down there to do. The point is that here is where each weak point is found out. It cannot be discovered, and the border work has become the greatest school of truck design that could ever be invented. What racing is to passenger car design, border work is to truck design.

There are a great many holes as well as a great many trucks, and the hole and truck combine to form a situation, at frequent intervals. It does not do a truck any good to race the engine up to a very high speed and then to let the clutch in suddenly, to get out of a mud hole. It is better to have a very low gear ratio to pull the truck out of the hole and this method is successfully employed on some of the later shipments of trucks. In other words, it is necessary to have high available torque at low speeds in order to overcome the road conditions.

Alkali Dust Causes Wear

If some device could be applied to the trucks for washing the air before it enters the engine it would be of advantage. As it is now, the alkali dust enters the cylinders and not only acts as an abrasive, but it seems to have an actual chemical action on the lubricating oil. Its action on the lubricant, whether chemical or mechanical, is certainly enough to cause rapid disintegration of the engine parts.

Springs naturally show the reflection of road conditions very quickly and there has been the normal amount of spring breakage, as would be expected. The cars that have been shipped down to the border have been in general equipped with the standard springs. As has been commonly observed in spring breakage, the fracture generally occurs on the rebound. It is quite possible that a large number of the spring breaks could be prevented by simply keeping a closer watch on the spring clips. These are bound to work loose and the spring is then deprived of a large part of its unit strength.

Racking Is Severe

It must be remembered that all the cars on the border, whether they are passenger cars or trucks, are submitted to a continual pounding and racking. Drivers say that the first few days in the seat of a car on the border is worse by far than learning to ride horseback. One reports that after riding several miles in an officer's touring car, he was unable to walk without stooping for 3 days. There have been many cases where a man sitting in the back of a touring car with the top up have been bounced so that their heads nearly went through the top material. It is necessary to hold fast to the top irons generally and a speed of more than 25 m.p.h. is rarely attained.

Every weak spot in a car is soon found out, and the manufacturers who have trucks on the border are making a mistake if some one from the engineering department is not watching developments.

Great Kerosene Activity in England

Government Reduction of Gasoline Supply Compels Development of Heavy Fuel Carbureters—One New Device Utilizes Jet of Exhaust Gas to Spray Fuel

By A. Ludlow Clayden

THE British government has recently introduced a system of supplying gasoline which has compelled every user to state the quantity he will require per month. When all the returns were in, the government issued tickets authorizing individuals to purchase a maximum quantity of gasoline (usually about 30 per cent of the amount applied for). These tickets remain in force for a period of 3 months entitling the purchaser to so much per month, *if he is able to buy it.* This means that every time a purchase of gasoline is made the quantity is to be checked off by the vendor and as soon as the recipient's card has been exhausted he can obtain no more until the end of the period.

A natural result has been the creation of tremendous interest in means for burning kerosene, the sale of which so far has been in no way restricted. To give an idea of the situation it may be mentioned that many owners of 30-hp. cars have been allowed 12 gal. or less of gasoline for the whole period of 3 months.

Gasoline in normal times has sold in England for approximately 30 cents a gallon and this price has not been high enough really to stimulate kerosene investigation. Now, however, that the alternative is kerosene or no motoring, the situation has been changed very greatly.

It is, of course, easy for users of automobiles in this country to be philosophic over the troubles of people on the other side of the Atlantic, but it seems probable that mankind in general will benefit very greatly from the restrictions imposed by the British government. The rising price of gasoline in America has stimulated investigation of the possibilities of kerosene but the encouragement now offered indirectly by the British government is a hundred times as strong.

Two Interesting Systems

The British automobile journals for the past few weeks have been filled with descriptions of kerosene carbureters and similar devices. It is noticeable that very many of these have originated in America and are already fairly well known on this side of the water. There have, however, recently been described by the *Commercial Motor* (London) two instruments which differ considerably from the majority of kerosene-burning carbureters. The first of these is the Halliday carbureter, which uses a water supply designed to moisten the air and to produce steam in the cylinders.

In describing the operation, the *Commercial Motor* says:

"Among the troubles encountered in burning kerosene in engines designed for gasoline are: excessive use of lubricating oil, owing in part to the higher temperature necessary when kerosene is being used; failure of lubricant because the kerosene has not been properly vaporized, or because it has again condensed in the cylinders and liquid kerosene has run down past the pistons into the crankcase, eventually thinning the lubricant to such an extent that it fails to act; excessive carbon deposit, and a tendency to knock on very little provocation.

"The outstanding feature of the Halliday carbureter, whereby it is claimed that these troubles are effectively eliminated, is the utilization of a jet of steam to accompany the ingoing charge of air and vaporized kerosene. It is very ingeniously designed, as a reference to the illustration will help to confirm. Briefly, the device consists of two float chambers, one containing gasoline, for starting purposes, and the other kerosene, both connected to the same jet, with a cock adapted to divert either fuel to the orifice as may be required. This jet is situated within a narrow venturi-shaped choke tube, of such a size that at slow speeds a fairly rich mixture is provided; at high speeds, the spring-controlled extra air valve dilutes the charge.

"So far as will be seen, the device differs but little from several other two-fuel fittings which we have hitherto described. The novelty consists of an additional jet to which water is supplied. This jet is situated in another choke tube controlled by a small throttle valve. The connections to the carbureter are so arranged that when gasoline is being used the small extra throttle valve is shut, but on the kerosene's being supplied, then this throttle valve is open, according to the strength of mixture required. From the water jet, an additional pipe runs to the main engine induction manifold, so that a percentage of moist air is carried into the cylinders with each charge. To this feature must be credited the efficiency of this carbureter. The effect of the inclusion of moist air in the charge is to cool it somewhat and thus allow a greater volumetric efficiency on the induction stroke. On explosion, the moisture in the air is converted into steam, the extra pressure thus obtained providing additional power, and cushioning the explosive effect.

"A new company has just been formed to proceed with the manufacture of this carbureter on a large scale. The name of the company is the Halliday Carburetter Co., Ltd., with temporary offices at Broad Sanctuary Chambers, Westminister, London, S. W."

Uses Exhaust for Spraying

The second instrument is called the Cairns Hevfuel Gasifier, which seems to operate on an entirely novel principle, the following being the *Commercial Motor's* description of the action:

"The Cairns Hevfuel Gasifier incorporates the feature, not hitherto described, of an exhaust gas injector, some of the spent gases being mixed with the fuel. On theoretical grounds one would be justified in casting doubts on the efficacy of such a proceeding. We have, however, already investigated privately the merits of one carbureter in which this is accomplished, and in the Cairns device, although exhaust gas is re-admitted, the quantity is very small.

"We have not been able to make a test of this carbureter, and can only repeat, therefore, the claims of the inventor as to its capabilities. He particularly emphasizes the fact that the heavy fuel is thoroughly vaporized and does not recondense; furthermore, that maximum heat and velocity with a minimum quantity of exhaust gas is utilized. Its fitment necessitates, as is now generally understood, the addi-

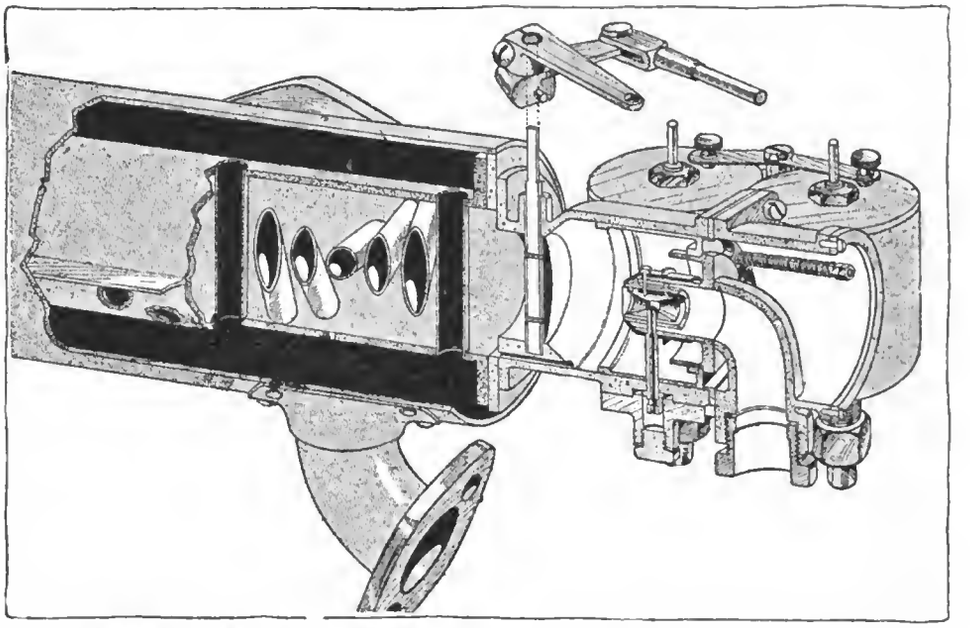
tion of a small supplementary tank for gasoline, utilizing the main reservoir for kerosene.

"The device consists of a kerosene float chamber and jet, a muff round the exhaust pipe, and centrally disposed inside this muff a tube inserted into the exhaust pipe, which serves to collect a small quantity of the spent gas, and directs it across the jet. Reference to our illustration will enable the reader to grasp the general arrangement of the fitting. It will be noted that it is entirely additional to, and separate from, the standard gasoline carbureter, interference with which is avoided, except that the connection from the kerosene carbureter is made to the main air inlet of the gasoline carbureter.

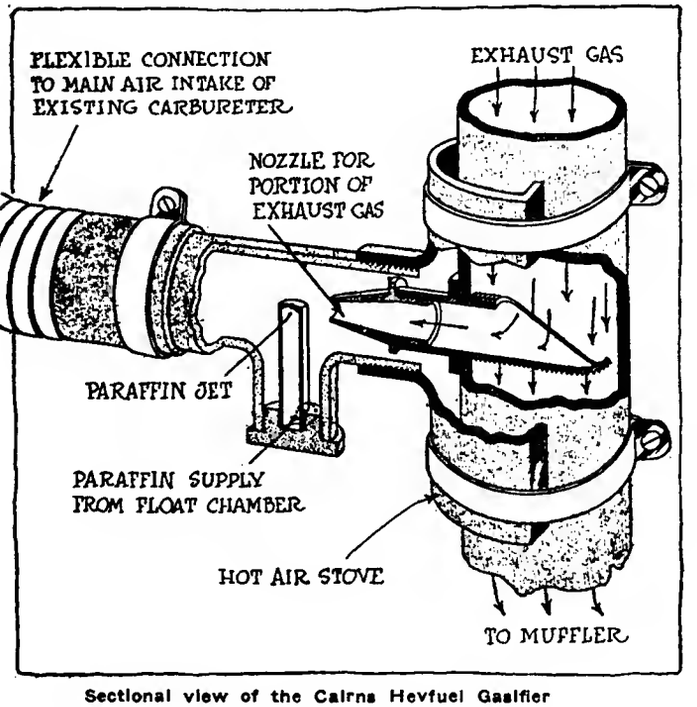
"In action the device provides that the blast of hot gas at high velocity is driven across the top of the fuel jet, atomizing and vaporizing the kerosene. A small amount of air for preliminary dilution purposes is drawn in by the injector action of the nozzle, not sufficient, however, to give a combustible mixture, but providing a gas rich in fuel. This rich mixture is taken through a flexible pipe, which is covered with non-conducting material, to the main air inlet of the gasoline carbureter, where provision is made for further dilution by means of an extra air control. The ordinary gasoline carbureter throttle-valve is utilized to regulate the supply of gas to the engine. It is claimed that the user can change over to heavy fuel after a minute's running of the engine on gasoline. We understand that the inventor, Thomas Walker Cairns, of 2 North Road, Birkenhead, England, will consider an arrangement to manufacture commercially in quantities."

This seems to be a particularly interesting device but it is not obvious what will be the effect of speed or load upon the operation. In a kerosene vaporizer more heat in proportion to the amount of kerosene used is required when running at low throttle than when running at full power. There seems, however, no reason why the Cairns carbureter should not be so designed that it will conform very closely to the ideal conditions. The principle appears to be an advance upon those of several other inventors who have actually ignited and burned a small portion of the kerosene, using the heat so evolved to vaporize the remaining portion.

With nearly all kerosene carbureters it is necessary to start the engine on kerosene and change over the heavier fuel when the engine is running. This necessitates carrying two fuels and it is therefore somewhat of a nuisance.



Halliday carbureter and vaporizer in detail. This device has a water supply as well as one for kerosene. The two bowls are for kerosene and gasoline



Sectional view of the Cairns Hevfuel Gasifier

Starting on Kerosene

The two British papers, the *Light Car* and *The Autocar*, have recently been discussing methods for starting up on kerosene direct, and one ingenious idea suggested is to warm up the intake manifold, or the vaporizer, by heat obtained from two or three small gas jets which can be coupled up to the ordinary household supply before starting out in the morning. Once the vaporizer and intake manifold are warmed the car can run all day on kerosene without trouble, provided the engine is not allowed to stop altogether for more than a few minutes at a time.

Another suggestion is to place a small boiler on the fire, taking the steam created into the radiator by means of a flexible pipe. This steam bubbling through the water will soon bring it to near the boiling point and this, it is stated, is hot enough to allow a start to be made on kerosene. The writer has found in warm weather that it is often quite possible to start on kerosene by first injecting a very small quantity of ether into the intake manifold or cylinders.

Having regard to the electrical equipment of most modern automobiles it appears that far the best way to get a start on kerosene would be to spray the fuel onto a coil which could easily be raised to a red heat by the battery current. A throttle placed in the exhaust pipe could be almost closed to make the manifold heat up quickly, so as to allow the current to be switched off swiftly.

Those vitally interested in the kerosene carbureter problem should pay close attention to British contemporary literature during the next 6 months, for undoubtedly it will contain practically everything that is known regarding the application of moderately heavy oil to automobile usage.

Heat Deteriorates Cast Iron

Cylinders and Piston Heads in Large Oil Engines Slowly Oxidized by Temperature of Explosion —Nature of Grain of Iron Affects the Action

THE issue of *Engineering* (England) for Aug. 4 contains an interesting article by J. E. Hurst entitled, "The Growth of Internal Combustion Engine Cylinders," dealing with the phenomenon of "growth" in the cylinders of large oil engines, particularly Diesel engines. The author first mentions cases where gray iron structures have failed when subjected to frequent and violent changes of temperature, such as the appearance of cracks in cast iron fittings of superheated steam mains. In the original investigation of the problem the conclusion reached was that the hot gases of a furnace can penetrate the iron by way of the graphite plates which are a constituent of cast iron. Long action results in the oxidation of the graphite contained and also, to some extent, of the iron itself.

Regarding the effects observed in the cylinders of internal combustion engines, the author says:

"Experience with internal-combustion engine liners shows a phenomenon which would appear to be very much allied to this 'growth.' When a new liner is put to work it is invariably necessary to make some slight adjustment to the piston. Apart from such considerations as slight inaccuracies in machining, etc., this adjustment is often necessary owing to the slight changes in volume of the cast iron of which the liner and piston are constituted. This is further borne out by the fact that looking back over a series of examples the character of the iron would seem to influence the extent of adjustment to be made. If the iron should be in any degree open grained, or rather contain more large graphite plates, the degree of adjustment necessary is greater than in the opposite case. In so far as can be judged by observation over a long period, the grain size, and more particularly the size of the graphite, is the controlling factor. The difficulty of obtaining any definite information as to the cause of this phenomenon will no doubt be obvious. The miscroscope gives little information.

Expansion in Grains

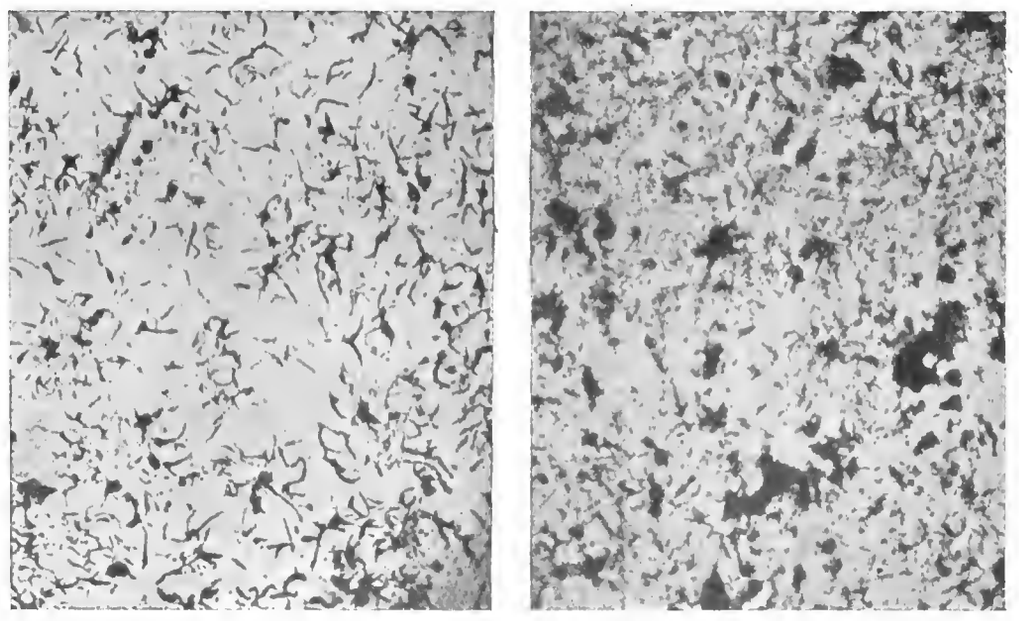
However, in the author's opinion this change in volume would seem to be due to an expansion among the grains composing the liner and piston surfaces, brought about by the rapid succession of changes of pressure within the cylinder. This results in the entrance of gases and lubricant into the interstices of the grains by way of the graphite plates, an action which is no doubt facilitated by heat; hence the slight changes of volume.

"Experience with micro-sections from such surfaces frequently shows the presence of lubricant, which is ofttimes troublesome during the preparation of such specimens, even after the specimens have to all intents and purposes been thoroughly cleaned.

"Undoubtedly this phenomenon results in a falling off of the mechanical strength figure; but it is considered that the change in volume is confined to a comparatively thin layer of the surface only, and it is obvious that the extent will be controlled largely by the grain size and the internal pressure.

"*A loosening of the surface grains is an invariable consequence of this change in volume, a factor which is of great importance in determining the wear of liners and pistons.*

"In the internal-combustion engine, and more particularly in engines of the Diesel type, the piston head is heated to an excessive temperature, quite distinctly red. This heating is local and extends over an area in the center of the piston head, on which the flame produced by the combustion of the charge impinges. The effect of this heat on the material composing the piston is to eat away a layer of the metal, and if the material be certain kinds of cast iron radiating cracks are produced extending from the center of the heated area across the piston head. Such cracks are commonly put down to the growth of the metal under the influence of the alternate heating and cooling. However, an examination of specimens of this type of occurrence would lead one to the conclusion that this is not growth in the strict sense of the term. The chemical analysis of such specimens does not undergo any appreciable change in total composition, nor is there any trace of oxidation in the actual metal; and further, in direct opposition to Carpenter and Rugan's conclusions respecting growth, a reduction of the phosphorus content of



Left—Fig. 1—Normal iron, showing graphite plates. Unetched. Right—Fig. 2—Heat-treated iron, showing swelled graphite. Unetched. Both are magnified seventy-eight diameters

the iron entirely eliminates all these troublesome cracks.

"Undoubtedly these cracks are the product of a series of events occurring internally in the cast iron under the special circumstances. On heating common foundry iron up to a temperature of from 750 to 900 deg. C., a range of temperatures which includes that of the Diesel engine piston top, it is observed that some of the graphite is absorbed, forming the austenite (hardenite) solid solution. The extent of the graphite absorption at any particular temperature depends largely upon the time of heating and the volume of the material. This absorption is accompanied by a formation of numerous cavities larger in cross-sectional area than the original graphite plates, Figs. 1 and 2. On cooling down slowly the free carbon is redeposited, but this time it is not necessarily in the graphitic form, but in a condition more of the nature of temper carbon. The phosphorus assists this absorption of carbon considerably, though exactly the manner in which it does so is as yet somewhat obscure. It is observed that the absorption of carbon takes place with increased rapidity in the high phosphorus irons, while in low phosphorus irons the action is brought about with some difficulty. It is further noted that at the higher temperature, 900 deg. C., the phosphorus tends to liquate and aggregate into larger rounded areas. In the red-hot piston top of the Diesel engine some of the free carbon is absorbed in a like manner as above described. The extent of carbon absorbed, limited, of course by the saturation point at the particular temperature, depends largely on the length of time and the bulk of the metal heated, and in addition on influence of the phosphorus content. On cooling down this absorbed carbon is deposited in the temper carbon form, a fact which will account for the distinctive grayness of these overheated pistons when fractured. This absorption and re-precipitation of the carbon alone, apart from the expansion of the graphite plates shown in Fig. 2, the reason for which is not quite clear, will set up a series of repeated expansions and contractions, the effect of which will be obvious. In addition, it will be appreciated that at the temperature of this particular portion of the piston the phosphide eutectic is perilously near to its melting point, and it is in all probability a fact that liquation does occur, a phenomenon which will further assist in the production of cracks.

"The high and constantly changing gas pressure in Diesel engine cylinders will also largely assist in the production of cracks by the gas forcing its way into the cavities and cracks produced by the absorption of the graphite, and the liquation of the phosphide eutectic, and there assisting in the rending apart of the component grains. This action is not confined to a thin layer of the exterior surface only, but extends right into the interior of the metal. In this respect it is unlike the former case mentioned.

"In the case of low phosphorus irons, in which the chances of liquation of phosphide eutectic are reduced to a minimum, all trouble from cracked piston heads is practically absent."

Naturally automobile engines are not subject to quite the same severe conditions as the bigger engines of Diesel type, but the phenomenon of cast iron deterioration in exhaust pipes and muffler parts is well known. Also, it seems possible that cylinder wear might be reduced by choosing the cast iron best suited to the high temperature conditions; that is, the low phosphorus iron. In the large cylinders or tractor engines the nature of the iron might reasonably be expected to have an effect upon the wear.

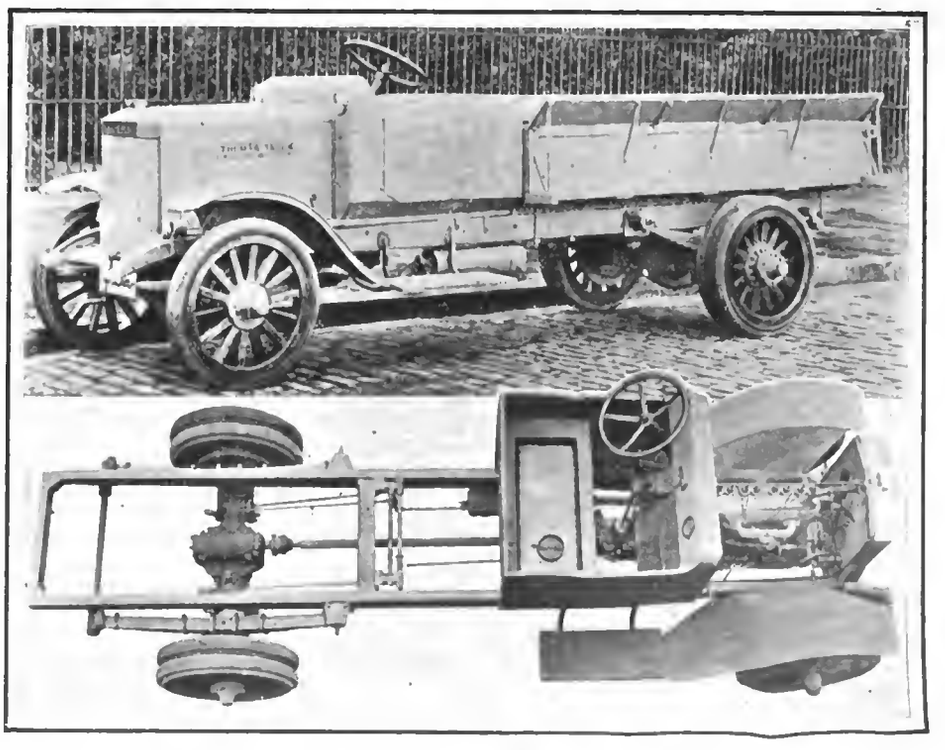
Harder Iron Shows Less Friction

Mr. Hurst's article recalls to the present writer a puzzling case where two different sorts of iron were used for two cylinder blocks otherwise precisely similar, and a horsepower test with all other parts of the engine unchanged, showed the harder iron to have less friction. Speaking from memory, the soft iron cylinders gave a maximum b.h.p. of 42 and the hard iron 45 at the same crankshaft speed. The sizes of the combustion spaces and the accuracy of the bores was checked carefully and there was no difference, so that the only explanation possible was that the hard iron was the better to lubricate. Both cylinders were ground on a Heald grinder.

There is more to be known about cylinder irons, and the subject is one that has been very much neglected.

Thomas Cab Protects Driver

THE Thomas Auto Truck Co., 639 West 51st Street, New York City, was organized early this year to make a ¾-ton, a 1-ton, a 1½-ton and a 2-ton truck. The 2-ton is shown in the accompanying illustrations. The engine is a Buda, 4⅛ by 5½ in. with Bosch fixed spark magneto. There is a dry disk clutch and a unit gearbox with three speeds, the rear axle being a Timken worm drive design. The wheelbase is variable to order, the standard length being 150 in. and the alternative 166 in. Special attention is drawn to the protection afforded to the driver by the high side doors to the cab and the passenger car type of cowl. Bosch lighting and generator and battery is provided and the equipment includes a windshield and a bumper in addition to all the usual accessories. Tires are 34 by 4 in., dual on the rear.



The Rostrum

Six-Cylinder Firing Order

EDITOR THE AUTOMOBILE:—I notice in the Rostrum of THE AUTOMOBILE for Aug. 10 that B. Bros. ask: "Will a six-cylinder motor firing 1, 2, 3, 6, 5, 4 develop as much power at 1500 r.p.m. as one firing in the conventional order?" If a plain crankshaft is used I agree with your answer, but please express your opinion when a seven-bearing crankshaft is used, having twelve balance weights of proper size and shape fixed to it.

2—Is it not easier on crankshaft and bearings to balance each individual cylinder with two balance weights, one on each side, so that each cylinder will have its own balance more nearly in its own plane?

3—I do not see why this construction firing 1, 2, 3, 6, 5, 4 should not be freer from vibration on account of less tendency to rock the ends of the engine.

Tampa, Fla. L. C. H.

—With the firing you suggest the bearings would be stressed to a considerably more severe degree than with the conventional firing, since all the stresses would be at one end of the shaft. It must be remembered that in a six-cylinder engine the explosions are 120 deg. apart and with the firing you mention the shaft would be first stressed on one end and then on the other so that the explosion strokes would not tend to offset one another as they do with conventional firing, but would merely multiply the intensity through overlapping.

2—In balancing a six-cylinder crankshaft it is necessary to take into consideration the longitudinal rocking action as well as the horizontal components of each individual cylinder, therefore, even though each cylinder is balanced independently in certain respects the other cylinders must be considered.

3—With the firing you mention the tendency to rock the ends of the motor would be greater than with the conventional firing, that is, the vertical moment of the shaft about its center would be greater.

Chevrolet 490 Now Being Made

Editor THE AUTOMOBILE:—Are the manufacturers of the Chevrolet automobile building or putting on the market for 1917, the car which has been called the 490 Chevrolet, or has this model been discontinued?

Eden Center, N. Y. G. H. B.

—The 490 Chevrolet is being actively manufactured, the 1917 models being equipped with electric starting and lighting, which equipment was not standard on previous models.

Broke Two Crankshafts in Few Months

Editor THE AUTOMOBILE:—I have a 1914 model Ford in which I have broken two crankshafts in the past few months —in both instances was driving the car on smooth road at about 20 m.p.h. Both shafts broke in the same place, just forward of the rear main bearing, and after taking the motor down I failed to find anything out of true either time. The bearings were fairly tight and no lost motion to amount to anything anywhere. I drive with the spark advanced all it will bear without causing the engine to knock. I was wondering if it could be possible that by giving the motor the gas too suddenly with the spark advanced all the way down while driving at a speed of 20 m.p.h. would have anything to do with the crankshafts breaking.

I have been serving as automobile mechanic for the past 4 years, but I admit that I am at a loss to understand the cause of this trouble.

Carbon Hill, Ala. L. S.

—Without seeing the crankshaft it is quite difficult to pass upon the causes of trouble. It is hardly possible that the trouble results from defective material, as it is unlikely that you would receive two shafts which are not up to standard in so short a period. Neither does it seem possible that the trouble could result from manipulation of the spark and throttle in the way you suggest.

Investigation will probably show that the trouble results from crystallization following operation in a motor in which insufficient oil has been used at some time. It may also be due to loose or improperly adjusted bearings or to some part of the motor being out of line. This condition could come from a continuous misfiring of the engine.

Howling in Axle of 1916 Car

Editor THE AUTOMOBILE:—Can you advise me of any remedy for a howling in the rear axle of a new 1916 model? I understand there is some means of tapping the torsion tube which will stop this howling.

Madison, Wis. R. W. D.

—It is not advisable to tap the torsion tube, although this would cut down the resonance. In all probability as soon as the gears have worn in a while this howling will stop.

Connecting-Rod Bearings Not Right

Editor THE AUTOMOBILE:—I am having trouble with a 1912 Ford. I overhauled it last spring and took up the main bearings. The owner took it out and the second time he drove it he ran out of oil and burnt the bearings. We were able to scrape the burned part out, but now the engine runs very hot so that the exhaust pipe is red all the time and the water boils after a short run and the bearings keep loosening up. Before the car runs 100 miles a knock commences and grows worse gradually until we take up the bearings again.

2—We have moved the timing gears one cog both ways from the marking but it makes no difference with the heating. Can you tell me what makes it run so hot and why the bearings do not stay after being taken up?

3—What kind of babbitt is used in a Ford?

4—What is the exact valve timing of a Ford?

Bloomingdale, N. Y. R. C. A.

—It is very probable that the trouble in this case results from the fact that proper repairs were not made after the engine was operated without oil. Apparently all that was done was to scrape out the bearings and draw the caps up tighter. If the parts were burnt the connecting-rod bearings should have been replaced and the motor block rebabbitted and new crankshaft bearing caps fitted. Probably it would be better where the damage is as extensive as this to have the car brought to a large service station where the equipment will be found to carry out the work.

2—The model T timing gears are properly set when the motor leaves the factory and the adjustments should not be changed, that is, the engagement of the gears should not be altered, as it is likely to cause trouble.

3—A nickel babbitt is used in Ford cars. It must be remembered that the rebabbitting of a cylinder block is a difficult operation. It requires more than a skilled mechanic as special equipment is necessary.

4—In timing the valves the teeth of the crankshaft and timing gears should be brought together so that the tooth on the small gear which carries the zero mark will mesh between the two teeth of the large timing gear at the zero mark on the large gear.

Why Tires Are Marked on Outside

Editor THE AUTOMOBILE:—Kindly advise me whether or not it is for the purpose of advertising or otherwise that tire companies mark their tires "Apply this side first."

Rainbow Lake, N. Y. J. H. W.

—Tires that are marked on the outside only carry this sign on the inside. Most of the manufacturers do not mark their tires in this way. It may be that some of the tire manufacturers mark their cars in this way on account of the flaps which are, in many cases, cemented in. Other manufacturers do not cement their flaps and hence would not need this marking. In all probability, however, where the lettering you state is used it is merely to bring the other markings outside.

Scripps-Booth 1917 Cars Now Out

Editor THE AUTOMOBILE:—Are the Scripps-Booth cars which are at present coming through production the 1917 models, especially the four-cylinder roadster?

2—Is it the policy of the Scripps-Booth company to announce yearly models?

3—What improvement will the 1917 model roadsters have over the same models this year?

Auburn, N. Y. B. H. F.

—The Scripps-Booth cars which are now coming through production are the 1917 models.

2—It is not the policy of the Scripps-Booth company to announce yearly models.

3—The 1917 model now on sale is fitted with the inclosed valve mechanism and a two-unit starting and lighting system instead of a one-unit system used in last year's model. It is also equipped with a bevel gear rear axle.

Miller Car Not Built at Present

Editor THE AUTOMOBILE:—I note in THE AUTOMOBILE for Aug. 10, on page 242, an inquiry in reference to the builder of a Miller car. You will find a reference to this car in *Motor World* for Feb. 29, 1912.

Glenbrook, Conn. C. L. C.

—The Miller car is no longer built. It was manufactured by the Miller Car Co., of Detroit, Mich., had a 30-hp. L-head motor with a bore and stroke of 3¼ by 5 in. Leather-faced clutch, three-speed gearbox and 34 by 3½ front with 34 by 4 rear tires were among the specifications.

Wants Stationary Power Plant Engine

Editor THE AUTOMOBILE:—Will you kindly give your views on the following questions:

1—Are the present-day kerosene and crude oil engines giving satisfactory service? That is, do they require an expert to attend them? We are intending to install a small power plant in the Isle of Pines, Cuba, and on account of the price of fuel are naturally anxious to cut expenses of same to the minimum figure.

2—Are the Diesel types of engine satisfactory?

3—Please give names of leading manufacturers of heavy fuel engines. Also the engine that is considered the leader, if possible.

Manchester, Vt. R. P. M. Co.

—At the present day developments in large unit or stationary heavy fuel engines are such that they are reliable and do not require anyone but a fair mechanic to attend them.

2—Diesel engines are very satisfactory.

3—If you will write THE AUTOMOBILE, mentioning the size of engine you require and what its purpose will be, the desired information will be supplied.

Wiring Diagram of Entz-Chalmers

Editor THE AUTOMOBILE:—Kindly publish a wiring diagram of the Dyneto-Entz motor generator as used on Chalmers cars.

New Brunswick, N. J. A. K. F.

—The motor generator as used on Chalmers cars was manufactured by the Chalmers company under the Entz patent. The wiring diagram of the Entz-Chalmers is shown in Fig. 1.

Use Dull Paint Under Varnish

Editor THE AUTOMOBILE:—I have a Ford roadster and want to repaint it. I want the running gear a bright red, the fenders black and the body blue. In painting it would it be advisable to use a paint with a glossy finish over old paint or to use a dull finish paint and varnish it afterward?

Bellerose, N. Y. D. M. L.

—It would be better to use a dull-colored paint rubbed down and finished with varnish. You can obtain the materials required at any paint store.

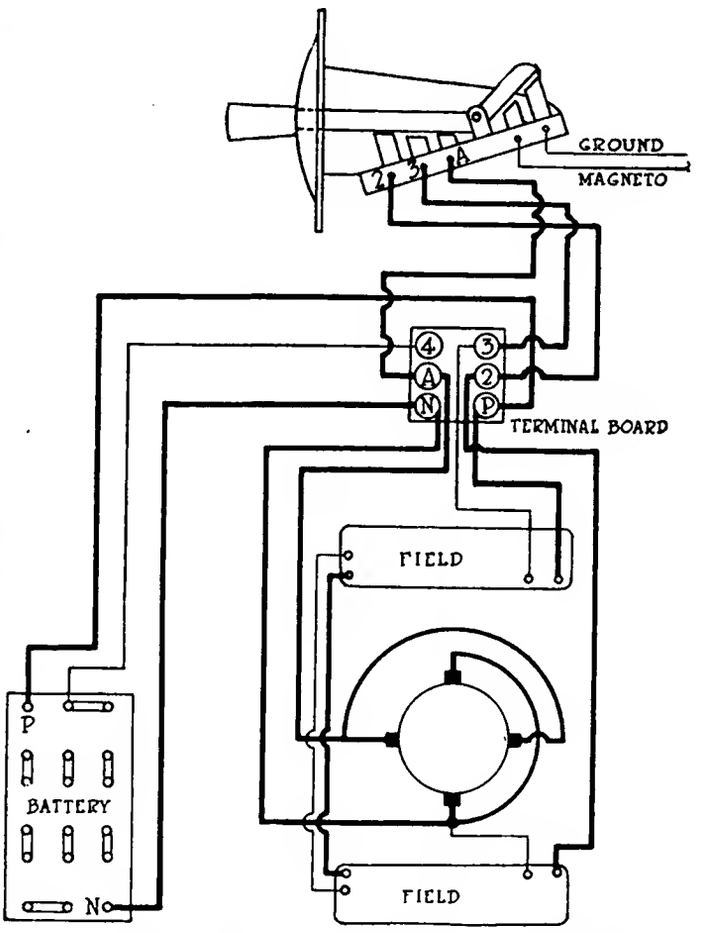


Fig. 1—Wiring diagram of Chalmers-Entz motor-generator

Doble Steam Car Is Up-to-Date

Limited Number of High-Class Chassis To Be Built and Fitted with Custom Bodies — Power Plant Embodies Refinements—Starting Is Instantaneous

ABNER DOBLE, who for a number of years has been experimenting with steam automobiles, has appeared in Detroit with a newer design of vehicle that adheres to the same general principles as the first steam car he brought out about 2 years ago, but embodies a number of later ideas that bring it strictly up to date.

A company has been organized here to be known as the General Engineering Co., with Doble as one of the officers, and this organization is to build a limited number of the steam vehicles, with bodies designed by Holbrook. These cars will be in the high-priced class and excellently appointed and constructed in every particular, it is stated. In addition, the concern plans to license manufacturers to use the Doble system of steam propulsion, which, by the way, can be constructed of a size to meet the requirements of any chassis.

Briefly, the Doble steam car employs a vertical-tube steam generator placed under the hood, where the engine would be in a gasoline car, and under this is placed a combustion chamber lined with a refractory material. Kerosene is introduced here, and ignited by a point, electrically heated to sufficient temperature to ignite the kerosene. The steam is then passed back to a two-cylinder engine mounted in unit with the rear axle. A condenser is utilized, so that the steam is re-converted into water and used over again. The kerosene tank is mounted at the rear of the chassis, just as a gasoline reservoir would be carried.

Aside from the advantage of not requiring a new supply of water at frequent intervals, the Doble car starts practically instantaneously, although steam is not already up. All that is necessary to start and run the car is to turn the switch to the running position. This heats the igniter point and ignites the fuel. Then the throttle is opened and the machine starts immediately. In case the car has been inactive for several days, so that everything is cold, it takes about 1½ min. to start, but after a wait of a few hours, such as over night, the machine can be started at once. In case the electric switch is left in the running position, the steam pressure remains at the normal point continuously.

No clutch nor gearset is used. Power is transmitted to the rear axle by spur gears, a forty-seven-toothed gear on the engine crankshaft and a forty-nine-toothed gear on the differential. That reduction gears are not required was demonstrated by the fact that the engine had more power than was needed to spin the wheels from rest on a dry pavement.

Water Tube Generator

The water tube generator consists primarily of a number of identical sections placed in an insulated casing. These sections consist of two horizontal headers connected by sixteen vertical tubes. The headers and tubes are made from cold drawn seamless steel tubing, and the tubes are welded to the headers by the autogenous acetylene process, making the section of one piece of steel. The tube is swaged down to about ⅝ in. at the weld, thus reducing the amount of welding required and also making the weld stronger than if it were the full diameter of the tube.

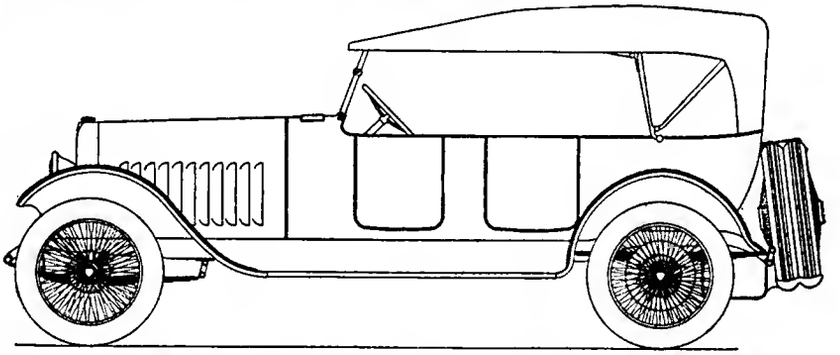
About one-third of the sections are used as the economizer, and the remaining sections form the evaporating part of the generator. The water enters the generator through the lower headers of the economizer and rises through the tubes to the top headers, becoming heated on its way by the gases that have passed through the evaporator portion of the generator. From the top headers of the economizer the water is fed through a pipe to the bottom headers of the evaporator sections. The water level is maintained automatically about half way up the generator. The steam rises through the upper part of the tubes, becoming superheated on the way, and goes out through the upper headers into the steam pipe, where it is led to the engine. The amount of steam passing is regulated by a throttle valve.

The combustion takes place in a combustion chamber of efficient design, made of a special refractory material, which attains a very high temperature, and insures efficient combustion, by heating the gases before they burn, and by catalytic action. The gases rise past the tubes of the evaporator portion, and are then passed over a bridge wall and down past the tubes of the economizer portion, where the remaining heat units are abstracted by the relatively cool water entering the generator by way of the economizer.

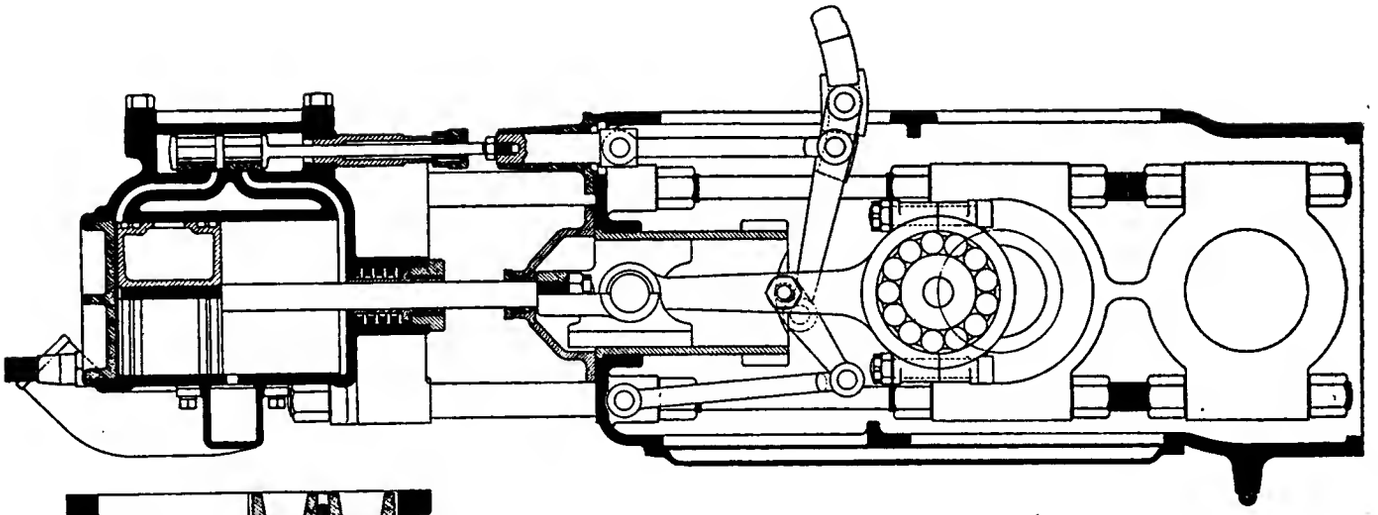
Two-Cylinder, Double-Acting Engine

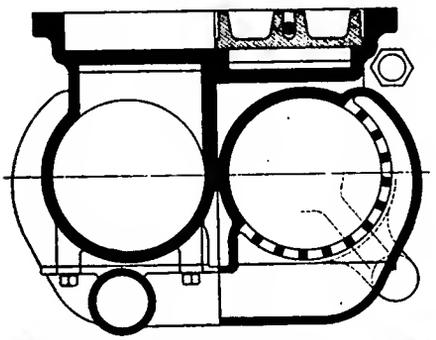
Thus, the fuel is burned by means of a system that eliminates any attention or labor on the part of the driver, and reduces the time necessary to start the car from cold by the amount formerly necessary to properly pre-heat the vaporizer. This has been accomplished by taking a few pointers from internal combustion motor design, broadly following the same idea whereby air is made to pass through a device which mixes into it a correct amount of fuel, then this mixture is led into the combustion chamber described above in connection with the generator, where it is ignited by means of electricity. In order to cause the air to flow, a small blower is used, and is driven by an electric motor, such as is used in vacuum cleaners. This blower forces air through the carbureter into the combustion chamber.

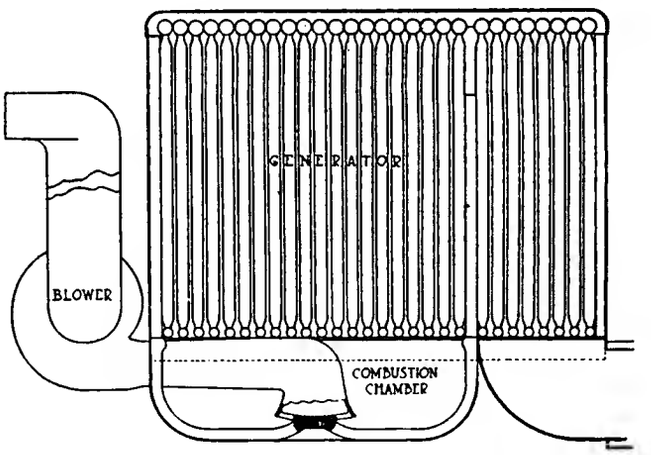
The steam is used in a simple, uni-flow, double-acting, two cylinder, locomotive type, steam engine, with a bore of 5 in.



Illustrating the lines of the Doble steam car to be manufactured in Detroit. Note the similarity to a gasoline car of the modern streamline type







Above—Plan section of the two-cylinder, double-acting locomotive type steam engine to be used in the Doble steam car. It has a bore of 5 in. and a stroke of 4 in. The steam travels through it in only one direction
Right—Water tube type steam generator consisting of two vertical headers connected by sixteen vertical tubes. One-third of the sections are used as the economizer and the rest form the evaporating part of the generator

and a stroke of 4 in. This type of steam engine is one in which the steam travels through it in one direction only; that is, it goes from the cylinder head to the center exhaust port. The slide valves are on top of the cylinders, and are actuated by a Joy valve-gear. This gear dispenses with the need for eccentrics, thus making a one-piece crankshaft possible, and gives a superior steam distribution. The gear also reverses the engine without the need of extra devices. The cut-off can be set at any desired point, three being the usual number of cut-offs provided. In operation three-quarters cut-off is used for starting or heavy going, three-eighths for ordinary running and accelerating and one-eighth for high speed and high economy work.

After the steam has done its work in the engine, it is led to the top of the radiator, and in passing down through the tubes, gives its heat up to the air passing through the radiator and condenses into water. The water of condensation returns to the water-tank, where it enters near the bottom, so that at nearly all times the opening is below the surface of the water.

Piston-rods pass through special solid cast-iron glands, which are made such good fit on the piston-rod that no steam can blow by. Due to the long bearing surface there is practically no wear, and never any need for repacking, it is said.

The crankcase is a well-proportioned aluminum casting, and contains the entire moving parts of the engine except the pistons and valves. The differential is also contained in the crankcase, and the taper-tubes of the axle bolt directly to it. Thus the engine and rear axle are one unit.

The main bearings, and the big end connecting-rod bearings are annular roller, and are of such proportions that no wear should occur during the natural life of the car. All of the other bearings such as the wristpins and valve gear bearings are hardened steel, running in hardened steel bushings.

The power is transmitted to the rear axle by means of two perfectly cut spur gears, a forty-seven tooth gear on the engine crankshaft and a forty-nine tooth gear on the differential. There are no change-speed gears and no clutch, and the engine has more power than is needed to spin the wheels from rest on a dry pavement, as was demonstrated.

The electric system, to take care of the lights, horn and combustion system, comprises a dynamo and a storage battery. The dynamo is driven from the main axle drive gear.

Truck and Tractor Engines—Part I

(*Continued from page* 390)

Curve *T.R.*, Fig. 3, represents the tractive resistance at various truck speeds and illustrates the surplus in power required in common practice for running on level roads with low tractive resistance.

Running under the conditions as indicated above, the load on the motor would be about 33 per cent. The best economy that would be expected would be from 0.9 to 1.0 per hp.-hr. and this would be seldom attained in service. By using a four-speed transmission the horsepower required to pull the load would remain the same, while the speed of the engine would drop; therefore, the speed at which the engine would have to operate without changing gears should be established by speed of maximum torque. The steps in transmissions are governed by this range of speed. Referring to diagram Fig. 3 it is easily seen that the engine would be between the one-half and three-quarter full torque, resulting in economy of 0.8 lb. per hp.-hr.

(*To be Continued*)

A-B-C starting and lighting system mounted on Ford engine

Accessibility Features A-B-C System

6-Volt Electric System for Fords Has Low Initial Draw on Battery

SEVERAL marked advantages are claimed for the two-unit, 6-volt starting and lighting system for Fords made by the A-B-C Starter Co., Detroit, Mich., and selling for $85 installed. It is the design of Alexander Churchward, well-known starting and lighting expert, who is vice-president and engineer. Special importance is attached to the fact that the system does not interfere with the accessibility of the engine and is itself accessible. It takes only a small amount of the engine power as the generator is only ⅛ hp. The supporting brackets are so designed that they do not put an undue strain on any of the engine parts. Another important feature is that no changes in the Ford construction are made.

The generator is mounted at the left front of the motor on a bracket which is supported from the crankcase, longer crankcase bolts being used. It is driven by a broad, flat belt from the regular crankshaft fan driving pulley. The fan pulley itself acts as an idler and the spring keeps the belt taut. A Ward Leonard current regulator is mounted on the top of the machine.

Starting motor is placed on the right, forward of the carbureter and is carried on a cradle bolted to the crankcase flange on one side and supported on the other side by a lip around the edge of the frame.

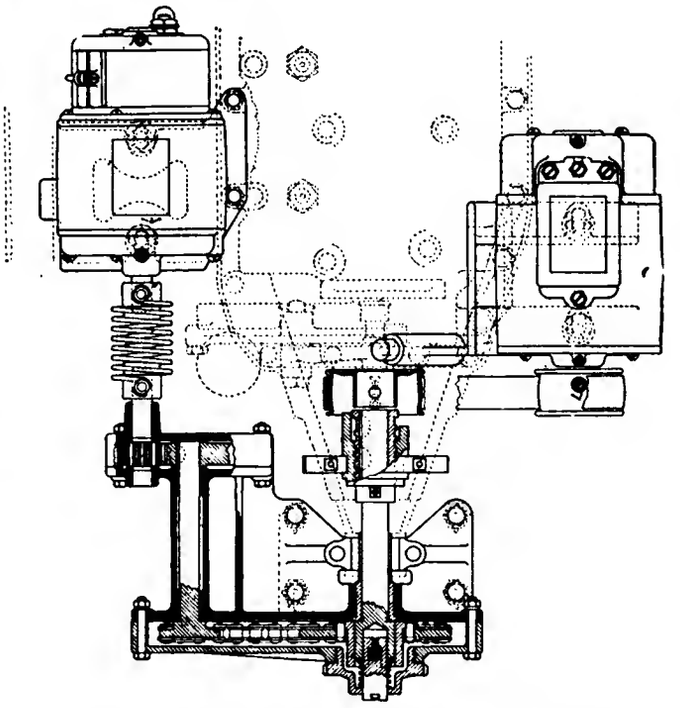
A double reduction is used, the first being through spur gears and thence through a roller chain which drives through a shaft connecting with the front of the crankshaft. This mechanism is carried in a rigid casting anchored to the front spring clips.

There are two innovations in the design of the starting apparatus: One is the use of a cushioning spring interposed between the ends of the armature shaft and the starter reducing gear, so that the actual inertia of the armature may be used to give the high initial pull required to overcoming the high starting friction. The result is that the initial draw on the battery is much less than if the armature were solidly connected; thus a 60-amp. hr. battery suffices. The second point of interest is the method of engaging and disengaging the starter clutch. The principle is somewhat similar to the Bendix drive. When the starter begins to rotate the driving member of this clutch slides forward and engages the crankshaft. This sliding motion is obtained by cutting a spiral thread on the outside of the sleeve and having meshed with it another sleeve or nut which is held from sliding by a loose-fitting collar. This sleeve is free to rotate, yet the collar produces sufficient friction so that when the starter begins to operate the inner sleeve is held back so that the outer one may be screwed forward into engagement.

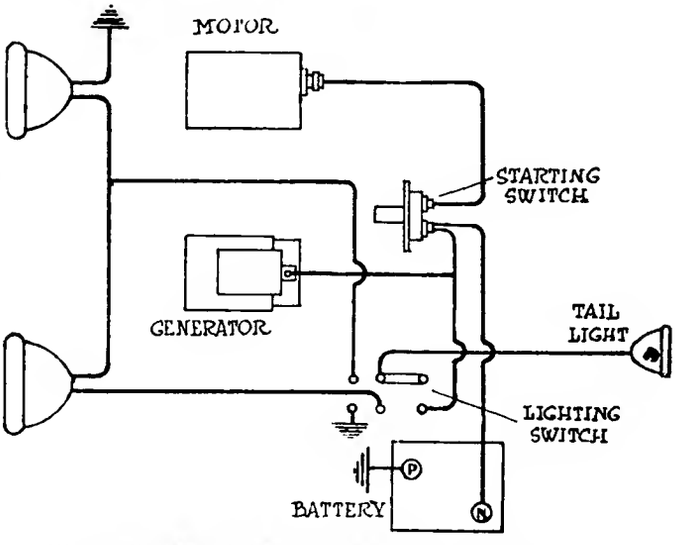
The device is disengaged automatically, the motor running away from the starter and thus drawing it out of engagement.

The lighting switch is placed on a panel at the left on the dash and the starting motor is operated through a small pedal in the floorboard.

Equipment includes ammeter, starting switch, lighting switch with dimmer attachment, etc.



A-B-C system in part sectional plan view as mounted



Wiring diagram of the A-B-C electric system for Ford cars

Bits of Ball-Bearing Experience

Prominent Engineers Contribute Information Regarding Care and Installation of Annular Bearings—Chemically Neutral Lubricant Must Be Used

In carrying out some research work on ball bearings, the S. K. F. Ball Bearing Co. has obtained the opinions of a numher of automobile engineers on points pertinent to annular installations and their care. Taking as a basis the statistics compiled for the annual show numher of THE AUTOMOBILE, it has been found that the manufacturers of 1916 passenger cars use ball bearings to the extent of 67.2 per cent in the gearhox, 56 per cent in the front wheels, and with varying percentages in other parts of the chassis. This is hased on the number of models and not on car production.

A symposium was conducted among the engineers of the country using ball hearing installations to secure from them what thoughts came up in their mind in connection with this type of bearing installation, and as a result a number of interesting though unclassified facts were gathered in. Probahly of most interest to the consumer were the points mentioned on lubrication. In commenting on this phase of hall bearing practice, the engineers who responded were almost unanimous in stating that the luhricant used must be chemically neutral, that is, neither acid nor alkaline.

Both Grease and Oil

The actual lubricant used varied according to the general opinions with the duty which the bearing performs. There is a slight difference of opinion, however, regarding the weight of the grease or oil to be used in different places. F. A. Whitten, of the General Motors Truck Co., states that a very light neutral grease or non-fluid oil should be used in almost all of the hall bearings, although in a few places a heavy oil can he advantageously employed. A. L. Riker, of the Locomobile company, finds that ball hearings ·hould be luhricated with a grease containing no acid. For detailed usage W. P. Chrystler, of the Buick company, recommends steam cylinder oil for the gearset and rear axle and also steering gear and a soft cup grease for the front and rear wheels and the clutch.

W. G. Wall, of the National company, mentions a fact which should be given heed, and that is that there should he a considerahle source of lubricant for ball bearings in places exposed to heat, as around the engine. Regarding the clutch C. Biedermann, of the O. Armleder company, says that manufacturers of drive plate clutches cannot afford to ignore the lubrication of the clutch. If the clutch runs without oil then the system of hearing luhrication must he complete in every detail. The clutch pilot bearing will not run without oil and the clutch throwout bearing cannot endure more than a few days without oil. Transmission oil must be guaranteed to be free from acids, alkalis, water or any gumming mixtures used to ohtain quiet gears.

In regard to the mounting of hall bearings and the selection of the bearing size, several interesting comments were made. C. W. McKinley, of the Willys-Overland company, in mentioning installations, states that he secures the hest results when the shaft mounting is so arranged that the inner race of the hall bearing is a tight fit on the revolving shaft, or if not, the hearing should be retained between the thrust shoulders by a locking means so as to prevent the inner race from moving on the shaft.

Fit of Bearing Races

The outer race should he mounted with a sucking fit so that it can move in its retainer and thus present various points on the surface to action of the load. Also, the outer race should be mounted in some hard metal, such as malleahle iron or steel, especially if the case of the gearset is aluminum. When the bearings are mounted to take any considerahle end thrust, the surface which takes this thrust should be hardened as much as possible, and also of a fairly high carbon steel, or else case hardened. There is a slight creeping action of the races and also a hending action when the bearings are used in differentials. This gives a tendency to wear down the thrust collar against the hearing race—referring to the collar against the inner race.

Russell Huff, chief engineer of Dodge Bros., states that the best results are secured where one race is allowed to float in its setting with the other held tightly against the shoulder. Fred Bizzants, of the Gramm-Bernstein company, says that all the hearings for his concern are pressed on to the shaft of the same size as the hore of the bearings. They are then secured with nuts castellated, and cotter pin fastened.

W. P. Chrystler agrees that the inner race should be a tight fit on the shaft; in fact, a light press fit, with the exception of the rear wheel bearing. The inner races of the latter are a hard push fit. All inner races, except the race of the primary shaft driving pinion bearing, are tightly clamped between suitable shoulders and nuts to prevent their creeping. The one exception is made a drive fit on the hub of the pinion. Regarding the fit of the outer races, he believes in a hard push fit. The races of the hub bearing and those of the forward hearing of the propeller shaft are clamped tightly. The others are free.

Lessons of Experience

Some lessons learned from actual practice are given by Mr. Biedermann. The hearing must be so arranged as to meet conditions of load, speeds and lubricant as recommended by the hearing manufacturer. All bearing manufacturers should issue very stringent instructions and data covering the entire route of the hearing.

It is necessary to guard against distortion of the races in the opinion of T. P. Chase, of the King Motor Car Co. Packing with sufficient luhricant will aid in this, according to his views.

J. W. Whitbeck of the Chandler Motor Car Co., states that he believes it important that either one of the races he allowed to float laterally to a small amount.

Some of the reasons assigned by manufacturers for the use of hall hearings in specific parts are as follows: Minimizing friction, small space of installation, freedom from attention, accuracy secured, easy assemhly, radial and thrust components, small amount of luhricant, uniformity of wear and adaptability for use in places where adjustahle bearings are impossible.

ACCESSORIES

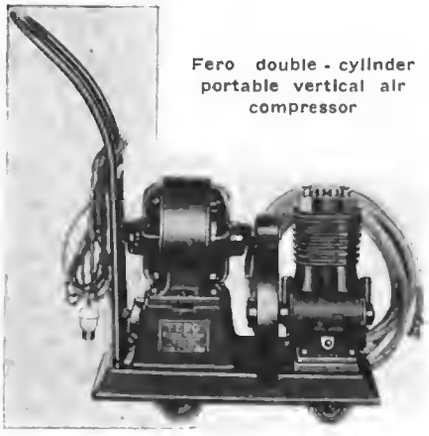
Fero Electric Air Compressors

THE Fero line of air compressors is designed to meet the needs of private and public garages and service stations, being made in portable and stationary form and in several sizes. The single-cylinder, horizontal stationary compressors driven by a ¼ hp. electric motor is suitable for garages housing not more than twenty cars. It may be advantageously used in connection with a 20-gal. air tank, together with an automatic switch or controller.

A double-cylinder, portable, vertical model for the direct inflation of tires, also operated by a ¼-hp. motor, displaces 1.8 cu. ft. of air at 500 r.p.m. with a pressure of 125 lb. per square inch.

A double-cylinder, portable or stationary vertical compressor with a 1/3-hp. or a ½-hp. motor is made for the direct inflation of tires in connection with an air tank.

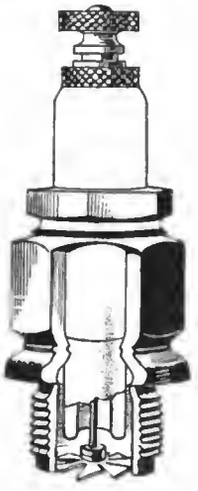
To the heavy-duty, double-cylinder vertical compressor is fitted a ¾-hp. motor of the repulsion type, which will start the pump against a tank pressure of 125 lb. and compress to 175 or 200 lb. tank pressure. Westinghouse alternating and direct current motors are used and electric controllers are furnished when desired for the stationary compressors used in connection with an air tank and not for the direct inflation of tires.—B. M. Fero, 509 Penwood Avenue, Wilkinsburg, Pa.



Fero double-cylinder portable vertical air compressor

Fan-Fire Spark Plugs

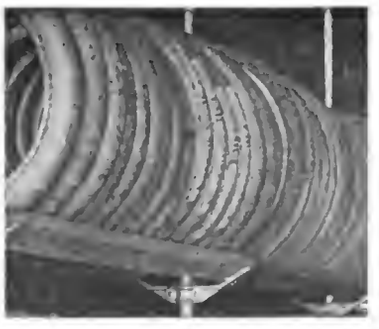
The feature of this plug is the use of a small fan-shaped member carried at the lower end of the central electrode. This fan is designed to rotate, due to the movement of the gases in the combustion chamber and thereby to prevent fouling of the spark gap. The spark jumps from the tips of the fan blades to the plug shell, the constant rotation presenting new surfaces opposite each other. The balance of the plug is of standard construction. Price, $1.—Fan Fire Spark Plug Co., Yonkers, N. Y.



Fan-fire spark plug. Note the revolving fan at the end of the central electrode

Effecto Finishes

Effecto is an enamel designed especially for automobile bodies. Only one coat is required and the composition is such that it will dry evenly and smoothly, no matter how carelessly it is applied. It dries quickly so that dust does not have much chance to settle. It is said to be durable, will not crack, chip off nor become dull to weather or through repeated washing. Effecto finishing varnish restores the original luster of the car and is of use when the original finish is shabby but not badly chipped or marred. Effecto top and seat dressing is designed to restore mohair and leather automobile tops, seats, side curtains, leather work, etc. It is a rich black. The dressing dries in about an hour. There is no danger that clothes will stick to the seats because it does not soften or become sticky, according to the manufacturer.—Pratt & Lambert, Inc., New York City, Buffalo and Chicago.



Elgin tire rack brackets enable the dealer to construct his own tire racks

Elgin Tire Rack Brackets

These brackets enable tire dealers to build their own tire racks. Upright standards of 1½-in. pipe are erected at about 6 ft. intervals, and the brackets are clamped onto the pipes. Planks are then screwed onto the brackets, making the racks continuous. In a 480 tire installation, 110 ft. of 1½-in. pipe and 33 brackets were used. The complete fixture cost less than $35. One dozen brackets are sufficient for a 150 casing rack. Price, $9 per dozen.—Elgin Motor Power Mfg. Co., Cedar Rapids, Iowa.

Major's Spring Lubricator

A combination dust boot and spring lubricator. It is a waterproof casing, lined with felt and laced over the leaves of the spring. The felt is saturated with oil, and the motion of the spring draws the oil between the leaves. All grit and water is excluded, it is said, and the constant supply of oil promotes easy riding and reduces spring breakage. Prices, per set of four, Ford, $12; runabout or five-passenger car, $20; seven-passenger car, $25.—Major Mfg. Co., 461 Pearl Street, New York City.

Superlustre Polishes

Superlustre polish is designed to clean the surfaces of automobile bodies thoroughly without injuring them in any way, leaving a glass-like finish on which dirt and dust cannot accumulate. By the use of this polish the manufacturer states that the car can be washed or used in rainy weather without ill effects.

The scratch and stain remover is intended to remove tar or grease stains and surface scratches on highly-finished bodies. It is claimed to restore the original finish when impaired by exposure or indiscreet methods in washing.—James J. Fero, Inc., 792 Seventh Avenue, New York City.

Showing the method of lacing Major's spring lubricator to the spring. The outside covering is a waterproof material and lined with oil saturated felt. The lubricator is said to keep all grit, water, etc., from between the leaves and furnish a constant supply of oil to the springs

The Automobile

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Widening the Industry

THAT the manufacture of gas tractors is going to be a part of the automobile industry is just as certain as it is that the manufacture of trucks will remain one.

All self-propelling vehicles for use on surfaces other than steel rails can be classified together, and all such machines have difficulties to overcome which are identical throughout the whole range from the speedway racing car to the caterpillar type of gun hauling tractor.

It is easy to trace how the design of the motor truck has been based upon that of the passenger car, and it is beginning to be clear that the tractor is being based upon the truck. Really a tractor is nothing more than a special sort of a truck, working under rather harder conditions.

This being the case, it is rather remarkable that none of the big automobile manufacturing concerns have yet seen fit to enter the tractor field. Probably it is simply because they have been so busy with their other products that it was impossible to consider an extension, but the day when cars, trucks and tractors all come bearing the same brand is not far distant. There is room for almost as many sorts of tractors as there is for passenger cars. There is need for cheap machines and for the super-excellent also. A select few parts makers have seen the opportunity, but far fewer than seems reasonable; one misses from the tents at a tractor meet many names which could be there to their own advantage.

Engines, carbureters, magnetos, oils, greases, spark plugs and many other details are all wanted by tractor makers and tractor users. The manufacturers of these things have, so far, apparently been blind to the really huge business the birth of which is now in progress.

Kerosene Nearly Arrived

THE stimulus given to the use of kerosene in internal combustion engines on both sides of the Atlantic simultaneously cannot fail to have a great effect on the automobile industry. The rising price of gasoline in America has made it almost impossible to operate a tractor on the lighter fuel; many trucks are now running on kerosene, and devices are appearing which will function well in passenger car service.

In England government control of gasoline has almost shut off supply from passenger car users and has restricted the commercial vehicle supply greatly, so that a man must burn kerosene in his engine or allow his machine to lie idle. The inventive genius of two great engineering nations is thus concentrated on the one problem.

It is not an easy problem in many ways, but it is no harder than many others that have been solved, and there is reason to feel confident that the days of gasoline are numbered; at least for gasoline as the commonest automobile fuel. So many inventors are so near the kerosene carbureter that will do *everything* that can be done with gasoline that complete perfection cannot be far off. A little merging of patent interests, a little give and take between the inventors and a little really sympathetic interest on the part of motor car manufacturers are needed. Given these three things and the problem is solved. If the matter is not tackled promptly and squarely the European industry will steal another march on the American trade.

Temperature Control

ALTHOUGH the use of the thermostat for controlling the temperature of the cooling water in the cylinder jackets of automobile engines has now been applied to a good many thousand cars, there has been very little discussion concerning its merits. In a broad and general way these have been mentioned, but they have never been analyzed carefully.

Next Thursday the Detroit section of the S.A.E. will have a paper on the subject and will discuss the matter fully. It is an important matter, and is made all the more important by increasingly heavy fuel which is more susceptible to temperature changes. The author of the paper is an entirely disinterested individual who is well qualified to examine any scientific subject, so the meeting ought to get further forward with the subject than is the rule when an avowed protagonist of some system puts up his ideas to be criticised.

To Revive Giant's Despair Climb

Wilkes-Barre Club Applies for A. A. A. Sanction to Hold Event October 7

WILKES-BARRE, PA., Sept. 6—The Automobile Club of Wilkes-Barre, Pa., has requested the American Automobile Assn. Contest Board for a sanction for a hill-climb up Giant's Despair mountain just outside of Wilkes-Barre for October 7. According to present tentative plans there will be ten events, seven for stock cars and three for non-stock machines. This possibility of reviving this hill climb is a good indication of the increased interest in hill-climbs. With Pike's Peak in the Rocky Mountain district and Giant's Despair in the East the nucleus is formed for a series of hill-climbs which should greatly assist the speedways in maintaining interest in motor car events.

19 Indianapolis Race Entries

INDIANAPOLIS, IND., Sept. 4—Nineteen cars and drivers have been entered in the Harvest Racing Classic, which will be held on the Indianapolis Motor Speedway Sept. 9 as follows:

Car	Driver	Bore and Stroke	P.D.
Peugeot	Aitken	3.6x6.7	274
Peugeot	Merz	3.6x6.7	274
Osteweg	Osteweg	4.11/32x5	296.4
Sunbeam	Christiaens.	3.21x6.14	294.5
Premier	Lewis	3.6x6.7	275
Premier	Wilcox	3.6x6.7	274
Maxwell	Rickenbacher.	3.74x6.75	298.2
Duesenberg	Buzane	3.63/64x6	300
Sunbeam	Galvin	3.21x6.14	294.5
Maxwell	Henderson.	3.75x6.75	298.2
Duesenberg	Devlin	3.63/64x6	300
Duesenberg	D'Alene	3.63/64x6	300
Burman	Gable	3.⅝x7½	298
Kleinart	Klein	3.⅝x7½	298
Unnamed	De Palma	.....	....
Dans L'Argent	Muller	.....	....
Hoskins	Unnamed	.....	....
Rawlings	Unnamed	.....	....
Omar	Toft	.....	....

There are three events on the program: The 100-mile championship is the longest of the day. The other two events are the 50-mile and 20-mile dashes from a standing start.

Howard Marmon of the Nordyke & Marmon Co., Indianapolis, has been selected by the Indianapolis Motor Speedway officials to act as referee.

Ohio Speed-Trap Industry Hit

CLEVELAND, OHIO, Sept. 2—The automobile speed trap law in Ohio was dealt a heavy blow in an opinion which rules that township justices of the peace have no right to collect fines in speed cases. This opinion holds that peace justices do not have final jurisdiction in speed cases.

Owen Magnetic 4-Day Tour

NEW YORK CITY, Sept. 2.—The second annual Owen Magnetic tour will start from this city Sept. 9 and will embrace a four-day trip through the Berkshires and the White Mountains. A dozen or fifteen cars provided by the company will carry over fifty invited guests. The route will include Pittsfield, over the Mohawk Trail to Greenfield, first night; thence along the Connecticut Valley to Hanover, N. H., for lunch and to the Profile House, White Mountains, for the night. The third day will be to Boston and the fourth back to New York.

$100,000 Speedway Planned for Denver

DENVER, COL., Sept. 2 — A $100,000 speedway for automobile races is being planned by the Colorado Springs Athletic Club, which expects to push the project through by next summer. Among the promoters of this new enterprise for the Rocky Mountain region are Spencer Penrose. Charles MacNeil and other millionaire sportsmen who financed the building of the $250,000 highway to the summit of Pike's Peak and conducted the recent hillclimb over that highest road.

Milwaukee Dealers' Tour Ends

MILWAUKEE, WIS., Sept. 2.—The Milwaukee dealers to-day concluded their second annual State-fair-boosting tour of Wisconsin. Between Monday morning and this afternoon they traveled 555 miles, visited forty-four cities, villages and hamlets, and took the message to a territory of 1,000,000 people.

Weston Leaves U. S. Tire to Join Mitchell Motors

NEW YORK CITY, Sept. 2.—J. C. Weston, general sales manager of the United States Tire Company since 1914 and connected with that company since its inception, has resigned to become vice-president in charge of the sales of the Mitchell Motor Company, Racine, Wis. He thus takes up the duties of O. C. Friend, former sales manager of the Mitchell-Lewis Company, who resigned last July to become vice-president and general manager of the United Motors Company.

Mr. Weston has been in the tire business since 1896, when he became a salesman for Morgan & Wright. In 1906 he became secretary of the company and stayed with it when it became a member of the United States Tire Company. At that time Mr. Weston's duties were confined to the Pacific Coast district, which he organized. From there he took charge of the central district in Chicago and in 1913 came to New York as head of the contracting department, handling all of the automobile makers' business. The next year saw him in the position he has just vacated.

Though no successor has as yet been named by the tire company, his former duties will be redistributed at the present time by President J. N. Gunn.

Armored Mack in Fast Run

Covers 325 Miles from N. Y. to Plattsburg at Average of 10.3 M.P.H.

PLATTSBURG, N. Y., Aug. 31.—L. Grinnel, wealthy rookie at the training camp here, in his Mack 2-ton armored car arrived at 10 o'clock last night, having made the 325-mile trip from New York City in 22 hr. 13 min. actual running time, after being on the road 31 hr. 24 min. Average road speed was 10.3 m.p.h., after subtracting 4 hr. 29 min. of minor road stops. Not including the night or meal stops actual running speed was 14.6 m.p.h. This performance was made in spite of four detours of some length and one run of 20 miles on the roughest sort of mountain road between Elizabethtown and Keesville. At this point the speed was only 9.4 miles per hour. Between Troy and Saratoga Springs the 30.1-mile run was made in 1 hr. 40 min., at a speed of 19 miles. The time of the entire trip, including night stop at Troy, was 41 hr. 31 min., in which time 325 miles were covered. There were nineteen stops other than for meals and sleep, but no serious mechanical trouble. The engine missed some and one of the Kelly sectional blocks on the right rear wheel was lost when the truck came near going off the road on a particularly bad detour between Rhinebeck and Hudson. The driver failed to get the low gear meshed in time on a bad hill, so the truck backed within a few inches of a deep ditch.

32 M.P.H. on Good Roads

Besides detours and bad stretches above Elizabethtown the roads on an average were excellent, but the many turns slowed the vehicle down due to the impossibility of seeing ahead and danger of meeting other cars on the narrow roads. Paced by a motorcycle, however, it made 31 and 32 m.p.h. frequently on good straight roads. The machine was built for Grinnel by the International Motor Company for use in a volunteer machine gun company he is organizing in New Bedford, Mass. Being a rookie at Plattsburg, he determined, on being notified that the car was completed, to run it up here and put it through maneuvers with the Englewood battery on the hike of the August camp now in progress. Lieutenant R. A. Osmun of the Coast Artillery Corps at Governor's Island, escorted the car on an Indian motorcycle. In the machine were Grinnel, H. F. Welch, engineering department International Motor Co., M. C. Horine, editor of *The Commercial Vehicle*, observer and S. A. E. representative, and W. J. Wright, driver. Fuel consumption was over 7¼ m.p.g.

$59,994,118 Profits for Ford

49,870 Employes on Payroll—$52,550,711 Cash on Hand and in Banks

(*Continued from page* 381)

payroll contains 49,870 names, this including the parent plant and all branches. Of this number, 27,002 are employed at Detroit and getting $5 a day or more, 14,335 at the eighty-four branches and assembly plants, and 34,485 is the total at the home plant. The home office force numbers 1,028.

The marvelous growth of the Ford cash balance in 5 years is indicated by the following table:

1912, cash on hand and in banks....$6,400,100
1913, cash on hand and in banks....13,225,710
1914, cash on hand and in banks....27,441,468
1915, cash on hand and in banks....43,788,151
1916, cash on hand and in banks....52,550,771

In the same period of years, the value of the materials and supplies on hand has jumped from $6,629,533 to $31,895,434, and the investment in plants from $2,596,115 to $17,293,293.

The balance sheet for the past fiscal year tells the story. It appears herewith in connection with similar statements for the past 5 years.

Coincident with the making public of its financial statement, the Ford company, through Henry Ford, made it known that work is to commence at once on the much-talked-of steel plant and blast furnaces at River Rouge, a suburb on the west side of Detroit along the river. For some time past the Ford company has been acquiring a large tract in this district, but this is the first positive assurance that has been given that work is to be commenced soon. Julian Kennedy, recognized expert on the design and construction of blast furnaces, has been retained by the Ford company to design and superintend the construction of two furnaces on the River Rouge property. It will take 134 acres of land to accomodate the down-river works, the location of which will make it advantageous for the big ore freighters to bring the ore down from the northern part of the state and from Duluth. Blast furnaces, docks, coke ovens, and other buildings of the plant will entail an initial expenditure of $3,500,000. Most of the work will be done by machinery in this modern steel and iron plant, and only about 500 men will be employed at first, according to Henry Ford.

Profit-sharing Pays

Mr. Ford made a very significant statement on the issuance of the financial report. He said, "If you expect a man to give you his time and energy, you must fix his wages so he will have no financial worries. It pays. Our profits this year, after giving our employees a big share in them, show that to pay good wages is the most profitable way to do business." This is one of the big secrets of Ford success.

"My ambition," says Mr. Ford, "is to employ still more men; to spread the benefits of this industrial system to the greatest possible number, to help them build up their lives and their homes. To do this we are putting the greatest share of our profits back into the business."

In the report no mention is paid of the contemplated output of cars for the coming year, but elsewhere it has been stated that the output of cars will be 750,000, and 250,000 of the new Ford 1-ton truck that is to come out about the first of the year.

Ford Motor Company's Balance Sheet for 1916, 1915, 1914, 1913 and 1912

	1916	1915	1914	1913	1912
ASSETS					
Cash on hand and in banks...	$52,550,771.92	$43,788,151.23	$27,441,468.79	$13,225,710.82	$6,400,100.66
Michigan municipal bonds at cost	1,259,029.01	1,311,924.10	1,330,546.84	1,283,943.59	1,075,051.48
Accounts receivable	8,292,778.41	2,300,456.42	3,233,582.73	448,233.93	230,912.17
Merchandise inventory at cost.	31,895,434.69	14,335,767.87	9,284,449.26	9,046,171.68	6,629,533.83
Outside investments	9,200.00	9,200.00	9,200.00	7,433.32	7,772.04
Prepaid expenses	434,055.19	385,377.56	437,089.77	215,259.29	44,591.07
Real estate	5,232,156.10	3,148,263.01	2,227,567.88	1,540,483.42	820,636.97
Buildings and building fixtures	17,293,293.40	12,931,884.45	10,714,928.45	4,615,156.82	2,596,115.61
Factory and equipment	3,868,261.02	2,606,356.06	1,661,155.23	676,589.49	371,110.90
Furniture and fixtures	431,249.37	328,497.30	105,263.95	77,357.60	58,059.39
Power plant and machinery...	8,896,342.31	5,693,768.50	3,821,465.38	2,832,907.33	1,843,967.02
Tools	1,690,688.54	1,491,824.85	1,199,779.11	824,901.04	566,510.17
Patterns	170,619.77	142,998.22	105,992.30	92,710.13	66,884.06
Patents	64,339.85	61,472.84	59,767.47	57,224.27	51,793.96
Machinery, tools and equipment at branches	.....	.....	.....	.....	52,746.30
Total	$132,088,219.58	$88,535,840.41	$61,632,257.16	$35,033,919.86	$20,815,785.63
LIABILITIES					
Accounts payable—not due....	$7,680,866.17	$4,947,805.81	$3,335,139.01	$3,049,586.86	$2,261,026.63
Accrued payrolls	847,953.68	428,907.14	537,489.70	191,940.70	149,166.45
Accrued salaries	338,268.86	341,814.16	44,229.95	24,169.30	12,327.45
Accrued expenses	1,175,070.72	463,111.47	218,140.50	266,119.43	178,766.10
Contract rebates	2,199,988.00	1,281,661.01	621,381.12	25,960.00	58,350.00
Contract deposits	1,519,296.40	1,968,844.89	1,452,622.82	.....	.....
Reserve for refunds to take care of reduction in prices..	.....	.....	.....	.....	75,000.00
Reserve for employees' bonus.	.....	.....	.....	134,999.96	242,033.80
Reserve for bad debts	.....	.....	.....	3,510.55	3,655.04
Reserve for depreciation of fixed assets	.....	2,855,188.94	1,935,440.07	1,061,805.25	742,626.99
Reserve for depreciation of plants	4,260,275.33	61,472.84	59,767.47	57,224.27	51,793.96
Buyers' P. S. Rebate	48,099.00	.....	.....	.....	.....
Fire insurance reserve	57,493.89	51,263.49	43,934.45	34,059.63	11,900.40
Reserve for profit sharing	.....	15,000,000.00	2,557,080.00	.....	.....
Unearned profits—branches...	.....	.....	.....	60,370.23	284,043.34
Capital stock	2,000,000.00	2,000,000.00	2,000,000.00	2,000,000.00	2,000,000.00
Surplus	111,960,907.53	59,135,770.66	48,827,032.07	28,124,173.68	14,745,095.57
Total	$132,088,219.58	$88,535,940.41	$61,632,257.16	$35,033,919.86	$20,815,785.63

*The 1915 statement represents the business for only 10 months because last year it was decided to change the end of the fiscal year from September 30 to July 31.

FORD STATISTICS

Total output 13 years, 1,406,997 cars.
Employed 311 men first year.
Total of employees at home plant now, 34,489.
Total of employees, all plants, 49,870.
Total of employees getting $5 a day or more, 36,626.
Largest one-day output, 2,430 cars, Feb. 29, 1916.
Sales value of 1916 output, $206,867,347.47.
Sales value of 1903-1904 output, less than $2,500,000.

PRODUCTION FIGURES

Year	Cars Made and sold	Increase or Decrease	Daily Average
1916	533,921	plus 225,708	1816
1915	308,213	plus 59,906	1027
1914	248,307	plus 83,855	827
1913	164,452	plus 95,908	545
1912	68,544	plus 30,078	228
1911	34,466	plus 15,802	115
1910	18,664	plus 8,057	62
1909	10,607	plus 3,209	35
1908	6,398	minus 2,025	21
1907	8,423	plus 6,284	28
1906	1,599	minus 96	5
1905	1,695	minus 13	5
1904-1903	1,708	.....	5

532 Maxwells Built in 1 Day

Average Production 400 Cars Daily—120,000 Cars for 1916-1917 Year

DETROIT, Sept. 5—A record was made by the Maxwell Motor Co. on Aug. 26 when 532 cars were turned out by the big plants here. The previous record was made only the day previous, when 501 cars were turned out. The average production of the big Oakland Avenue assembly plant is now about 400 cars per day, as compared with a maximum daily output 1 year ago of about 200 machines.

All Maxwells are assembled here, while most of the parts are manufactured in the concern's factories at Dayton, and Newcastle, Ind. These units are now making for the Detroit factory some 400 units daily, to keep pace with production.

It is stated that the 1916-1917 year will see 120,000 Maxwells built, as compared with 60,000 for the year just ended.

Morgan Appointed Abbott President

CLEVELAND, OHIO, Sept. 2.—G. W. Morgan, of the Mitchell Motor Car Co., Racine, Wis., has been appointed president and general manager of the Abbott Corp., this city. He succeeds C. L. Lewis, who recently retired as president.

Toft's Omar, Vail'a Hudson and Merz's Peugeot in a brush before the grandstand in the 300-mile Labor Day race on the new Cincinnati speedway

Aitken Wins at Cincinnati

Peugeot Makes 300 Miles at 97.06 M.P.H.—D'Alene Finishes Second

Car	Driver	Time	M.P.H.
Peugeot	Aitken	3:05:27.22	97.06
Duesenberg	D'Alene	3:09:56.00	95.05
Sunbeam	Galvin	3:18:35.58	90.06

CINCINNATI, OHIO, Sept. 4.—Driving at more than 97 m.p.h., J. D. Aitken won the 300-mile Labor day race on the new $750,000 Cincinnati Speedway before 27,000 spectators. D'Alene was second and Galvin third. Gil Anderson, in a Stutz, drove too close to the inner wall, crashed into it, and both he and his mechanician were badly hurt, Anderson sustaining injuries to his spine and a broken leg and arm.

It was confidently expected that Resta would win the race, in view of his previous victories on speedways all over the country, but he was forced out.

At the end of the first hundred miles Resta was averaging 100.55 m.p.h., and he did not stop until the end of the 168th mile, when he had a lead of 1:22 over Aitken, who was second.

George Buzane, in a Duesenberg, was fourth in 3:23:19; Art Klein, in a Crawford, was fifth, time 3:34:15; Devlin finished sixth in a Duesenberg in 3:46:06. Haibe's Kleinart was flagged at 270 miles and given seventh money, being the only car running at that time, although there were ten prizes to compete for.

Resta Takes the Lead

Resta took the lead in the first lap, closely followed by De Palma, and while the Mercedes lasted these two rivals fought for position. Resta was headed by De Palma at the end of 8 miles and held his position two laps, then gave way to Resta for one lap, taking the lead again for three laps, Resta taking the lead at 10 miles and De Palma going out with a broken connecting rod at the end of 22 miles, Aitken moving up to second place. Mulford's Peugeot was third and Wilcox's Premier fourth at the end of the 28th mile.

Flying start of the 300-mile race on Cincinnati speedway. There were 27,000 spectators

Resta and Aitken ran one-two until 165 miles were reached; then Aitken took the lead and held it until the finish, although there were times when his margin was very narrow. By the time 200 miles were covered Resta had taken third place, D'Alene holding second. There was a constant fight between Resta and D'Alene for second place, reversing once or twice every 20 miles until Resta went out at 288 miles with an overheated motor due to a balky radiator. Resta made four stops, but only changed one tire, which shows how his car was going.

With a field of twenty-eight cars it is surprising that so few finished. The speed during the early part of the race was around 105 miles per hour, but the terrific pace told on engines and tires. One by one cars dropped out, the majority of them with broken rods or burned bearings, which seems to indicate that the track is faster than the cars could stand. Nine cars had not made any stops until they went out.

As to tires, the track seemed fairly easy, only thirty casings having been changed, or an average of a little over one to each car starting.

Buzane a Surprise

Buzane, who took fourth money, was a surprise. He was a last-minute qualifier. His car was wrecked at Kalamazoo a week ago, and it was only by night and day work that he got it rebuilt. He reached the track at noon Sunday, fitted a new block on his motor and qualified late in the afternoon, just before the final limit given.

It is felt that Anderson's accident might not have happened had he had sufficient rest. He burned out a center crankshaft bearing in practice Saturday and had to go to Indianapolis to get another. He practically tore his car down last night and worked on it nearly all

Specifications and Details of Equipment of Cars Which Started in the 300-Mile Cincinnati Derby Held on Labor Day at the New $750,000 Speedway

Car	Driver	Bore	Stroke	Dis.	Carb.	Ignition	Plugs	No. Plugs	No. Valves	Valve Location	TIRES Make	TIRES Size	Wb.	Wheels	Pistons	Oil	Shock Absorbers	Other Equipment
Sunbeam*	Christiaens	3 28	6.14	294 2	Miller	Bosch	K L G	6	24	Over	Silvertown	35x5	113	R.-W.	Alum. Al.	.....	Hartford	Moto-Meter
Peugeot	Resta	3 70	6 65	274 0	Miller	Bosch	K L G	4	16	Over	Silvertown	.....	100	R.-W.	Leavitt	Oilzum	Hartford	Moto-Meter
Peugeot	Merz	3 70	6.65	274 0	Zenith	Bosch	K L G	4	16	Over	Goodyear	35x5	106	R.-W.	Leavitt	Castor	Hartford	Moto-Meter
Premier	Wilcox	3.65	6 63	274 5	Miller	Bosch	K L G	4	16	Over	Goodyear	35x5	105	R.-W.	Lenvitt	Oilzum	Hartford	Moto-Meter
Stutz	Anderson	3 81	6.50	293 8	Stromberg	Bosch	Bosch	8	16	Over	Silvertown	33x5	102	Houk	Lenvitt	Oilzum	Hartford	Moto-Meter
Omar	Toft	3.75	6.75	298.2	Miller	Bosch	Rnjnh	8	16	Side	Goodyear	35x5	106	R.-W.	Leavitt	Oilzum	Hartford	Moto-Meter
Crawford	Klein	3.75	6.75	298 2	Miller	Bosch	Rnjah	8	16	Side	Silvertown	34x4 5	106	R.-W.	Leavitt	.....	Hartford	Moto-Meter
Crawford	Chandler	3 75	6.75	298.2	Zenith	Bosch	Rnjah	8	16	Side	Silvertown	33x5	106	R.-W.	Leavitt	.....	Hartford	Moto-Meter
Mercedes	De Palma	3 70	6.49	279.0	Mercedes	Bosch	Eisemnnn	8	16	Over	Silvertown	33x5	114	R.-W.	Leavitt	Monogram	Mercedes	Moto-Meter
Peugeot	Aitken	3 65	6 65	274 0	Zenith	Bosch	K L G	4	16	Over	Goodyear	35x5	106	R.-W.	Aluminum	Castor	Hartford	Moto-Meter
Maxwell	Rickenbacher	3.75	6.75	298.2	Miller	Bosch	K L G	4	16	Over	Goodyear	35x5	106	Houk	Lenvitt	Oilzum	Hartford	Moto-Meter
Duesenberg	D'Alene	3.75	6.75	298.2	Miller	Bosch	Rajnh	8	16	Side	Silvertown	3.5x5	106	R.-W.	Leavitt	Oilzum	Hartford	Moto-Meter
Maxwell	Henderson	3.75	6.75	298 2	Miller	Bosch	K L G	4	16	Over	Goodyear	35x5	106	Houk	Leavitt	Oilzum	Hartford	Moto-Meter
West Duluth	Rawlings	3 75	6.75	298 2	Miller	Bosch	Rajah	8	16	Side	Silvertown	33x4 5	106	R.-W.	Leavitt	Oilzum	Hartford	Moto-Meter
Delage	Franchi	3.70	6 29	268 9	Delage	Bosch	K L G	4	16	Over	Silvertown	34x4 5	106	R.-W.	Steel	Castor	Hartford	Moto-Meter
Kleinart	Haibe	3 98	5.00	248.0	Miller	Bosch	Rajah	8	8	Side	Nassau	33x4.5	99	R.-W.	Leavitt	Monogram	Hartford	Moto-Meter
Delage	Lecain	3.70	6 29	268 9	Delage	Bosch	Rnjah	4	16	Over	Silvertown	34x4.5	106	R.-W.	Leavitt	Castor	Hartford	Moto-Meter
Sunbeam*	Galvin	3.28	6 14	294.2	Claudel	Thomson	Rnjah	6	24	Over	Silvertown	35x5	113	R.-W.	Alum. Al.	Castor	Hnrtford	Moto-Meter
Dans l'Argent*	Muller	3 50	5 00	288.0	Hudson	Delco	Rajah	6	12	Side	Silvertown	34x4	102	R.-W.	Leavitt	Castor	Hartford	Moto-Meter
Duesenberg	Milton	3.75	6 75	298 2	Miller	Bosch	Rnjah	8	16	Side	Silvertown	34x4 5	106	R.-W.	Leavitt	Oilzum	Hartford	Moto-Meter
Duesenberg	Buzane	3.75	6 75	298 2	Miller	Bosch	Rajah	8	8	Side	Silvertown	33x5	106	R.-W.	Leavitt	Castor	Hartford	Moto-Meter
Hudson*	Vail	3.50	5.00	288.0	Hudson	Delco	Rnjah	6	12	Side	Silvertown	35x5	105	R.-W.	Leavitt	Castor	Hartford	Moto-Meter
Duesenberg	Devlin	3.75	6.75	298.2	Miller	Bosch	Answer	8	16	Side	Silvertown	33x5	106	R.-W.	Leavitt	Oilzum	Hartford	Moto-Meter
Osteweg	Osteweg	3.34	5.00	295.2	Miller	Bosch	Rajah	8	16	Side	Silvertown	33x5	102	Houk	Leavitt	Oilzum	Hnrtofrd	Moto-Meter
Hoskins	Hoskins	3.75	6 75	298.2	Miller	Bosch	Rajah	8	16	Side	Silvertown	34x4 5	106	R.-W.	Aluminum	Monogram	Hartford	Moto-Meter
Premier	Lewis	3.65	6 63	274.5	Miller	Bosch	K L G	4	16	Over	Silvertown	35x5	105	R.-W.	Leavitt	Oilzum	Hartford	Moto-Meter
Peugeot	Mulford	3.65	6 65	274 0	Zenith	Bosch	Rajah	4	16	Over	Silvertown	35x5	110	R.-W.	Leavitt	Oilzum	Hartford	Moto-Meter
Crawford	Moore	3.75	6.75	298.0	Miller	Bosch	Rnjah	8	16	Side	Silvertown	34x4 5	106	R.-W.	Leavitt	.....	Hartford	Moto-Meter
Frontenac	Chevrolet	3.87	6.38	300.7	Miller	Bosch	Rnjah	8	16	Over	Silvertown	33x4.5	103	R.-W.	Lynite	Castor	Hnrtford	Moto-Meter

*Six cylinders; all others four cylinders.

Infield at the new $750,000 speedway at Cincinnati during the 300-mile race which marked its inauguration on Labor Day. Note the parking of the cars in which a good share of the 27,000 spectators came to the track

night. D'Alene asked for and was given No. 13, and it seemed to have a charm, his winnings for to-day being $6,000.

Aitken won $12,000 and an extra $1,000 for leading at 200 and 250 miles. Resta got the Gibson trophy given by the Hotel Gibson for being first at 50 miles and $500 for being first at 100 miles. Galvin won $3,000, Buzane $1,500, Klein $1,300, Devlin $1,200, and Haibe $1,100. Haibe was overcome by the heat and Art Klein relieved him after having finished in a Crawford, thus winning two prizes in one race finished by two cars.

Planked Speedway

The 2-mile speedway is built on a tract of land 1 mile long and 1½ miles wide near Sharon, Ohio. Two-by-four planks are used and are laid lengthwise. This construction continues up at an angle of 90 deg. on the turns, thus making a safety rail with no breaks. The course is similar to New York's so far as the curves being part of a parabola.

35,000-Car Gain in Wisconsin

110,350 Cars and Trucks Registered Up to Sept. 1—353 More Dealers

MILWAUKEE, WIS., Sept. 4.—On the morning of Sept. 1 the report of private owners' registrations showed that 110,350 cars in the hands of private owners have been registered and licensed since Jan. 1. On the same day a year ago, the total was 75,600, showing a gain of nearly 35,000 cars for 1916. At this point last year the gain was 25,500 over the corresponding period of 1914.

20,559 More Than in 1915

On Sept. 1, Wisconsin registered 20,559 more cars than the total for the entire year 1915, which was 79,791. The gain represents more cars than were registered in Wisconsin during the entire year of 1912, when 24,578 cars were licensed. Likewise, it comes close to the total registration of 1913, which was 34,646.

The decided increase in the number of dealers is a feature of the situation in Wisconsin. In 1915, the state licensed 1,583 dealers. This year, up to Sept. 1, the number was 1,936, a gain of 353. Inasmuch as the practice of using dealers' licenses on privately-owned cars has been almost wholly discouraged, the license figures would indicate that Wisconsin has nearly 2,000 automobile dealers at this time, or just twice as many as it had in 1912.

Comparative figures on Wisconsin registration follow:

	1912	1913	1914	1915	To Sept. 1, 1916
Cars....	24,578	34,646	53,160	79,791	110,350
Dealers..	1,052	1,393	1,202	1,583	1,936

Over 16,000 Registrations in N. H.

CONCORD, N. H., Sept. 1.—Automobile owners will pay into the State treasury this year upwards of $325,000. Up to date the fees have run above $300,000, while last year they reached $257,000. More than 16,000 cars have been registered this year and about 1600 of them, or 10 per cent, are those of non-residents. Last year visiting motorists paid more than $15,000 into the State treasury. As September and October are good touring months many more visitors are expected here, and as the limit is but 10 days for them the fund is bound to swell.

Maine Registrations Increase 5534

AUGUSTA, ME., Sept. 1.—Maine is going to get a large revenue from the motorists this year. A few days ago the receipts had totaled $341,367.75. For the entire year of 1915 the state received $271,987, so the present total is $69,380.75. If the cars continue to increase the state will get at least $100,000 more than a year ago. The following table shows the increase up to Aug. 1:

	Jan. 1, to Aug. 1, 1915	Jan. 1, to Aug. 1, 1916	Increase
Automobiles	21,374	26,172	4,798
Trucks	1,098	1,834	736
Operators licensed	26,658	32,106	5,448
Dealers	324	305	*19

*Decrease.

180,000 Cars in Mo.

ST. LOUIS, MO., Sept. 4.—At the end of August, 180,000 automobile licenses had been issued by the state, more than 25,000 in excess of the total of last year. Of these, 19,453 were in St. Louis, 11,954 were in Kansas City.

U. S. L. Directors Elected

BUFFALO, N. Y., Sept. 1.—At the recent annual meeting of the stockholders of the U. S. Light & Heat Corp., the following board of directors were elected: E. H. Gold, J. A. Smith, R. C. Caples, H. W. Farnum, A. H. Ackerman, C. L. Lane, K. H. Addington, J. A. Roberts, Conrad Hubert, G. G. Shepard and E. K. Gordon.

The corporation recently obtained nearly $3,000,000 of new automobile storage battery business and has greatly increased its floor space and facilities to care for this increased volume of business.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Frl.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.58	.58	.58	.58	.58	.60	+ .02
Antimony, lb.	.13½	.13	.12¾	.12¼	.12¼	.12¼	— .01¼
Beams and Channels, 100 lb.	2.77	2.77	2.77	2.77	2.77	2.77	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb	.28	.28	.28	.28	.28	.28	...
Copper, Lake, lb	.28	.28	.28	.28	.28	.28	...
Cottonseed Oil, bbl.	9.30	9.40	9.61	9.60	9.60	9.70	+ .40
Fish Oil, Menhaden, Brown, gal.	.55	.55	.55	.58	.58	.58	+ .03
Gasoline, Auto, bbl	.23	.23	.23	.23	.23	.23	...
Lard Oil, prime, gal	1.05	1.05	1.05	1.00	1.00	1.00	— .05
Lead, 100 lb	6.70	6.70	6.70	6.70	6.70	6.70	...
Linseed Oil, gal	.72	.72	.72	.72	.72	.72	...
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.30	2.30	2.30	2.30	2.30	2.30	...
Rapeseed Oil, refined, gal	.90	.90	.90	.90	.90	.90	...
Rubber, Fine Up-River, Para, lb.	.69½	.69½	.69½	.69½	.69½	.69½	...
Rubber, Ceylon, First Latex, lb	.57	.56½	.56½	.56½	.56½	.56½	— .00½
Sulphuric Acid, 60 Baume, gal.	2.50	2.50	2.50	1.50	1.50	1.50	—1.00
Tin, 100 lb.	39.50	38.88	38.75	38.75	38.75	38.75	— .75
Tire Scrap, lb.	.05⅜	.05⅜	.05⅜	.05⅜	.05⅜	.05⅜	...

New York Gasoline Drops 1 Cent

Metropolitan District, Covering Long Island and Conn. Affected By Reduction

NEW YORK CITY, Sept. 5.—Gasoline prices in this city, Long Island, and Connecticut, have been lowered 1 cent a gallon wholesale to 22 cents by the Standard Oil Co. Texas gasoline sells at 23 cents wholesale. Quotations from the rest of the country are as yet unchanged, though prices are expected to drop on account of the large expansion in gasoline manufacturing capacity and the improvement in refining methods enabling a larger gasoline yield with a corresponding increase in the production of crude oil.

Market Prices Steady

NEW YORK CITY, Sept. 5.—Quotations on the automobile materials last week in this city were steady and strong with a brisk demand. Changes for the most part were unimportant. Aluminum has again risen to 60 cents a lb., and is still in large demand by the automobile makers. The steel market was steady with prices unchanged. Many of the manufacturers are now putting in their contracts for future delivery on steel. Tin has gone down to $38.75 per 100 lb., a loss of 75 cents. Copper prices are holding at the high rate of 28 cents a lb., with few buyers at that price.

Gasoline goes down 1 cent a gal. tomorrow in this city and the surrounding territory. The wholesale price will be 22 cents per gal., and consumers will pay 25 cents.

Tenth Market Report Issued

CHICAGO, Sept. 2.—The tenth edition of the National Used Car Market Report has been issued by the Chicago Automobile Trade Assn. The book is much the same as the ninth edition; zone 11, centering in Dallas, is still missing, the co-operation of dealers in that section not having yet been arranged.

The H-A-L and Liberty are new names. The Marion-Handley supplants the Marion. The Crow has been dropped but the Crow-Elkhart remains. There are 139 gasoline cars and fourteen electrics listed.

The Liberty, Madison and Saxon factories are now co-operating in the distribution of the report to dealers, making twenty-one car manufacturers.

The pocket edition accompanies the larger edition, containing in abbreviated form the data in the larger book. The form in both has been found satisfactory and has not been changed.

G. M. C. Features Securities

Rises 25 Points on Report of Financial Readjustment on Sept. 7

NEW YORK CITY, Sept. 5—The automobile and accessory securities were on the whole lower last week, though in good demand. General Motors featured with a net gain of 25 points for the week, its quotation on Saturday being 550. The directors of this company have considered a readjustment of the capitalization of the company and will take definite action on Sept. 7. Although details have not been completed, the plan which is now under consideration calls for the formation of a new corporation with a capitalization of $100,000,000. It is understood that five shares of new common stock for one of old will be given under the new financing plan. The preferred, according to the plan, would be exchanged either share for share, or possibly six shares of stock for five of the old issue. The new common shares would probably be of no stated par value.

Firestone a Cleveland Feature

Firestone Tire common on the Cleveland Exchange was also a feature last week, with a gain of 20 points, the stock rising to the record price of 1020. This company, it is stated, is about to declare a share dividend of 700 to 800 per cent. The capital is to be increased to $50,000,000. The rest of the tire issues were strong and steady, sharing the generally buoyant tone which pervaded the securities market at large.

Goodyear common was unchanged at 240. Miller common sold at 220. Kelly-Springfield in a turnover of 24,000 shares rose 7⅛ points. It is rumored on the street that negotiations are being arranged for the merger of several of the large tire companies.

Dividends Declared

Stutz Motor Car Company initial quarterly of $1.25 a share, payable Oct. 2.

Chandler 2 per Cent Extra Dividend

CLEVELAND, OHIO, Sept. 6—An extra dividend of 1 per cent has been declared by the Chandler Motor Co., which has also declared the regular quarterly payment of 2 per cent both to be made Oct. 2 to stock of record Sept. 18. The company inaugurated dividends at the rate of 6 per cent last April and in July put the issue regularly upon an 8 per cent basis.

Bowser Treasurer Resigns

FORT WAYNE, IND., Aug. 31—At a meeting of the board of directors of S. F. Bowser & Co., Fort Wayne, the resignation of C. A. Dunkelberg as treasurer, to become effective Sept. 1, was accepted and W. G. Zahrt was elected to succeed him. Mr. Dunkelberg has been connected with the company for 17 years and Mr. Zahrt for 12½ years.

Firestone Stock $50,000,000

May Declare 800% Stock Dividend—To Retire Preferred at 110

AKRON, OHIO, Sept. 4.—The Firestone Tire & Rubber Co. has called a meeting of shareholders for Sept. 30, to authorize an increase in capital from $4,000,000 to $50,000,000.

Of the new capital $10,000,000 will be 6 per cent preferred, of which $5,000,000 has been underwritten by banking interests. The other $5,000,000 will not be issued at present.

5 per Cent on Common

The present issue of $1,000,000 preferred will be retired at 110, and the present common stock issue of $3,000,000 will be increased to $40,000,000. Dividends on this new common will be at the rate of 5 per cent.

It is reported that a stock dividend of from 700 to 800 per cent will be declared. If this dividend is 700 per cent, the income return to the shareholder will be just double the 20 per cent now paid on the smaller issue.

Six years ago Firestone common was selling for $105 a share. By 1915 it reached $360 a share. During the panic period it dropped to $300 a share, but by July of last year had reached $510. Yesterday it sold for $1,050 a share, an increase of 900 per cent in six years.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co. (new)	..	..	64	65	..
J. I. Case pfd	72	79	80	84½	—2
Chalmers Motor Co. com	95	97	150	170	..
Chalmers Motor Co. pfd	95	97	95	100	—3
*Chandler Motor Car Co.	..	..	102½	103½	— ½
Chevrolet Motor Co	..	..	188	194	—9
Fisk Rubber Co. com	..	..	110	140	..
Fisk Rubber Co. 1st pf	..	..	..	..	..
Fisk Rubber Co. 2d pfd	..	..	..	..	..
Firestone Tire & Rubber Co. com	520	535	1020	..	+20
Firestone Tire & Rubber Co. pfd	111	..	112	114	..
*General Motors Co. com	241	243	550	580	+25
*General Motors Co. pfd	112	113	125	126	+3⅛
*B. F. Goodrich com	61¼	62¼	71½	71⅝	— ¼
*B. F. Goodrich pfd	107	108¼	113⅜	113⅞	..
Goodyear Tire & Rubber com	270	274	240	245	..
Goodyear Tire & Rubber pfd	108	109½	107	108	+ ¼
Grant Motor Car Co	..	..	7	8	..
Hupp Motor com	..	..	6	6½	— ½
Hupp Motor pfd	..	..	80	100	..
International Motor Co. com	30	31	6	10	..
International Motor Co. pfd	60	65	15	20	..
*Kelly-Springfield Tire & Rub. com	195	205	80⅞	81	+7⅛
*Kelly-Springfield Tire & Rub. 1st pfd	86	87	95	86⅝	..
*Lee Rubber & Tire Corp	..	..	45¼	46	+1¼
*Maxwell Motor Co. com	43	44½	83	83½	+ ½
*Maxwell Motor Co. 1st pfd	90	91½	85	86½	..
*Maxwell Motor Co. 2d pfd	36¾	38	54½	55	— ¼
Miller Rubber Co. com	190	194	220	226	..
Miller Rubber Co. pfd	107½	..	105	106	..
Packard Motor Car Co. com	120	..	160	170	—5
Packard Motor Car Co. pfd	101½	..	100	103	..
Paige-Detroit Motor Car	..	..	46	51	..
Peerless Truck & Motor Corp	..	..	23	24	—1½
Perlman Rim Corp	..	..	..	..	..
Portage Rubber Co. com	46	48	150	152	..
Portage Rubber Co. pfd	93	94	150	152	..
Regal Motor Co. pfd	..	..	17	22	..
Reo Motor Truck Co	17	18	36¼	37	+ ¼
Reo Motor Car Co	32½	34	40¾	43	—2½
Saxon Motor Car Co	..	..	70½	72½	—1½
Springfield Body	..	..	83	83½	— ¼
Standard Motor Co	..	..	6½	7½	..
Stewart-Warner Speed. com	64	65	111	113	—6
Stewart-Warner Speed. pfd	105	107	..	..	..
*Studebaker Corp. com	111	112	122¾	123⅛	—2½
Studebaker Corp. pfd	104	105	107½	111	..
Swinehart Tire & Rubber Co	88	90	95	100	..
United Motor Corp	..	..	77	79	+16½
*U. S. Rubber Co. com	49	50	57	57¼	+ ½
*U. S. Rubber Co. pfd	104	104¾	110¾	111¾	— ⅜
White Motor Co. (new)	..	..	52½	53½	—1¼
*Willys-Overland Co. com	182	184	42½	42¾	—3½
*Willys-Overland Co. pfd	105	108	103¾	103¾	— ¼

*At close Sept. 2, 1916. Listed New York Stock Exchange. Quotations by John Burnham & Co.

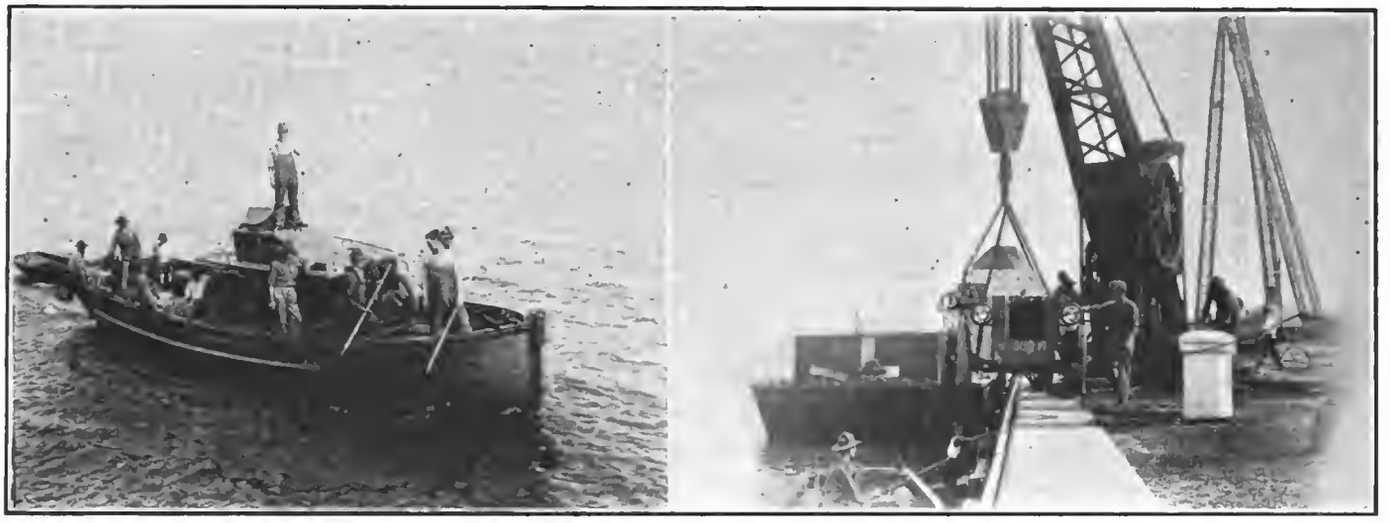
OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Bid	Asked	Wk's Ch'ge
Auto Body Co	..	..	36¾	..	..
Chalmers Motor Co. com	99	..	..	155	..
Chalmers Motor Co. pfd	95	97	99	103	..
Continental Motor Co. com	..	300	35	36	— ½
Continental Motor Co. pfd	84	86	9½	10½	..
Ford Motor Co. of Canada	..	1525	305	330	—15
General Motors Co. com	240	244	505	580	—35
General Motor Co. pfd	111	114	125	129	+5
Maxwell Motor Co. com	43	45	82½	85	+ ½
Maxwell Motor Co. 1st pfd	89½	92	84	87	—1
Maxwell Motor Co. 2d pfd	37	39½	54	57	..
Packard Motor Car Co. com	..	120	165	171	..
Packard Motor Car Co. pfd	100	..	100	102	—1
Paige-Detroit Motor Car Co	440	450	52½	56	+7½
W. K. Prudden Co	20¼	22	42½	44	..
Reo Motor Car Co	33½	34¼	41¾	43¼	—1
Reo Motor Truck Co	17¼	17¾	36	37	..
Studebaker Corp. com	109	112	122	125	—2
Studebaker Corp. pfd	102	106	105	..	..
C. M. Hall Lamp Co	..	..	..	..	..

INACTIVE STOCKS

Atlas Drop Forge Co	26	29	30	..	..
Kelsey Wheel Co	205	..	55	60	..
Regal Motor Car Co. pfd	..	21	17	..	..



King armored car undergoing tests for use with landing parties of marines. At the left, method of transporting by boat, and at the right, hoisting the car to the wharf

King Armored Car at Rock Island

After Tests at Fort Myer and at Sea Trials Are Continued

ROCK ISLAND, ILL., Sept. 5.—That government interest in military motors has not waned with the subsiding of the temporary excitement on the Mexican border is attested by the arrival at the government arsenal here to-day of the King armored car which was under test by the officers of the ordnance department at Fort Myer, near Washington, D. C., recently. With its arrival at Rock Island, the land battleship completed another of the series of strenuous trials through which it is being put.

A Reliability Test

The present test is for the purpose of determining the reliability in overland trips and began in New York, Aug. 29. It was under the supervision of F. E. Edwards, chairman technical committee of the American Automobile Assn., H. A. Tarantous, New York, and Darwin S. Hatch of *Motor Age*.

The armored car was accompanied also by Capt. W. A. Ross, who has been with the military cars of the Allies in Europe and now is connected with the Armored Motor Car Co., Detroit, Mich. The ordnance department had a representative on board.

The miniature scout cruiser for land fighting is almost completely covered with ¼-in. armor plate and carries a revolving turret in which is mounted a machine gun. In action, it carries three men, a driver, mechanic and gunner, the latter revolving with the turret. When not in action three additional men can be carried comfortably outside. It is arranged to be completely inclosed in action, doors even closing over the radiator, so that with the exception of the wheels, no vital parts are exposed to fire. Small slits in the armor plate give vision to driver and gunner. Three sources of gasoline supply are provided, all within the protective covering, thus assuring a supply of fuel, even though the main tank should become damaged. The main tank in the frame feeds by suction to the Carter tank, and two others holding 4 gal. each, feed by gravity. The body is the design of Captain Ross and was built by the Armored Motor Car Co., Detroit, Mich.

It is mounted on an eight-cylinder King chassis, which, except for the dual wire wheels and tires in the rear and the wire wheel in front, is standard King production. Equipped with the armored body the car weighs 4600 lb., a figure considerably less than the weight of the armored cars now in service of the United States government.

Some of the other features of the car and its equipment are of particular interest. The body is constructed in units so that it can be taken apart for handling very easily. Two bridges, each 12 in. wide and as long as the whole car are mounted, one on either side of the body so that they serve the purpose of mud guards as well as for crossing ravines or loading on freight cars, barges, etc. At present these bridges are wood with steel trusses.

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Hupmobile Capital-to-Capital Car Climbs Fort George Hill

NEW YORK CITY, Sept. 1—The Hupmobile model N touring car which is traveling from State capital to State capital, paused here long enough yesterday to give a demonstration of hill-climbing ability on Fort George hill. The car, driven by C. E. Salisbury, climbed the hill on high gear under the sanction of the American Automobile Assn. The hill is about 400 yd. in length and has a gradient of between 11 and 12 per cent all the way up. It is surfaced with Belgian block giving a very difficult road for traction, and is locally well known for its steepness. The test was under the supervision of J. Edward Schipper as technical representative of the A.A.A. The car left here for Hartford, Conn., to-day, after which other New England State capitals will be visited.

Hupmobile capital-to-capital car climbing Fort George hill in New York City under the supervision of the A. A. A.

Factory Miscellany

Indianapolis Parts Co. Builds—The Metal Auto Parts Co., Indianapolis, Ind., will build a plant costing $60,000.

Schwarz Wheel to Enlarge—The Schwarz Wheel Co., Philadelphia, Pa., has purchased 6 acres at Holmesburg, near its present plant, for extensions.

Philadelphia Machine Co. Builds—The Tinius Olsen Testing Machine Co., Philadelphia, is having a four-story factory building erected at 1210-12-14 Nectarine Street.

Claus Cock Co. Builds—The Claus Automatic Gas Cock Co., 2601 Vliet Street, Milwaukee, is building a new plant, 81 by 149 ft., at Franklin and Booth Streets, to be ready Oct. 15 or Nov. 1.

Makes Special Paint for Automobile Parts—The Shepard Paint Co., Columbus, Ohio, is placing on the market specially prepared paint for the protection of automobile parts, in addition to its regular line of paints.

John Brown Co. Installs Electric Ovens—The John W. Brown Manufacturing Co., Columbus, Ohio, maker of automobile lamps and accessories, has installed a series of electric ovens, which will double the capacity of the plant.

Piston Ring Co. Builds—With its new four-story factory building practically completed, the Piston Ring Co., Muskegon Heights, Mich., has started the installation of machinery. A machine shop of the latest description will occupy the greater part of the new building.

Delay on Falls Motor Addition—Some delay is being encountered in the commencement of work on the new assembling shop and repair shop for the Falls Motors Corp., Sheboygan Falls, Wis. Bids received early this week for the work were rejected and a new call issued. Figures closed Sept. 1 under the new request.

Makes Spring-Tempering Furnace—The Railway Materials Co., Stevens Point, Wis., has opened a new department which will manufacture fuel oil furnaces for tempering vehicle springs and steel forgings. Equipment is now being installed and a large production is being arranged for to fill the big volume of orders already in hand.

Partridge Rubber Buys Guelph Plant—The Partridge Rubber Co. of Montreal, Que., has bought the business and plant of the Standard Tire & Rubber Co., Guelph, Ont. The purchase price was in the neighborhood of $150,000. The company expects to give employment to 150 hands at the outset, and the expectation is that this number will be increased. The new concern takes over all the contracts of the Standard people.

Briggs & Stratton Build—The Briggs & Stratton Co., 258 Milwaukee Street, Milwaukee, Wis., one of the largest manufacturers of ignition and automobile specialties in the Middle West, has started work on the erection of a new plant costing in excess of $100,000. A new location, Hopkins and Center Streets, has been chosen. The main building will be five stories high, 60 by 220 ft. in size, and of strictly fireproof construction.

Perfection Tire May Build at Niagara Falls—The Perfection Tire & Motor Co., Ltd., manufacturer of automobile tires and mechanical rubber goods, will erect a factory in Niagara Falls, Ont., providing the ratepayers ratify a by-law which will be presented to them in a few weeks. The by-law provides that the city furnish the company with power at $10 a horsepower for a period of 10 years, also give the company a fixed assessment for this time.

Cleveland Factory Items—The National Acme Manufacturing Co., Cleveland, Ohio, has purchased 15 acres of land at East 131st Street and the Belt Line, where an additional plant will be located, as no more land could be secured on Stanton Avenue adjoining the present factory. The deal involved about $100,000.

The Bondy Manufacturing Co., maker of automobile tops, has arranged to lease for a term of 20 years a building that will be erected on Carnegie Avenue, just west of the Packard-Cleveland Co.'s new building. The width of the ground is 50 ft.

The Big Four Tire & Rubber Co., with offices in the new Guardian Building, has purchased the old plant of the Ohio Rubber Co. at Berea, a few miles south of this city. It will be equipped and in operation within 60 days, if present plans are carried out.

The Automobile Calendar

ASSOCIATIONS

Sept. 25—Indianapolis, Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.

Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.

Oct. 2-7—Kansas City, Mo., Dealers' Show, American Royal Live Stock Show; Kansas City M. C. Dealers' Assn.

Oct. 13—Flint, Mich., Fall Meeting National Assn. of Automobile Accessory Jobbers.

Dec. 2-9—Electricians' Countrywide Celebration.

CONTESTS

Sept. 9—Indianapolis Speedway Race.

Sept. 9—Newark, N. J., Track Race, Olympic Park, Racing Assn.

Sept. 16—Providence Speedway Race.

Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.

Sept. 29—Trenton, N. J., Inter-State Fair, H. P. Murphy, Racing Sec.

Sept. 30—New York City, Sheepshead Bay Speedway Race.

Oct. 7—Philadelphia Speedwsy Race.

Oct. 7—Omaha Speedway Race.

Oct. 14—Chicago Speedway Race.

Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.

Oct. 21—Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.

Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

April, 1917—Los Angeles to Salt Lake City Road Race.

GOOD ROADS

Sept. 1-9—Cincinnati, Ohio, Good Roads Exposition and Convention, Music Hall, Hamilton County, Dixie Highway Council of Cincinnati.

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

SHOWS

Sept. 2-9—Clevelsnd, Ohio, Show, Industrial Exposition and Fair, Edgewater Park.

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.

Sept. 4-8—Hartford, Conn., Show, Connecticut Fair Assn.

Sept. 4-9—Minneapolis, Minn., Show, State Fair.

Sept. 4-11—Indianapolis, Ind., Show, Indiana State Fair, Indianapolis Automobile Trade Assn.

Sept. 10-16—Milwaukee, Wis., Show, Wisconsin State Fair, Machinery Bldg.

Sept. 25-30—Salem, Ore., State Fair, Joseph M. Rieg, manager.

Oct. 14-31—Dallas, Texas, Show, State Fair.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 13-20—Montreal, Que., Show, Montreal Automobile Trade Assn.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Jan. 27-Feb. 3, 1917—Chicago, Ill, Show, Coliseum, National Automobile Chamber of Commerce.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb.—St. Louis, Mo., Show, Auto Manufacturers, and Dealers' Assn.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

March 3-10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

TRACTOR

Sept. 4-8—Madison, Wis., Tractor Demonstration.

Sept. 11-16—Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Week in the Industry

Hartford Trade News—F. G. Robins, Autocar distributer, Hartford, Conn., has removed from 522 Asylum Street to 45 Ann Street to the quarters recently vacated by the Chalmers Auto Agency.

Wells Wetherell, formerly of the firm of Kingsbury & Wetherell, has severed his connection and joined Frank G. Robins, Inc., taking with him the representation of the Saxon.

The Overland-Hartford Co. has removed the parts department from the towntown salesroom to the temporary service building on Lawrence Street, formerly the Billings & Spencer Co. machine shop.

D. A. Thrall, Ollie Thrall, E. H. Richardson and C. M. Colton have formed the Thrall-Colton Motor Car Co. and have taken quarters at 1283 Main Street. The firm will represent the Kissel Kar. C. M. Colton until recently was associated with the Colonial Auto Co. at 1270 Main Street.

St. Louis Items—R. W. Immasche, St. Louis, until recently distributor of the Stutz cars in this territory, has accepted the agency for the new Jordan car. He will open temporary showrooms at 4130 Olive Street.

The Dorris Motor Co. will open showrooms on Locust Street, for the first time taking a place on the Row. The former Chevrolet showrooms at the Locust-Lindell cutoff have been leased from the Chevrolet Co. of Missouri, Inc., which took over the distribution from the Triangle Motor Co.

C. B. Hollister has been promoted by the Efficiency Oil Co. and has charge of the company's plant at 2100 North Kings Highway. C. C. Thurston becomes sales manager at the branch at 3219 Locust.

Curtis Van Antwerp has been placed in charge of the service department of the Supreme Motor Co. Tom Herbert, formerly salesman for the Peerless distributor, has joined the force of the Supreme Motor So.

Packard Missouri Motor Co. has opened used-car showrooms in the recently leased building at Eighteenth and Pine Streets. E. Dillard, a newspaper man, is in charge.

Broadway Motor Co. has leased showrooms at Broadway and Cass Avenue for a Ford agency.

Tevis Motor Co. has leased 3118 Locust for a Ford agency.

Ohio News Items—L. C. Bailey, formerly manager of the Toledo-Mercer Co., Toledo, has been made sales manager of the George E. Wert Co., northwestern Ohio distributer for the Marion and Briscoe.

F. M. Bonner & Son is the name of a new concern at 21 East Walnut Street, Columbus, to handle and rebuild Fords.

The Commercial Motor Sales Co., 411 West Spring Street, Columbus, is the name of a new concern organized to handle Bessemer trucks in central Ohio territory.

The Broad & High Auto Supply Co. is the name of a new concern at 43 West Broad Street, Columbus, to handle supplies. It is operated by W. M. Borrow & Co.

The Blair Motor Truck Co., Newark, has opened an agency in Columbus under the name of the Blair Motor Truck Sales Co., located at 60 East Spring Street.

Oscar Lear Motor Car Co., Columbus, has solved the problem of disposing of used cars by holding an auction of second-hand machines. The offer was made that if the purchaser was not satisfied after trial the money would be refunded.

The Laurence Motor Co. is the name of a new concern organized at 165 North Fourth Street, Columbus, to handle Republic and Vim trucks in nine counties in central Ohio. Y. B. Jones is general manager. It is the intention to operate a service department in connection with the sales department.

In order to relieve the increasing congestion in the down-town business section of Columbus, C. L. McKee, a broker, plans the erection of a five-story fireproof garage at Fourth and Spring Streets to take care of cars during business hours. There is a strong agitation to prevent parking of automobiles on the downtown streets, and the plan is to provide a place for cars, which will be forced off the streets. In anticipation of the passage of an ordinance preventing parking of cars, many available sites are being optioned for the purpose of erecting garages.

Toronto Items—G. C. Pearsall, connected with the Russell Motor Car Co., Toronto, has been appointed Canadian distributer for the Scripps-Booth.

The Mutual Motors, 960 Gerrard Street, East Toronto, Ont., has been selected as Ontario representative for Marion-Handley cars.

Wis. Trade Happenings—J. C. Heitman, Sparta, has taken the agency for the Pathfinder in a large territory in western Wisconsin, including La Crosse, and has established headquarters in the M. Savage & Co. garage, 419 State Street, La Crosse.

E. A. Glab has retired from the Enger Motor Sales Co., Milwaukee, and will devote his entire attention to the Pathfinder Sales Co., 163 Eleventh Street, Milwaukee, of which he is president.

The Overland-Green Bay Co., Green Bay, northeastern Wisconsin distributer for the Overland-Wisconsin Co., Milwaukee, state agent, has awarded contracts for the erection of its branch house at Pearl and Walnut Streets, Green Bay. It will be 100 by 120 ft. in size, two-story and basement, and of fireproof construction. The Overland-Wausau Co., another subsidiary recently formed, is building a three-story branch house, 60 by 120 ft., at Wausau, to serve central Wisconsin.

The Milwaukee Auto Sales Co., Seventh Street and North Avenue, Milwaukee, is state distributer of the Briscoe and the Detroiter Six.

W. F. Schroeder, Platteville, has been appointed Mitchell dealer in southwestern Wisconsin territory.

Philadelphia Items—The Biddle Motor Car Co. of Philadelphia has opened an export office in Whitehall Street, New York, and is now shipping cars to foreign countries. The company has a number of models, but specializes on none. President Maris states that a change of policy is being considered and that next year the cars will be sold through dealers. More expensive bodies will be used.

The Smith Form-a-Truck Sales Co. of New York has opened a Philadelphia branch and service station at 2121 Vine Street. W. H. Durphy has been appointed district manager.

C. J. Rogers, of the Rogers-Sargent Motor Co., 202-204 North Broad Street, Philadelphia, was appointed by the manufacturers of the Lexington automobile Eastern representative, in charge of the sales in this State, New Jersey, Delaware and Maryland. Mr. Rogers will retain his office in the Lexington agency here.

The Philadelphia Gear Works, 1120 Vine Street, is erecting a tool house addition adjoining its plant.

The Chester County Motor Co., Coatesville, Pa., has leased a two-story building at 5740 Cherry Street, Philadelphia which will be used as a garage and service station.

The Belmont Garage, Forty-fourth Street and Parkside Avenue, has taken the agency for the Dixie automobile, made by the Dixie Motor Co., Louisville, Ky.

The Automobile

Vol. XXXV
No. 11

NEW YORK, SEPTEMBER 14, 1916

Ten cents a copy
Three dollars a year

"What a Fool"—

—said a man the other day as he watched a perspiring car owner laboriously inflating his tires by hand.

"For the modest sum of $12 that man can get a Stewart Tire Pump—let his motor do the work and get full mileage out of his tires in the bargain."

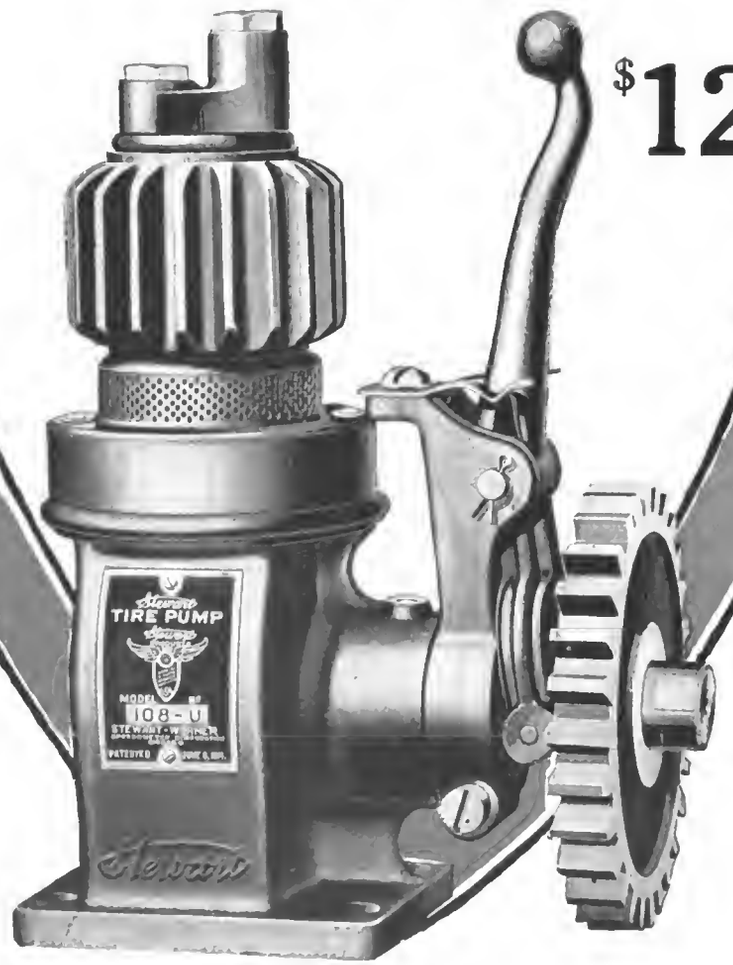
Dealers—tell this to every car owner that comes into your sales room and you'll do business!

"It will pay you to see that the car you buy is equipped with Stewart Products"

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Stewart

Motor Driven Tire Pump



$12

The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, SEPTEMBER 14, 1916—CHICAGO NO. 11

Maxwell Earnings Gain 135%

Car Sales Increase 88% Over 1915—Can Make 100,000 Cars Per Year

NEW YORK CITY, Sept. 13—Maxwell earnings have increased 135 per cent over last year and 260 per cent in the last 2 years, according to the annual statement issued by Walter E. Flanders, president of the Maxwell Motor Co., Inc., to the stockholders. The surplus earned in the last year was equivalent to 30 per cent on the common stock after allowing 7 per cent on the first preferred and 6 per cent for the second preferred. The report states that the surplus earnings after a deduction of $500,000 for depreciation were $5,426,000.

Net Assets $11,176,783.26

The net working assets of the company and its subsidiaries at the close of its third fiscal year are $11,176,783.26, an increase as compared with the close of the second fiscal year, of over $3,500,000 and an increase as compared with the close of the first fiscal year, of over $5,000,000.

Cash on hand is $3,269,552.50 as compared with $2,652,628.60 at the close of the second fiscal year, and $1,175,992.68 at the close of the first fiscal year.

The inventories have been taken on most conservative lines, without any element of profit due to advanced prices for materials purchased under favor contracts.

The number of cars sold by the Max-

(*Continued on page* 462)

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August a Record Month for Paige

DETROIT, Sept. 8—For the month of August just closed, the Paige-Detroit Motor Car Co. established a new record for volume of business done. Although August is not generally regarded as a big month with automobile manufacturers, nevertheless Paige transacted in the 31 days $2,020,000 worth of business, which is the greatest month's showing in the concern's history.

In making this announcement, Paige points out that the figures quoted do not tell the whole story, however. The demand for immediate shipment was much larger than the total volume of business would indicate. It was necessary to hold up orders for 1982 cars, and place the delivery of these in September. It is believed that the present month will even exceed the August record.

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Willys-Overland Capacity for 1917 Is 300,000

TOLEDO, OHIO, Sept. 12—By the end of the present year the Willys-Overland Co. will be in position to manufacture 300,000 cars annually, according to a statement by John N. Willys, president of the company.

The total outlay for this construction and additional equipment will be less than $5,000,000 and will terminate, temporarily at least, the company's policy of expansion, which has made Overland the second largest car manufacturer in the world.

From this time on, Mr. Willys states, the energies of the organization will be devoted to reducing costs, increasing efficiency and improving production.

The recent sale of 600,000 shares of common stock has placed the company in such financial position that no further increase in preferred or common will be required for its expansion. The statement of assets and liabilities as applied to the balance sheet of June 30 last, shows that upon payment for the new stock, the company will have more than $20,000,000 cash on hand and more than $25,000,000 of other quick assets.

Mr. Willys owns a majority of the common and states that it is his intention to continue personally to control and direct the affairs of the company.

United Motors Corp. Buys Klaxon

Sixth Accessory and Parts Concern To Be Merged—McConnell President

NEW YORK, Sept. 12—The Klaxon horn business has been taken over by the United Motors Corp., which was formed several weeks ago as a merger of five parts companies. The Lovell-McConnell Mfg. Co. of Newark, N. J., which built the horn business, will become the Klaxon Co. and F. Hallett Lovell, Jr., president and principal owner, will retire from active connection with the company, although he will remain a director.

The Lovell-McConnell plant will be doubled at once to provide for increased production. Simultaneously with the consummation of this merger, comes a statement from the Willys-Overland Co. that it will discontinue the manufacture or horns and will close a contract with Klaxon for a term of years.

Contracts are also being executed for the use of the Klaxon horn on the Cadillac, Buick, Oldsmobile, Oakland, Scripps-Booth and Chevrolet. It is used on many other cars.

D. A. McConnell, who has been vice-president since the concern was organized, about 9 years ago, will become president; Otis C. Friend, who recently retired from the Mitchell to join the United Motors, will be the new vice-president, and Walter P. Coghlan, who has been secretary, will become secretary and treasurer. While Lovell will remain a director, his time will be chiefly devoted to other concerns.

The United Motors Corp. includes besides the Klaxon, the Perlman Rim Corp., Remy Electric Co., New Departure Mfg. Co., Hyatt Roller Bearing Co., and Dayton Engineering Laboratories Co., maker of Delco electric systems.

Ford Races Draw 10,000

Rebuilt Cars Average Well Over 60 M.P.H. on Chicago Speedway

CHICAGO SPEEDWAY, Sept. 10—Fords that looked like Fords and some that did not showed their speed proclivities today in the world's first Ford speedway race. If any of the 10,000 spectators came with any doubt as to rebuilt Fords doing a mile in a minute or less they went away with minds relieved of that feeling. They saw 20 miles run at an average of 62.83 miles per hour, 30 miles at 60.4, and 50 miles at 62.5 miles per hour, first honors in the former and latter going to Paul D. Harvey, Oak Park, Ill., whose car carried No. 1, and bore a striking resemblance to Dario Resta's blue Peugeot. Just to show that his car had some reserve speed, Harvey did a lap in the 50-mile event in 1 minute and 35 seconds, or at the rate of 72.5 miles per hour. This came immediately after he lost the lead at the end of 38 miles through a stop at the pits to change a spark plug.

Harvey's time for the 20 miles was 19 minutes and 6 seconds, and his average speed 62.83 miles per hour. Laznasky's time was 19 minutes 12.4 seconds; speed, 62.49. Jury finished in 19 minutes and 21.4 seconds, his average being 60.7 miles per hour. H. A. Wolf, Desplaines, Ill., was fourth in 20 minutes and 44.2 seconds; speed, 57.87 miles per hour. The others were flagged. Harvey won $125; Laznasky, $75, and Jury, $35.

The Illinois Championship

The second race of the afternoon was for the Illinois State championship, limited to Illinois entries only, and was for 30 miles. Eight cars started and stellar honors went to B. F. Davis, Paris, Ill., who turned the fifteen laps in 29 minutes 47.3 seconds. His average being 60.4 miles per hour. Only once did he give up the lead, Verne Abbott, Woodstock, Ill., heading him across the tape at the end of 26 miles. He regained his position, however, before the next lap was completed and finished 6.3 seconds ahead of Abbott, whose total time was 29 minutes 53.6 seconds, an average of 60.2 miles per hour. Third place went to P. F. Walter, Merrillville, Ind., in 32 minutes and 36 seconds, a speed of 55 miles per hour.

Harvey led throughout the 50-mile race except for the one lap as mentioned previously. Davis was a close contender up to 32 miles and it seemed to be a toss-up between them until a broken connecting rod put the Paris (Ill.) car out of the running. At 10 miles Harvey's time was 9:28:6; speed, 63.25; 20 miles, 18:39:6; speed, 64.25; 30 miles, 27:47; speed, 64.75, and his finish 48:10, speed, 62.5 miles per hour. Laznasky was second, in 48:08:6, and his speed was 61 miles per hour. Henry Mueller, Chicago, was third, his time being 52:35:4, and his speed 57 miles per hour. Peter F. Cordell, Oak Park, Ill., finished fourth, his time being 52:45:6.

The interstate championship, or 50-mile windup, carried a $500 first prize, $100 second and $50 third. Thus Harvey, by winning $125 in the first event and $500 in the final, won $625. He was the only entrant to win two prizes. How these cars were rebuilt is told on pages 465 and 466.

—

1917 Elcar at $795

NEW YORK CITY, Sept. 8—The 1917 Elcar, selling at $795, has been announced by the Elkhart Carriage and Motor Car Co., Elkhart, Ind. There are two body types, the Clover Leaf roadster, seating four passengers, and a five-passenger touring car.

The specifications include a long-stroke motor, 3½ by 5; unit power plant; three-point suspension; 114-in. wheelbase; full-floating rear axle; Delco ignition; full Turkish style upholstering.

—

Applications Now for Show Space

NEW YORK CITY, Sept. 13—Application blanks for floorspace and diagrams have been issued for the seventeenth annual automobile shows by the National Automobile Chamber of Commerce. They must be returned, filled out, by Sept. 30 in order that the applicants may participate in the drawing for the first allotment which takes place at the Chamber of Commerce headquarters on Thursday, Oct. 5. The New York show will be at the Grand Central Palace from Jan. 6 to 13. The Chicago show will be at the Coliseum and Armory from Jan. 27 to Feb. 3.

As usual, there will be two departments of the automobile section, which at New York will include the first and second floors of the Palace. There will also be wall space on the third and fourth floors. At the Coliseum and Armory the automobile section will include all of the main floors of both buildings. The remaining space will be devoted to accessories, parts, motorcycles, etc. The price per square foot is as follows: New York, $1.10 to $1.50; Chicago, 75 cents to $1.25.

—

White Co. to Erect Addition

CLEVELAND, OHIO, Sept. 11—The White Co. is to add a $200,000 building to its present manufacturing facilities. It will consist of a one-story concrete and steel structure 241 by 304 ft. This will be built at the northeast corner of the present plant.

Reo Truck and Car Combine

Directors Believe One Organization Better in Handling Increased Business

LANSING, MICH., Sept. 8—The Reo Motor Truck Co. and the Reo Motor Car Co. are to be formally consolidated by an exchange of the shares of the truck company for an equal number of shares of the car company.

According to an announcement sent out to-day to the stockholders of the two companies the directors of the Reo Motor Car Co., who are also directors of the truck company, after careful consideration, believe the interests of both corporations will be best served by such a move. The same executive, selling and office organizations have endeavored to handle the business of both, and up to this time the same motors and many parts manufactured by the Reo car company have been used by both companies. However, changes in design and further development of the business will make such an arrangement impractical, it is stated.

Increased business, it is pointed out, has correspondingly increased the difficulties in handling the affairs of the two corporations separately, and makes it impossible to secure the results that the directors are convinced can be obtained through one well-organized corporation and administration.

Administration Simplified

Accordingly, the Reo Motor Car Co. will purchase all Reo Truck stock delivered to the Capital National Bank, Lansing, or to Secretary D. E. Bates of the Reo Motor Car Co., on or before Sept. 20th, and pay for these shares with car stock.

The car stock has been selling on the Detroit Stock Exchange around $44 per share, and the truck stock some 5 points under it, but to-day the truck stock climbed to the same figure as the car.

Buys Three Blocks

A tract of land covering three city blocks located south of the Grank Trunk railroad tracks and extending to the Michigan Central tracks, have been purchased by the Reo Motor Car Co. Together with other land purchases made in that section of Lansing, the Reo company now has nearly half a mile of land along the Grand Trunk tracks. The purchases have been made to be prepared for further extensions of the plants of both the Reo car and the Reo truck companies, and it is not unlikely that the erection of new buildings will be started in the near future.

Motor Products Gets Lozier Plant

$1,000,000 Deal Gives Lozier Present Plant of Rands Mfg. Co.

DETROIT, MICH., Sept. 8—A deal said to involve a $1,000,000 consideration has been closed here between the Motor Products Corp. and the Lozier Motor Co., whereby the large modern plant of the Lozier company comes into the possession of the Motor Products Corp. The Lozier company does not go out of existence by this move, however, for it will take over the plant now used by the Rands Mfg. Co., one of the subsidiaries of the Motor Products combine.

The Lozier plant is a large group of up-to-date factory buildings located on Mack Avenue, on the west side of the city, and covering about 62 acres. There is an attractive administrative building in front of the factory structures, and a power plant for supplying ample power for all machinery. It was occupied by the old Lozier company prior to the reorganization, and has since been used for the manufacture of Lozier cars by the new Lozier concern.

Motor Products Corp. was organized in May of this year, with a capitalization of 100,000 shares of no par value, as a holding company for several large parts manufacturers located in Detroit and vicinity. The Rands Mfg. Co., maker of windshields, tops and steering wheels; the Vanguard Mfg. Co., specialist in windshield manufacture; the Diamond Mfg. Co., producer of automobile metal stampings; and the Universal Metal Co., maker of metal parts and possessing a large tube mill are all parts of the Motor Products Co. and located in Detroit. Besides these, the combine includes the Superior Mfg. Co., Ann Arbor, Mich., which is also a windshield and metal parts producer.

To Concentrate

The acquisition of the large Lozier works is the first step toward the concentration of the activities of the consolidation, and it is pointed out by one of the officials that the new plant will allow Motor Products to realize at once the fundamental purposes for which the company was formed. By means of this concentration in one plant, it will not only enable the concern to put in effect some great economies in manufacturing, but will enable the securing of managerial co-operation such as could not be attained while a number of plants were operating as separate units.

Motor Products is headed by well-known men in the industry. W. C. Rands is president; C. F. Jensen, vice-president; H. H. Seeley, vice-president; D. B. Lee, treasurer and general manager; M. L. Brown, secretary, and R. R. Seeley, director and production manager.

In addition to concentration in the new property it is the intention to make large additions to the tube mill to keep pace with a growing business, and to continue the Ann Arbor plant on special work, besides the expanding of the Walkerville, Ont., plant to care for an increasing Canadian business.

The plant that goes to Lozier, and up to this time has been occupied by the Rands subsidiary, was formerly the home of the Warren Motor Car Co., now out of business. Being constructed primarily for the making of automobiles, the Lozier people expect to effect economies in manufacture of their car. The buildings are of brick and occupy a site covering 6 acres. This property is said to be valued at $300,000. The cash received from the sale of the Lozier plant will be utilized as working capital by the Lozier concern, and plans for refinancing will bring new money into the business, according to Samuel Frank, secretary of the concern.

Watson Asst. to Haynes, Gen. Manager

KOKOMO, IND., Sept. 14—Don L. Watson, for the last year sales manager of the Haynes Auto Company, has been promoted to the office of assistant general manager, a newly created position. He will do a large part of the detail work in the general manager's office.

Davidson Resigns from Continental

DETROIT, MICH., Sept. 8—Wm. J. Davidson, of the engineering department of the Cadillac Motor Car Co., has resigned to take up other lines of activity in the industry.

Pike Heads Paige Efficiency Dept.

DETROIT, MICH., Sept. 8—The recently established efficiency and sales promotion department of the Paige-Detroit Motor Car Co. is to be managed by C. S. Pike, who comes from the sales department of the Burroughs Adding Machine Co., this city.

Batchelder Asst. Sales Mgr. of Dort Co.

FLINT, MICH., Sept. 8—C. F. Batchelder has been appointed assistant general sales manager for the Dort Motor Car Co., this city. He was for 10 years general sales manager of the John Deere Plow Co.

Bradley Is Paige Purchasing Agent

DETROIT, MICH., Sept. 8—Thomas Bradley, for 5½ years with the Paige-Detroit Motor Car Co., as assistant in the purchasing department, has been promoted to the position of purchasing agent, following the resignation of P. E. Stroup, former purchasing manager.

Harroun Cars by Show Time

To Make 25,000 Cars Next Year—Work on Design for 2 Years

NEW YORK CITY, Sept. 13—Papers will be filed to-morrow at Wilmington, Del., incorporating the Harroun Motor Corp. for $10,000,000, all common. Ray Harroun, well known as a racing engineer, and for his connection with the Maxwell racing team, has been working on this car for 2 years. The first car is now ready and there will be ten sample cars ready for the national shows in January. Production will start for dealers in March and by May 1 the organization is expected to be embarked on quantity production. It is planned that 25,000 cars will be made between May 1 of the first year and May 1 of the second.

Many Pressed Steel Parts

The car will be distinguished by a large number of pressed steel parts. It will sell for $595, and this low price will be met largely through the elimination of machine work by using the stampings. Such parts as the spring seats, brake, spiders, differential carrier, spring shackle, etc., will be manufactured in this way, thus cutting down labor to a minimum. While definite specifications of the car cannot be announced at the present time, it will have a four-cylinder high-efficiency motor with the valves probably in the head. The wheelbase is 107 in., and the first cars at least will have five-passenger bodies.

John Guy Monihan is president of the new organization. He was formerly with the Premier company and was later vice-president and general manager of the Marion. Ward Macy will be in charge of sales and Paul Bruske of advertising. The plant site will be located near Detroit.

DePalma Mfg. Co. Buys Plant

DETROIT, MICH., Sept. 8—The DePalma Mfg. Co., composed of Ralph DePalma and Frank Book, the latter a Detroit capitalist, have acquired a factory building on East Woodbridge Street for about $23,000, it is stated. The plant will be utilized for the manufacture of racing automobiles under the direction of the veteran driver, DePalma.

Kirkpatrick Is Hood Vice-President

DETROIT, MICH., Sept. 8.—W. H. Kirkpatrick, for 9 years head of the sales department of the Peerless Motor Car Co., Cleveland, has been elected vice-president of the Wallace C. Hood Service Bureau here.

ACCESSORIES In South America

No. IV

U. S. A. Tire Firms Should Become Strongly Established—Underinflation and Rim Cutting Main Troubles

By David Beecroft

ONE thing is certain, namely, that we should establish ourselves as strongly as possible to-day. Do not let us establish ourselves on shifting, uncertain sands, but on the bedrock of sound business. Sound business with South American houses is to give them our best prices, and is not to exact as high a price as we can get solely because competition is for the time cut out. It is expected that in a few months competition among U. S. A. tire firms may bring the price question to a legitimate adjustment.

Take a page from a day's conversation in tire repairs. One large supply dealer stocked up with a U. S. A. cement which cost him nearly 10 per cent more than the European cements he had previously handled. He could not get the European goods and had to take ours. He did not like paying a higher price for ours, but had to. As soon as he can get the European brands at the old prices he says he is going to. In the meantime is it not better business for our concerns to give lower prices where possible and cut the profits for the purpose of getting more firmly established? That is the way Germany got in so strongly. The Germans were willing to cut profits and get volume. We should to-day aim at the same objective.

Fancy Repair Cans

We need to put some of our tire repair goods up in more attractive cans. Europe can teach us lessons in how to put goods up in clean, business-looking tins. Several samples of our goods seen in two or three places had faded labels, and in others the labels were stained. From the buyer's viewpoint the goods looked old. Put yourself in the buyer's place. Walk into a supply house and see if clean-looking cans with clean labels are not attractive.

When goods come from a foreign country and from firms that we do not know much about our first impression of the goods is obtained from the way they are put up. If they are in clean, businesslike cans we are attracted. Our first impressions of those goods are favorable. We approach them with a fair feeling. If, on the other hand, the labels are stained or faded we approach them with mental uncertainty. We are not quite certain the goods are fresh. We think that some dumping act is being worked on us. Clean labels pay.

Some business questions will come up with regard to marketing tires in South America. Some of our concerns are already consigning stocks to certain large distributers. They find it necessary and they think it good business to do so and thus firmly establish themselves. In this way they are assured of always having a good stock on hand to distribute.

One or two other concerns that do not believe in consigning tires are giving their wholesale distributers very close prices and are giving 3 months' time and perhaps taking a few notes for longer periods. There is no reason why this cannot be done, because many of the large jobbers are just as reliable as any you can find in the U. S. A. With the National City Bank and its five branches and large credit departments in the five largest cities in Brazil, Argentina and Uruguay, there is not any difficulty with regard to credits. You can get any credit rating information you may desire. Dun's and Bradstreet's are also there. True, it takes a little longer time to get some of the credit ratings, but time is more of an element in all export business.

Tire Stocks

We told recently of how Michelin stocked heavily with his tires at several South American ports; of how he paid the import duties and of how he could make deliveries in a day or two to nearly any point in the different countries excepting those distant interior parts. We might also have told of the good business of the Michelin firm in having quantity contracts which when the dealer's sales reach a given volume within a year he gets an additional discount. This proved excellent business and is still proving excellent business with this enterprising firm.

The anti-skid rubber tire of our U. S. A. factories is more or less of a novelty to Buenos Aires and Brazil and to the citizens of many other cities. The European tire business consisted largely of the steel-studded tire that is used on one rear wheel and on the opposite front wheel. You see thousands of these in Buenos Aires and Rio, just as you do in London and Paris. A city ordinance in Buenos Aires required steel-studded equipment, so it was necessary for our tire dealers there to demonstrate before the traffic department of the city to prove the efficiency of the rubber-tread tire. This has been satisfactorily accomplished, and to-day there is no barrier to the sale of such tires.

Many Plain Treads

It is surprising how many plain tread tires are in use in many cities. In Sao Paulo, Brazil, you very rarely see a rubber non-skid. The taxi drivers all use plain treads and drive in the rain without chains. It is surprising how they get along and the speeds at which they travel. Already our tire people are putting on compaigns for their rubber treads.

and it is certain that good headway will be made. Undoubtedly when the European tire makers come back into the field they will have to come with rubber treads as well as steel treads.

U. S. A. tires generally got into the South American market in cart-before-horse fashion. We got in bad instead of good. We got a terrible reputation for rim cutting, for having cheap tires and tires that did not stand up. Fortunately we are getting over it, but not entirely.

Our Bead Trouble

Here is how it happened: Several of our tire builders, realizing that metric sizes were needed for South America, built metrics with beads to fit the standard English rim. When they got on the South American market they found the Michelin rim dominating the field. The Michelin rim differs from the standard English rim in that its hook to contain the bead is deeper radially. When our tires were put on these rims the bead did not fill the hook and the pressure came on the side of the tire, where it contacted with the edge of the rim. Rim cutting followed.

It was some time before explanations reached our factories and the correct tires reached South America. Then, too, some of our metric sizes were too small in tube diameter, really undersize tires. That got us in bad. Now, fortunately, one or two of our concerns are marketing metric sizes in South America that are of larger capacity than the European makes.

South America wants good tires. The car owners will pay for them, but they must have the mileage. It is not a question of our supplying the cheapest tire as much as it is supplying the best tire. We cannot afford to send anything but the best. One U. S. A. citizen who has lived in Buenos Aires for several years told of the errors of some of our undersized goods and of how escential it is to give good goods, particularly if we hope to hold the business. He further impressed on me the necessity of as low prices as possible. It is better for us if we are not ready with the right tire not to enter the field until we are. One of our large concerns followed this policy. It refused to sell in Argentina or Brazil until it had the correct bead and also the correct tire section. As a result, within the last few months it has been meeting with remarkable sales.

In one or two South American cities—namely, Sao Paulo and Montevideo—certain tire troubles may develop because of underinflation. This applies also to Santos, Brazil, where pavements are below the average. Rim-cutting complaints may come from these cities due to no fault of the tire. This underinflation regime will have to be counteracted. The United States Tire Co. in June started circulating in Portuguese a little tire booklet in Rio, Santos, Sao Paulo and other Brazilian cities showing the evils of underinflation. Good results were bound to follow and other concerns may have to actively take up this work.

(To be continued)

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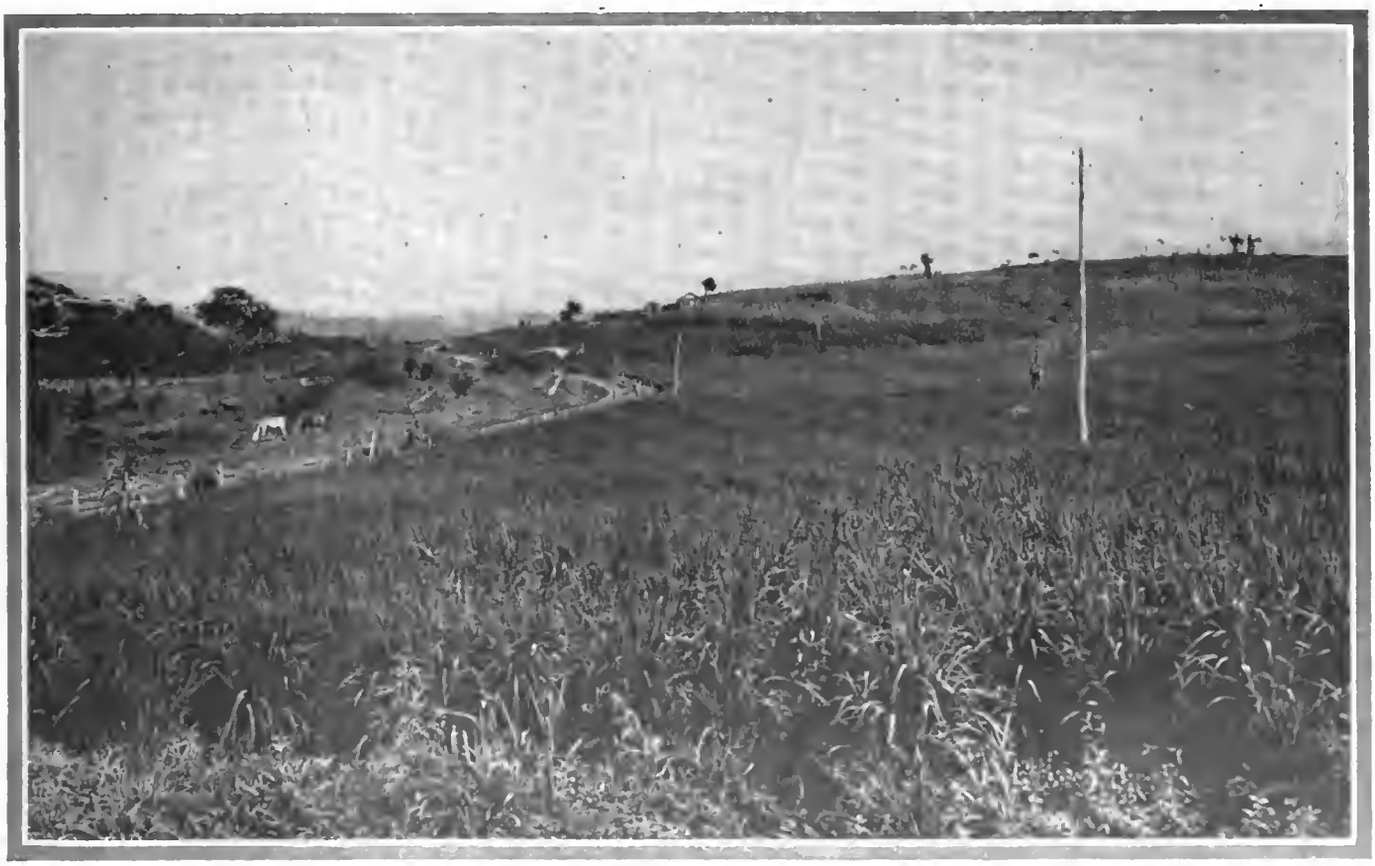
Venezuela Wants U. S. A. Cars

WASHINGTON, D. C., Sept. 2—The government of Venezuela, recognizing the supreme need for modern transportation facilities in that country, is active in encouraging the importation of motor cars and to that end has put them in the lowest or first customs class, the duty amounting to 68 cents per 100 lb. gross weight.

Gasoline is in the same customs class, but the expense attending the importation of the latter is such as to make the retail cost extremely high. The result is to limit the use of motor trucks, although it seems to have had little effect on the use of passenger cars.

Homer Brett, United States consul at La Guaira, is of the



General view of one of the great sugar cane sections of the State of Sao Paulo, Brazil. Although the coffee-raising industry of this State takes precedence among its commercial activities, Sao Paulo being the greatest coffee-growing region in the world, its large area, greater, in fact, than all New England, allows ample space for the cultivation of sugar-cane, etc.

view that there is a good future for automobiles in Venezuela. He says there are few countries where the modern motor car is so badly needed, due to the numerous towns and villages which have never heretofore been accessible except on muleback and which, because of the character of the country, never will be reached by railways. These isolated places, however, are the most healthful and the most prosperous in Venezuela, owing to their elevation and to the coffee crops produced near them.

The Venezuelan government, realizing the need for putting these out-of-the-way places in touch with the ports, is building wagon roads to all of these places. The result is that motor cars are penetrating to points heretofore not to be reached except by muleback, and they are making trips in two days which formerly required 2 weeks. In Ciudad Bolivar, on the Orinoco, there are numerous motor cars of North American make, and reports received from far beyond that point are to the effect every few days a motor car has reached some inland point in record time for that country as compared with the time made on muleback.

Reports received at La Guaira are that the invasion of Colombia by the North American-made machine has begun, and that it is being received with enthusiasm. Every steamer from New York these days carries a number of automobiles to different South American ports and the sales are steadily increasing each month.

The outlook in Peru just at present for the American-made car is only fair, but, as in other countries to the south, time is expected to work such changes as to open up a market worth cultivating. Cars of European make gained a foothold in Lima before the European war began, but the number in use there to-day is comparatively small. The streets of Lima are narrow and not well paved. Outside of Lima, the Peruvian roads are such that the successful use of motor cars upon them, until material improvements are made, is out of the question.

Electric cars are comparatively unknown in Lima. There probably are two or three such in use there. Later on, with electric power to be easily obtained in Lima, and at reasonable rates, the makers of electric machines might be able to build up a market there. Of the 300 or 400 cars in Lima, most of them are in the taxicab service, and of American make. It is the privately-owned car seen in Lima which is as a rule of European make.

Laminated Wood New Wheel Construction

Disk Design Is Strong and Light—Attractive in Appearance

THE latest idea in wheel building is to use laminated wood, the wheel appearing as a solid disk like a pressed steel wheel. This design has been produced by F. S. Merrill, Amesbury, Mass., Mr. Merrill being head of a firm that has been fifty-five years in the wheel building business. The principal claims for the new wheel are immense strength, moderate weight and handsome appearance.

Triangular Sections Combined

The wheel is built up in a very ingenious manner. Wood is cut into triangular pieces so that a number of triangles put together make up a circular sheet of wood. Several such circles are laid on top of one another, but the centers or places where the peaks of the triangles meet are not on a single center line. Suppose there are six layers of wood, then the center points of the six triangle assemblies will be spaced equally apart. Actually the points are arranged around a small circle, so that, if a nail was driven through each center the six nails would be six points on a circle. This is shown in diagram form in Fig. 1. Of course, when there are many layers the center points run in series. In the illustration the center points of the top series and of the bottom series are on the same line, but all the intermediate ones are staggered. The layers of wood are consolidated by heavy pressure. The inventor points out that this wheel, of which the strength is obvious, lends itself admirably to decorative painting. In natural wood it looks well, having none of that heavy appearance which often characterises a disk wheel of steel. The designs shown in Fig. 2 are suggestions for treatment in different colors and it is obvious that all sorts of patterns could be devised.

To Produce in Quantity

The wheels are at present obtainable by individual order at a cost of $175 per set of four, painted and finished in any style. It is expected that the factory will be open to consider the production of large quantities within a few months and the price would not be high when the necessary equipment is installed.

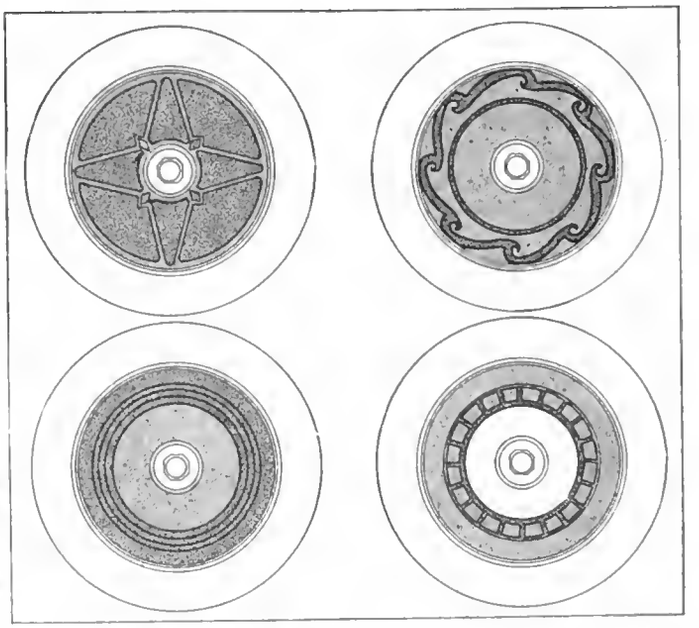


Fig. 2—Suggested schemes for painting laminated wood wheels in distinctive patterns

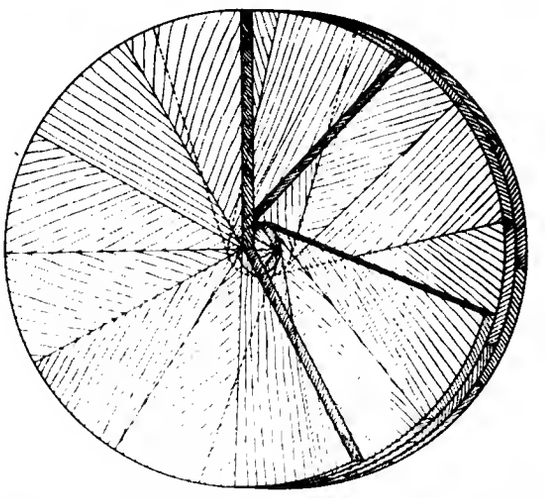
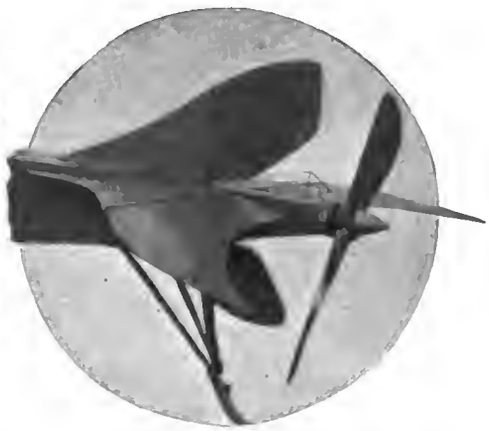


Fig. 1—Showing the construction of the laminated wood wheel in which each assembly of triangular pieces of wood has its center offset with respect to that of the next

Effect of the War on Aeroplane Engine Design

By Granville Pollock

Three-quarter front view of the Ruby monoplane, and, below, peculiar construction of the tail, showing propeller mounting



¶ EDITOR'S NOTE: *For over a year Granville Pollock, of Buffalo, N. Y., was connected with an anti-aircraft corps on the western front in the present war. He had direct charge of the Pierce-Arrow trucks used to carry anti-aircraft guns, as well as other trucks needed for various uses in the corps. Mr. Pollock lived in an atmosphere surcharged with aviation matters and had a good opportunity to observe the practical working out of different types of aeroplanes.*

AFTER having observed that several automobile companies in this country have undertaken the construction of aeroplane engines, and others possibly considering the same, the writer is of the opinion that a word or two on what he has seen of this subject would not be amiss, and would possibly clear up one or two errors that seem to exist in regard to the actual motor situation abroad.

Before going further, the writer wishes to make clear the fact that this is not intended as a criticism on any work or previous discussion of this subject, but is merely offered as the result of 22 months' residence in England and Europe, fully half of the time having been spent on the actual front and always at least indirectly connected with aeronautics.

Under these circumstances, he could not help noticing the various machines, engines and the uses to which they were put, but also the service they were actually giving and the preference of one type of engine over the other for certain classes of work, all this under the most trying and exacting conditions, i. e., military service.

Engine housing and machine gun of a captured Fokker monoplane. The engine is a rotary Oberursel

No Revolutionary Tendencies

Contrary to the general belief, there has been nothing revolutionary in development, and while this may have seemed the case to the casual observer, engine limitations had long been known and acted upon by the best plane designers in France and England, and while a preference had been given to rotary and air-cooled engines, it was but the natural outcome of working with what one had, and not a preference for this type on the whole.

The development of the stationary water-cooled engine in these countries had been extremely slow, partly the fault of the individual engine manufacturer, but principally due to the lack of official and popular support. A similar state of affairs is practically existing in this country to-day or at least has been until quite recently, and it is but to be expected that without sufficient incentive to the contrary, manufacturers will always work along the line of least resistance and most profits. Further, the production of a really successful and efficient aeroplane engine is anything but an easy matter, and to that end might be cited the fact that one of the foremost designers of Italy, who has been continually engaged on experimental work along this line for the past 2 or 3 years, has not as yet produced an article that he would care to put on the market under his name.

Three Power Groups

And to add to the mechanical difficulties of the work, there are also the elements of cost and the interference with usual production, two items of no mean importance, which can be readily appreciated by those concerns who have undertaken this class of work; as well as the possibility of not finding a ready market for the product when it is completed.

But to return to the subject, the engine question has gen-

A fleet of Pierce armored trucks with anti-aircraft machine guns. Note the heavy dual rear tires and nonskid chains; also shovels and other tool equipment

erally divided itself into three groups, the first being that of machines requiring power up to 100-hp.; the second from 100 to 200-hp., and the third from 200-hp. up. The first and second groups are by far the more numerous in point of numbers, and while a great deal of experimental work is being carried on with a view of utilizing more power, as yet very little of it has passed beyond this stage, although the writer has seen and examined planes with four and five different units mounted, totalling up to and in excess of 500-hp. However, as stated before, these have not passed the experimental stage sufficiently to make their appearance in the field of conflict.

Aerophane designers who have produced a machine that belongs to the first group have almost entirely relied for power upon the air-cooled motor, the rotary dividing honors with the stationary. The best example of this is the Renault, this being the standard recommended by the Royal Aircraft Factory for its B.E. type, of which hundreds have been built, and these are giving satisfaction within their limits of operation. There is also the Farman, which uses the same engine as a pusher.

Three Leading Rotary Types

Of the rotary type, the three well-known makes, Gnome, La Rhone and Clerget, have all been used to advantage, although where large power of, say, 100-hp. is required, the Gnome has had the preference in the mono-soupape, which, in proper hands, gives excellent results.

All these engines have their faults and have been severely criticized, and the loss of several good French pilots has been attributed to their failure to stand up under hard usage; but this has almost invariably been the result of working these engines beyond their limits, either in length of flights, or in overloads for too long a time, such as a fast scout plane might be subjected to in a battle with several adversaries where frequent loss of altitude was followed by periods of hard climbing, conditions that quickly tend to heat an air-cooled engine, and especially one that is partially inclosed for streamline purposes. These cases were frequently met with when a number of crack pilots were operating on the same front, and rivalry was carried to the limit, and it was only to be expected that if an engine had any weaknesses at all, they would be brought out under these conditions.

The natural question is to ask why these engines were not replaced by water-cooled ones that would not overheat and sieze, or lose power when worked to their limits of endurance, but to those conversant with the weaknesses of this type of engine for this use, viz.—fast scout planes, an answer is unnecessary. One has but to visit Les Invalides in Paris, where some of the trophies of the war are on view, to see one or more types of German planes mounting a Mercedes engine of this type, that have been brought down as the result of a single shot through the radiator, and they will see this clearly enough, although it is but one side of the question.

A fact remembered by few people is that a rotary engine when in proper condition will give its full power almost from the first revolution and that no preliminary warming up is necessary even in the coldest weather, and this in itself is invaluable where a quick get-away is required, or where hangars are not available and weather conditions are adverse.

The Center of Support

Another fact, and one that is of moment where a designer has to produce the limit in flying efficiency, is that the center of support of the engine is always the center of power and thrust, and often is the common center of head resistance, and not infrequently this line intersects the center of gravity of the whole machine. The true significance of this fact is more readily appreciated by the constructor than by the engine manufacturer, and not infrequently is the cause of mystification on the part of observers where this type of engine has defeated a stationary of similar or slightly greater power on a duplicate plane.

The rotating effect of the engine also is a factor in reducing the effect of power impulses on propeller vibration, and in inducing a certain steadiness of flight which is much appreciated by experienced pilots; and this, with the fact of always being able to switch the power off and on, more than compensates for the lack of throttling range as compared with that possible in the stationary type.

As proof of these features, one has but to recall the recent exploits of the German Fokker machines, which use exclusively the rotary engine. Had it been possible to get the same results with the standard water-cooled engine as used in all other types of German planes, it is most probable that it would have been done, for they are certainly easier and cheaper to manufacture, and more efficient as regards fuel consumption, but the fact that they were not so utilized is significant.

So much for the virtues of the rotary when used with reasonable care and within its limits. While the life of this type is entirely dependent on the attention given by the mechanics at the base, they will last just as long as any other engine, and while slightly more expensive in the cost of replacements, it is not uncommon to see 3 and even 4-year-old engines still in service, while many are still at the front that flew over the Channel at the commencement of

Side view of Pierce anti-aircraft armored car with the crew. This also shows the machine gun mounting

the war. Proof of their long life is to be seen in any of the school machines in England and in France; and at Hendon, especially, more pilots have been trained behind old "50" and "80" Gnomes than in all the rest of England combined.

Rotaries for Scout Work

That this type of engine will always be popular for the fast scout and dispatch class of work, where flights are for comparatively short duration, is the opinion of some of the best constructors in Europe; but that for any other uses where fuel efficiency is to be considered, then, of course, the other engine is unquestionably the best, as might reasonably be expected.

This, however, brings us to the second group of machines, viz.—those that are primarily intended for bomb dropping, lengthy periods of observance for artillery fire, raids and armed reconnaissance work, where loads are carried with power requirements up to 200 to 250 hp. Of engines for this class of work, there are many well suited to their work, comprising both radial, vertical and V types, although the six-cylinder vertical is by far the most popular and the most efficient for single installations; or where one single large power unit is not practical, two smaller ones are usually mounted out on the wings.

Caudron twin engine biplane on exhibition in Paris after being riddled with shot in active service

Austro-Daimler of High Power

Under these conditions, it has not only proved more efficient as regards actual power output, but is far easier to streamline and consequently diminishes head resistance, an item not to be overlooked on a large machine. Of this type, the best known is the Mercedes, although it is not by any means the best, as under comparative tests, the six-cylinder Austro-Daimler has shown a much higher efficiency, giving a power outpt that on occasions has risen to 147 hp., at 1400 r.p.m., a very high figure indeed when it is remembered that the propeller is not geared up, and working perfectly with only 3½ gal. of water!

In a case of this kind, it will be readily seen that two of these engines will give a higher efficiency than a single installation of, say, 250 hp., while propellers are regularly turned out by a prominent French concern that has no trouble in holding their efficiency at this speed and even higher.

This type of engine has been generally confined to the well-known two-seater tractor class of work, to which it is well adapted, as in this case it is usual to mount the engine with the heads exposed to get the benefit of the propeller draught, and also facilitate inspection or adjustment.

For this type of work there is no particular limits as to width of the mounting, and an eight is just as practical, although at high speeds the difference in vibration is not noticeable, as the success of the Renault eight has proven. It is, therefore, quite clear that there is nothing to be gained in increasing the number of cylinders or parts, as the efficiency does not keep pace with the complications for engines of this power.

Fuselage Design Problems

Fuselage design always has been a point of difference in opinion among the various designers, the smallest as to width or depth having always been Deperdussin, while such firms as Hanriot and Nieuport have always been noted for their deep-chested and broad construction, both types giving equal satisfaction in the hands of their respective pilots. It would, therefore, seem to be a matter of personal opinion and the class of work for which the plane was in intended, as machines with fuselages of one and even one and a half meters width have been seen by the writer to give excellent results, while the question of streamline or head resistance presents no difficulties, as a perusal of Eiffel's work on this subject will readily show.

On the other hand, when a machine of a size is built that requires over 250 hp., the purpose for which the plane is intended is generally such as to preclude the use of the forward part of the fuselage as an engine bed, and up to the present the tendency has been to mount them out on the wings so as to get the benefit of this large space for other uses, often mounting guns on the rails, which gives an extremely wide radius of action as well as permitting the wireless operator to work in peace away from the noise and the influence of the engines.

That this item is worth considering has been proven by the fact that the sending radius for wireless on planes has been extended to 200 miles by actual and frequent tests, which the writer does not hesitate to vouch for.

Mounting on the Wings

So far as the mounting of engines on the wings is concerned, the best results seem to be with not more than two different units, for while more have been tried and may eventually be used, the difficulty has been to mount them in such a way as to keep the slip-stream of one propeller away from the others, and not get the weights so far out on the wings as to make the whole machine cumbersome and heavy, to which is added the almost impossible task of keeping the engine speeds uniform.

With this in mind, the construction of really large power plants is now the most important of aeroplane engine work now going on in Europe, and units of 300, 350 and even greater are to be expected along shortly and undoubtedly these will be of the 12-cylinder V type, with a fairly wide range of throttle control, and a high fuel efficiency, though in this case the question of gross weight will not be the item it has been in the past, for in all probability the difference of a few kilos on an engine of this size will make very little difference to the size of the machine it is intended to propel. At all events it will be more up to the designer of the plane

(*Continued on page* 466)

Automobile Practice in Tractor Design

Many Valuable Pointers in Detail, Though General Features Differ Widely—Truck Construction Also a Possible Influence—Ultimate Tractor Engine of Automobile Type

By A. Ludlow Clayden

IN a previous article it was stated that the tractor to-day is what the automobile was in 1903, in so far as its detail development is concerned. The reason behind tbis is simply that the average tractor seems to be about as far away from the ideal as did the automobile 13 years ago. Examining a collection of tractors shows instantly that the new industry bas much to learn from automobile experience in the way of obtaining reliability and durability. It probably has much to learn in detail design, but little if anything in general feature. Tbat is to say, tbe tractor needs to be vastly different from the motor truck in general by reason of tbe totally different requirements, but it can advantageously be far more like the truck in petty detail; the sort of detail that gives trouble and annoyance of a petty character.

For example, it is only in a very few instances that accessibility has been given any consideration whatever in tractor design. Control rods and bell crank connections are wrapped around each other and mixed up till it becomes quite a task to follow the linkage, carbureters are buried deep in a mass of moving parts, magnetos without covers and of non-waterproof type are employed, clutches which have less work to do than a motor truck clutch are made with expanding segments and a conglomeration of levers and cams that make adjustment vastly difficult; instead of grease cups there are exposed oil holes to collect grit and waste lubricant. It would be possible to continue the list indefinitely, but enough has been said to indicate the sort of way in which automobile experience can be brought helpfully to bear on tractor design.

Tbe automobile was first built up, feature being added to feature as the need became apparent. Then followed a period of unification and simplification. It is this last that the tractor needs more than anything else to make it a finished macbine instead of a half-finished one.

Develop Machine First

This criticism of things as they are is not intended to be destructive. It is necessary to develop a machine first and simplify it afterwards. At present the tractor has reached a stage wbere it is ready for the simplification process to begin, and in isolated instances it already is beginning. Let it not be forgotten that the more like an automobile in its detail the tractor becomes tbe easier will the farmer be able to care for it. The American farmer knows his automobile, knows how to use it and how to look after it. Therefore, whenever a *detail* of automobile practice can be turned to account it is wise to employ it.

Major Problems of Design

Sounding the otber note, it must also be remembered that automobile experience is practically of very little use in settling tbe *major* points of design. For the power plant the requirements of the motor boat or even the aeroplane come much closer to the tractor requirements tban do those for any sort of road vehicle; the tractor calls for full power all the time, full power for hours or even days on end. This means that in the engine a larger factor of safety is necessary throughout. We cannot safely use tbe same unit pressures that are correct for a motor truck, and we cannot, of course, look for the skilled attention that enables the aviation engine to keep its capacity for long runs. Likewise the boat motor does not supply an exact parallel, for there is little need to limit the weight or size of the water-borne engine.

Tbere is a school of tractor engineering which believes that none of these examples is anywhere near the proper tractor type, and this is the school which has taken the stationary gas engine as a basis for developing the tractor engine. The automobile engineer is instinctively prejudiced against very large cylinders and heavy, slow-moving parts, so an automobile engineer's criticism may be discounted a little, but is it not true that the prejudice against the stationary engine type is well founded?

Modern Engine Tendencies

Go back a little way in automobile history and we see the gas engine type strongly supported, we see Olds, Reo, Cadillac and many others pinning their faith to a huge single or twin cylinder; earlier yet, and Benz, Daimler and many others are found.

Now wbat was it that experience taught? It taugbt that the massive engine "built on conservative and well-tried lines" was *not* the most reliable or most satisfactory type. It was the superior qualities of the vertical multi-cylinder engine wbich caused the abandonment of tbe large cylinder idea for automobiles. Even in the stationary engine field there is a strong tendency toward more cylinders of smaller size. The most modern engines of tbe leading German Diesel makers have had many vertical cylinders, because they gave less trouble; in England the high speed gas engine has been developed in recent years and has taken mucb from automobile practice. The automobile engine, the engine of the motor truck, the tractor or the aeroplane, is working under far more strenuous conditions than any stationary engine. It was this fact that has led to the elimination of the old type for use on vehicles; it simply was not up to the demands of the service. Tbus it is perfectly reasonable to assume that the old type will be still less able to cope with the heavy demands of tractor service than it was with the demands of the passenger car and truck to which it proved unequal.

No doubt this view will be strongly combated in many places, but it is a view that is shared by many in the tractor business, where the impression is strong that those wbo are fighting against the so-called automobile type of tractor engine are digging a pit for themselves and will soon find it necessary to climb out and start afresh.

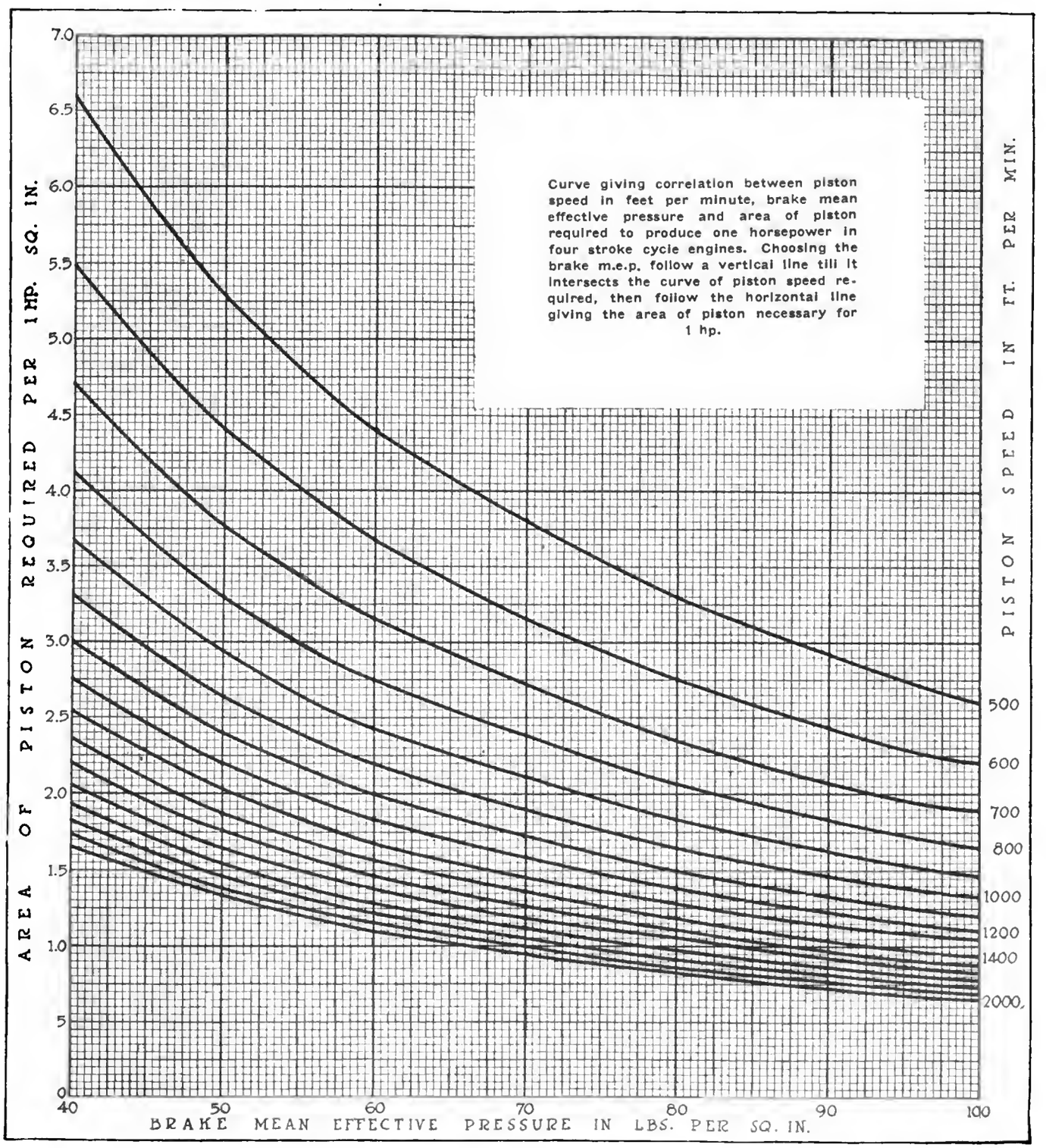
Determining Engine Size Necessary

To settle the proper size of engine for a tractor is very difficult. It is a matter of experience, and experience is not too plentiful. There is one way and only one way to figure it successfully and that is to start at tbe drawbar, taking tbe pull required and the speed of pulling as tbe fundamentals.

Then comes the efficiency of the machine and last the engine power necessary to give the required pull via the transmission. Having settled this there come the matters of piston speed and the best mean effective pressure, to be considered.

Now, there is no close agreement as to the proper drawbar pull or horsepower. It may be reckoned conveniently on the basis of plows to pull. For one plow the average pull required is not a safe basis for calculation unless that average is taken from a vast number of experiments. It varies greatly with the sort of soil and the condition of the soil and, of course, the depth of plowing. Now, there is not yet agreement as to the tractive effort that should be provided per plow, nor as to the best speed for plowing. A pull of 1000 lb. is apparently enough to take a plow through anything, and half or less than half this is sufficient under easy conditions. As to speed, 2 to 2½ m.p.h. is the rule, but the machines that exceed this speed certainly appear to have a more pulverizing action upon the soil. However, if we assume 2½ m.p.h. as the best speed, and take a mean value of 700 lb. as the tractive effort that should be available per plow at this speed, the results of calculations on these premises will not be far from the truth. Reducing the speed and traction to horsepower units, this means that the drawbar horsepower per plow allowed in the design should not be less than 4.7 or, say, 5 hp.

Now comes the efficiency of the transmission and the ma-



chine as a vehicle; gearing efficiency and power taken to propel the machine. Naturally this can vary greatly, hut several of the most prominent manufacturers are content to take the drawbar horsepower as equaling half the brake horsepower at the flywheel. Some estimate less than half and others a trifle more. Taking the exact 50 per cent as the loss between flywheel and drawbar this gives us as a necessary allowance 10 b.h.p. of engine per plow.

Supposing this serves as a hasic point from which to start the engine design we have next to decide the best piston speed and brake mean effective pressure. For motor truck engines the old formula $Hp = \frac{N\ D^2}{2.5}$ still holds fairly true. The formula assumes a piston speed of 1000 ft. per min. and a hrake mean effective pressure of approximately 67 lb. per sq. in. If we raise either speed or pressure the weight can be reduced and the cost can he cut, but there are corresponding drawbacks. Increased speed means still greater gear reduction and lower gear efficiency; increased pressure means more liability to ignition trouhle and more rapid carbonization. The reverse is, of course, true if speed or pressure be lowered, hut weight and cost increase.

Some Weight an Essential

Ohviously it is possible to guess at it and hope to strike the best mean, hut there are still some other factors that can he considered. First we must have a certain amount of weight, so there is no object in trimming the engine weight to the last ounce. Second, the higher the pressure the more "delicate" does the engine become, the more susceptihle is the power to small imperfections in the valves, ignition or carhuretion. Third, if the pressure or speed are above a certain amount pressure lubrication is essential.

These are three reasons against high pressures or high speed, now let us turn to the other side of the picture. Here we see that first, decreasing the pressure decreases the efficiency of combustion; a fairly high compression and consequent fairly high mean pressure give better fuel efficiency. Second, large slow speed engines may have smaller unit pressures, but must have larger total pressures which means that the force of each explosion becomes more of a hammer blow and so causes more shock to the engine parts and the transmission. Third, the large engine occupies a greater amount of space and when it is necessary to overhaul it, or scrape out carbon, which must be done periodically, the operation is a far more serious undertaking.

Altogether it is hardly surprising that tractor engineers have found it impossible to agree completely as to exactly where the happy mean lies.

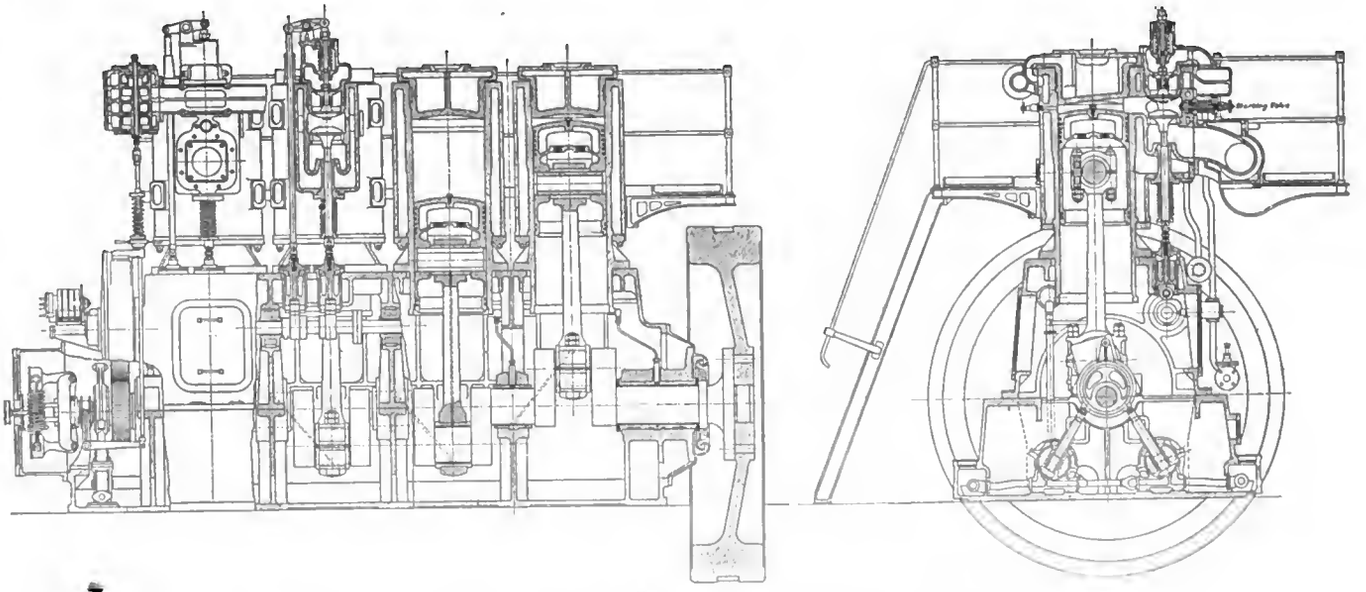
There is one thing that can be stated positively, however. It is based on motor vehicle experience admittedly, but that does not weaken the argument, and this is that engines with less than four cylinders ought not to be considered. Even if the stationary gas engine type of power plant is chosen it ought to have four cylinders as the low limit. This is because the vibration from any lesser number is destructive. With a stationary engine, on a massive bed set deep in concrete, vihration can be combated, and in driving by belt vibration in the engine is not transmitted to the machine driven, but on a vehicle engine vibration *must* pass through every portion of the machine before it can finally be ahsorbed hy the ground. It is possihle to ohserve tractors to-day in which the radiator top swings an inch from side to side with each explosion.

Further, as regards the punch applied to the gears in the transmission by large individual explosions, this is greater than might at first be imagined, greater than it would he on any other type of vehicle, because the tractor is positively driven hy the explosions. A tractor has not an eighth of an inch of "coast"; throw off the switch and it stops dead with a bump. Practically it is impossible to supply enough flywheel to do more than carry the crank from one explosion to the next.

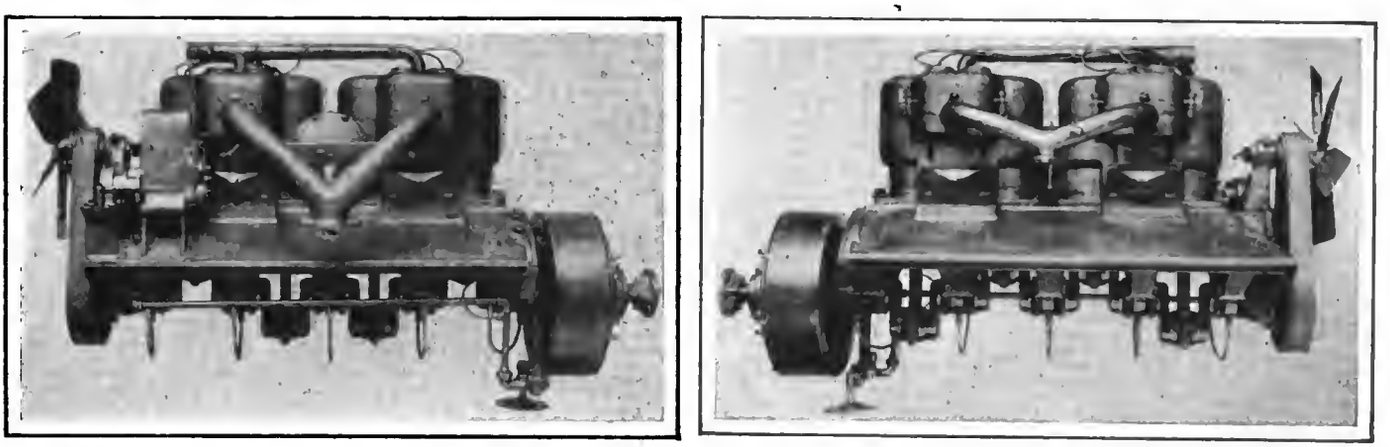
We have passed through the selfsame arguments and theories for and against the stationary type of gas engine with the development of motor trucks. Surely there is no need to go over all the ground once more with the tractor. It is often said that a son dislikes to profit from his father's experience, preferring to have a free hand to acquire his own, but life to-day is conducted at a speed which makes this hardly possible in the walks of industry.

Automobile Type the Ultimate

It is therefore safe to say that the automobile type of engine is going to be the ultimate type of tractors just as it has become the conventional type for trucks. If this be admitted, consideration of what a tractor engine ought to be can be narrowed down considerably. In brief it needs to be a large truck motor which will withstand usage a trifle rougher and more arduous than that given the average truck power plant. There are some truck engines which are perfectly suitahle for tractor work, hut others which are not, so



This is not a tractor engine but a new British gas engine of 900 hp. with 17 in. bore and 20 in. stroke. It shows in a striking way how automobile practice is being adopted for stationary engines of the larger sort



Engine of the J. I. Case Plow Co. tractor. This is a particularly rugged example of tractor motor based upon the automobile type

one might say that the very best of truck motors is what the average of tractor engines ought to be.

One thing cannot be stated too strongly, and this is the need for protection against dust, mud and water. The tractor engine operates under the worst possible conditions. Either the whole tractor is hidden in a fog of dust, or it is splashed with mud inches thick. It stands unprotected by covering, in rain and snow, it will be utterly neglected for a month and then called upon to do full work immediately. The tractor engine ought to be capable of being buried in slime at the bottom of a pond for a month and then dug up and put straight to work without any overhaul.

A side issue suggested by this consideration brings up a point where the tractor should not follow automobile practice. The engine should be under a hood, of course, but the radiator should *not* be the front end of the hood. The radiator should be separate, standing out somewhere in front so that it will be exposed to all the winds that blow, and the fan can be outside with the radiator. The engine should be boxed in so that the only communications it has with the outside are the carbureter air intake and the exhaust pipe. There might just as well be no hood at all as a hood with a fan to blow dust into it. This has always been an absurdity in passenger car and truck construction; it is far worse than absurd on a tractor.

As regards details, any engine that is running at full power 100 per cent of the time is placing a severe stress upon the valves and the ignition, particularly upon the spark plugs. Spark plug trouble is the main difficulty against which tractor engineers are contending at present, and it is intensified by the high temperatures produced by using kerosene as fuel. The answer seems to be to use the small plug now adopted for racing engines and likely to be standardized for aeroplane use. Several tractor engines are already fitted with the small plug and it is probable that more will follow.

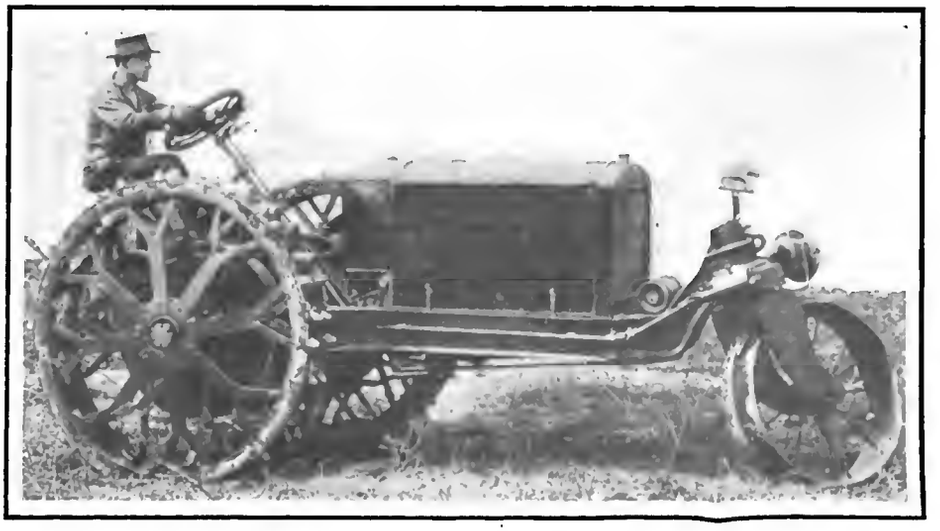
Valve areas have to be fairly large, though not very large in proportion to the cylinder size, since there is no need for high speed. Since valve trouble is always due directly or indirectly to valve temperature with an "all the time full power" engine, it is manifestly important to cool the valves as thoroughly as may be, and this suggests that it may be found advisable to use four valves per cylinder rather than two large ones. For the bigger sizes, where 60 hp. or more is wanted, a T-head cylinder with a pair of valves each side seems better engineering than any form of cylinder with two very big valves. This is just theory, it has not yet been tried out in practice, but it is worthy of note that Diesel engines, which have the severest temperature conditions of all to combat, most commonly employ multiple valves.

Since reliability, freedom from attention required and absence of parts affected by heat are three important requirements for a tractor engine there also seems some reason to think that the Knight motor would be eminently suitable. It has not been used much for trucks in America, but has been employed quite extensively in Europe and has proved extremely satisfactory for commercial vehicles. It possesses two outstanding advantages which are admitted freely by all poppet valve enthusiasts. One is there are no valves to grind or adjust, and the other advantage is that the Knight engine is far less affected by carbon deposit than any other type of gasoline engine. The writer has always been of the opinion that the admitted advantages of the Knight and other sleeve valve engines were far more important in the commercial field than in the passenger car. The chief drawback is cost, of course, but prime cost is not of prime importance when operating cost is large in proportion as it always must be.

Mastodon Tractor Ready

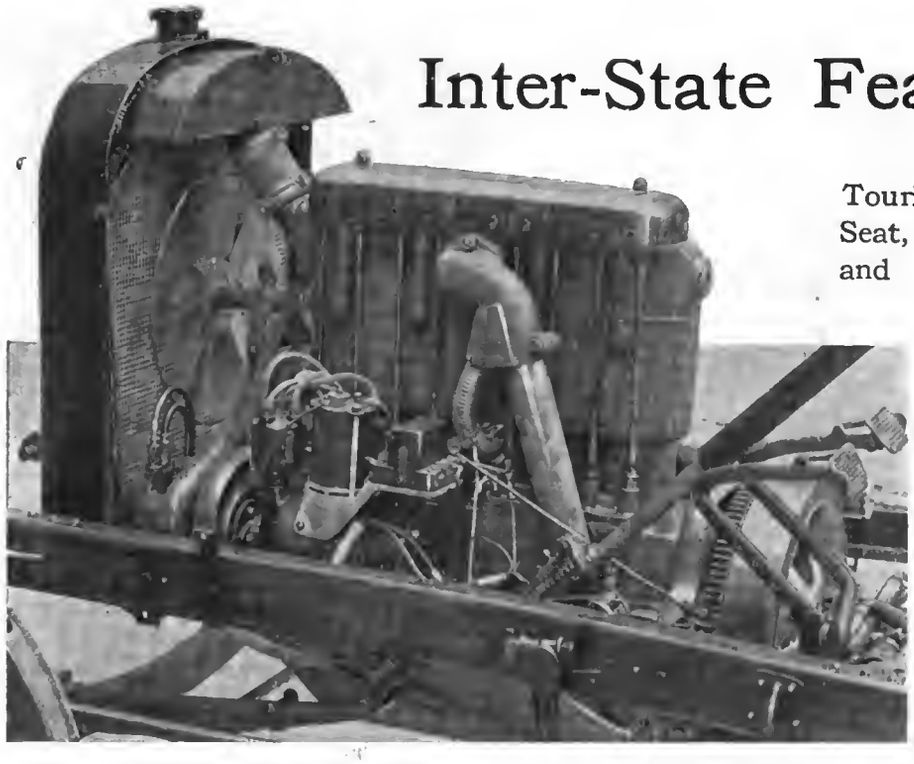
THE Mastodon tractor, made by W. E. Hosch of 2111 Olive Street, St. Louis, Mo., gets its name from the tractor wheel, which is patterned after the mastodon hoof, and it is claimed that it will travel readily over any soft or rough surface.

The machine is compactly built and every moving part is inclosed and runs in oil. Special attention is directed at the ease with which it is handled. Mr. Hosch expects to put the Mastodon tractor on the market this fall. He says that it is the result of 6 years' experimenting.



Inter-State Features Bodies

Touring Car with Divided Front Seat, Four-Passenger Roadster and De Luxe Delivery Car



Exhaust side of 3½ by 5-in. four-cylinder engine used in the 1917 Inter-State, showing mounting of lighting and ignition equipment. Overhead valves and the removable cylinder cover are features of this engine

NO mechanical changes have been made in the Inter-State for 1917, the only additions to the line being a divided front seat touring car and a four passenger roadster listed at $895. There is also a de luxe delivery car mounted on the same chassis, priced at $850.

Distinctive finish features the two new passenger bodies, the divided front seat touring car having for its standard colors a dark green body with cream wheels and the running gear finished in black. The four-passenger roadster is furnished in a gun metal gray body with battleship gray wheels and upholstered in brown Spanish leather. Both cars have the modern low, long lines and the Inter-State Motor Car Co., Muncie, Ind., has made a point of roominess and comfort in the seating arrangement.

In the five passenger divided seat job, the driver's seat can be moved backward or forward to suit the height of the driver, giving an arrangement which will be suitable for anyone to drive. As the adjustment is quickly and easily made, two people of different statures can drive the car with little inconvenience.

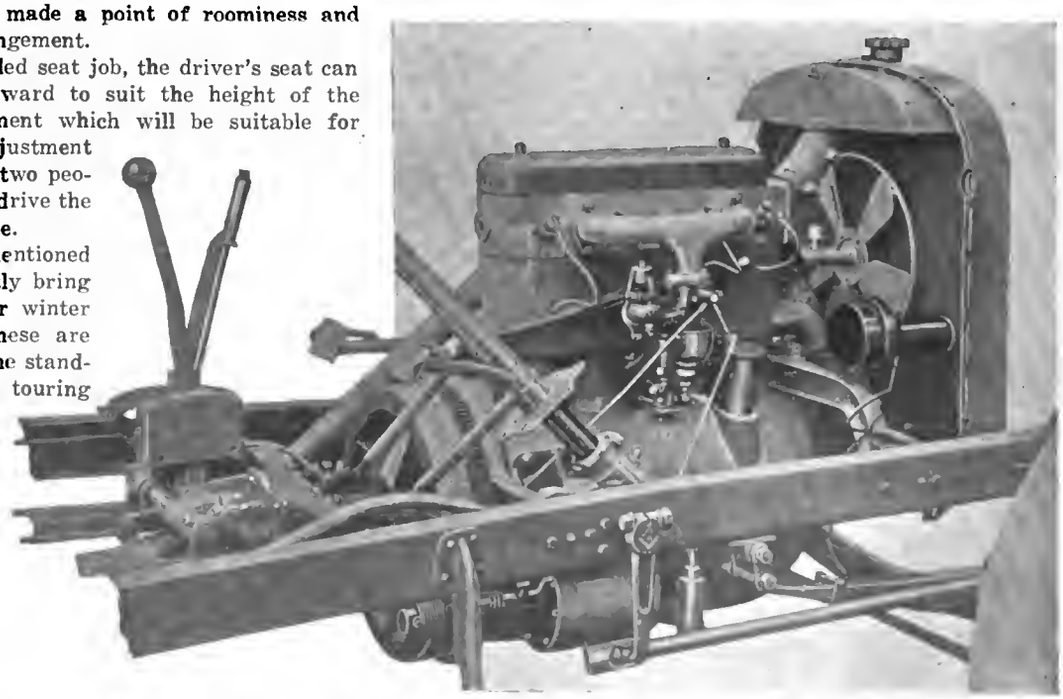
In addition to the cars mentioned the Muncie plant will shortly bring out some inclosed bodies for winter use, although details on these are not at present available. The standard series T five-passenger touring car, which is a conventional design with continuous front and rear seats, remains unchanged. It sells for $850, as does also the series TR roadster body, which is a continuation of the design of last season, except that a door has been added on top of the turtle back. This new feature permits of ready access to the large baggage compartment immediately behind the front seat and renders it possible for this space to be used without having to remove the tires. Both doors to this compartment can be securely locked and are thus rendered dust and waterproof.

Overhead-Valve Engine

The engine is a specially-built Rutenber job, having the four cylinders cast in a single block with the valves located overhead in a removable cylinder cover. The bore is 3½ in. and the stroke 5. Drop forged I-beam connecting-rods, having a length of 9¼ in. between bearing centers, are used. The rod bearings are 2 in. in length and 1¾ in. diameter. They are lined with babbitt, as are also the bearings for the 2-in. carbon steel drop-forged crankshaft. The dimensions of the main bearings are 2 in. in diameter and 2¾ in. in length for the front, 2 in. in diameter by 2 in. in length for the center and 2 in. by 3⅜ in. in length for the rear. The bearings are steel backed with the babbitt lining accurately scraped to a finish fit.

Lubrication is by circulating splash system operated through a gear-driven pump from the camshaft. The oil is contained in the bottom pan of the crankcase, being carried by the gear pump to the bearing leads from this reservoir.

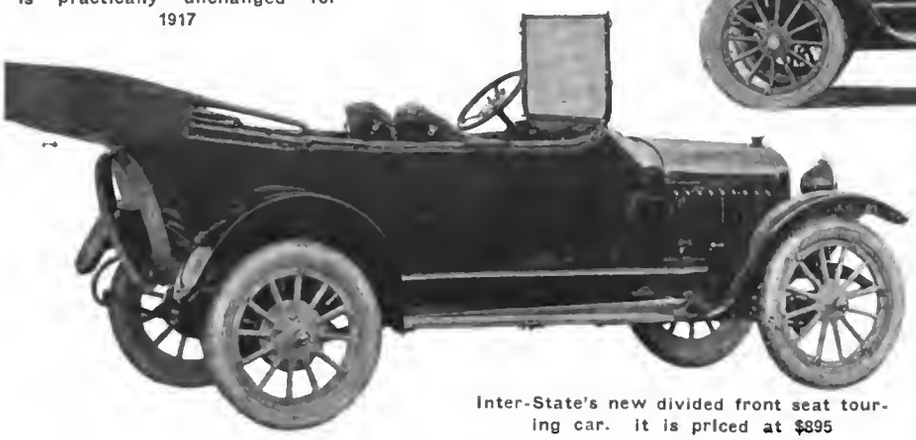
The gasoline system consists of a cowl tank and a Schebler



Intake side of the Inter-State engine, showing starting motor, horn and carbureter mounting

Above — Inter-State roadster, showing easy access to compartment under rear deck for tires, tools, etc. Mechanically the car is practically unchanged for 1917

Right—the new four-passenger cloverleaf roadster, showing the body contour and divided front seat



Inter-State's new divided front seat touring car. It is priced at $895

1-in. carbureter. The gasoline flow is by gravity, as sufficient hydraulic head is given by the cowl location of the tank, which is not only high, but is close to the carbureter and hence affected only to a minimum degree by variations in gradient. The gasoline gage which registers the depth of the fuel tank is mounted on the cowlboard in plain view of the operator.

Remy Electric System

Electrically the Inter-State car is Remy equipped, having this system for starting, lighting and ignition. The distributer is mounted on the left side of the motor block with the coil just behind. The ignition distributer drive is taken by bevel gears directly off the generator shaft which is connected by a flexible coupling to the same shaft which operates the oil pump. The starting motor is at the rear

New De Luxe delivery car on Inter-State chassis. It sells for $850

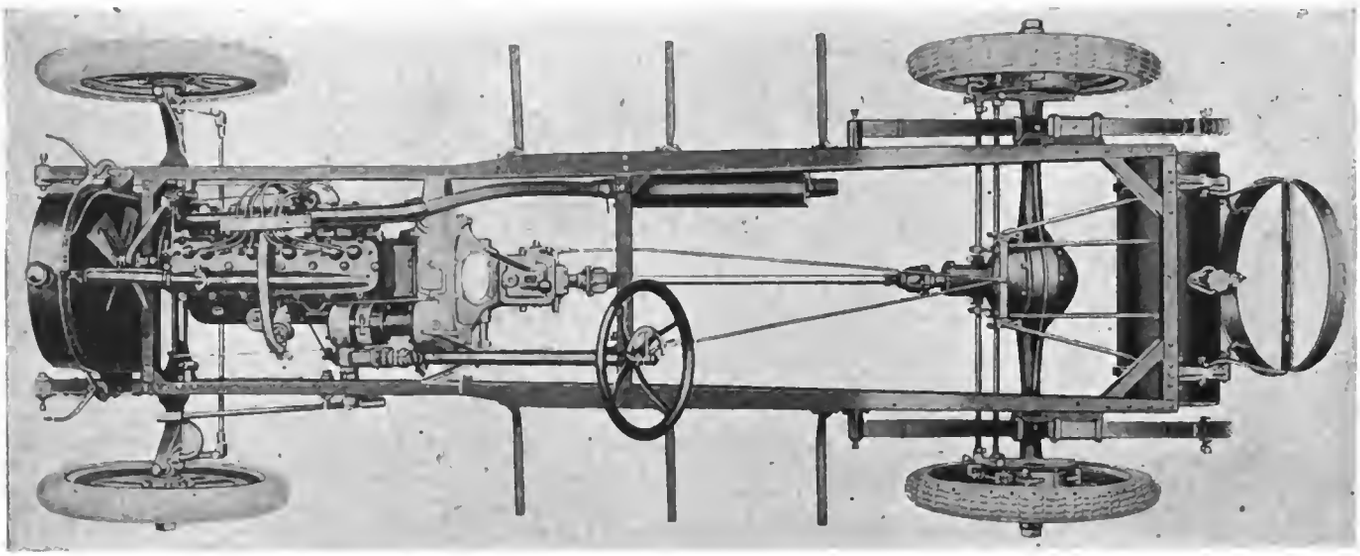
right and engages with the flywheel which is equipped with a ring gear on its forward face. The heavy wiring is inclosed in flexible metal conduits.

From the engine the drive is taken through a leather-faced cone clutch to a three-speed gearbox. There is a cross frame member just behind the clutch supporting the clutch shaft and the forward universal and torque yoke. The gearbox itself is mounted on the rear axle with the face of the box bolted directly against the rear axle housing. A direct ratio of 4 to 1 is secured through the bevel gear axle, which is supported on Hyatt roller bearings. The axle shafts are floating.

A pressed steel bottle-neck frame is used with the side channel members 3½ in. deep with a 5/32-in. section. The wheels are wood artillery type, having twelve spokes each 1⅜ in. in diameter. They are equipped with Firestone demountable rims carrying 33 by 4-in. tires and with non-skids fitted as standard equipment in the rear. Tires are Goodyear. Three-quarter elliptic rear springs are used, the length of these being 46 in. and the width 2 in. The front springs have a length of 36 in. and a width of 1¾ in.

Five Body Styles

With the additions mentioned there are at present five bodies mounted on this chassis. The standard five-passenger touring known as series T has undivided front and rear seats. The TR is the standard roadster with rear deck, having a two-passenger capacity. The TD is the divided front seat job with the adjustable driver's seat feature. Series TR four is the new four-passenger roadster and TC is the parcel delivery wagon of 800 lb. capacity. It is especially adapted for the use of florists, confectioners, clothiers and grocers. There are double doors in the rear and the loading dimensions give a width inside of the body at the top of 46 in. and at the bottom 42 in. The height is 51 in. and the length from the back of the seat to the doors is 65 in. In finishing these bodies all the fenders and dust skirts are black enameled and baked in the ovens of the Inter-State factory. Selected natural wood wheels will be furnished on any of these cars at $5 extra per set.



Paterson chassis for 1917 which is fitted with a Hess floating axle and uses the Hotchkiss type of drive

Two New Paterson Models for 1917

Four-Passenger Roadster and New Touring Design with Double Cowl—Floating Axle and Hotchkiss Drive

THE 1917 Paterson chassis, built by the W. A. Paterson Co., Flint, Mich., has a new rear system and will be fitted to a four-passenger roadster body in addition to a new design of touring car body with the popular double cowl effect. The offering of one of the so-called sociable types of roadster or close-coupled bodies is a new thing with Paterson, heretofore only the touring car body being offered. The price is $1,065 with the touring car body.

Mechanically, the only changes in the chassis, which is powered with a six-cylinder Continental engine, are the adoption of a Hess floating axle, and the use of the Hotchkiss type of drive, whereby the driveshaft back from the gearbox is open and fitted with two universal joints, and the drive and torque are taken through the rear springs, the main leaves of which are made strong enough to take on these added duties. Formerly an inclosed driveshaft with a single universal at the front end has been used, the newer construction being lighter and doubtlessly much more efficient as applied.

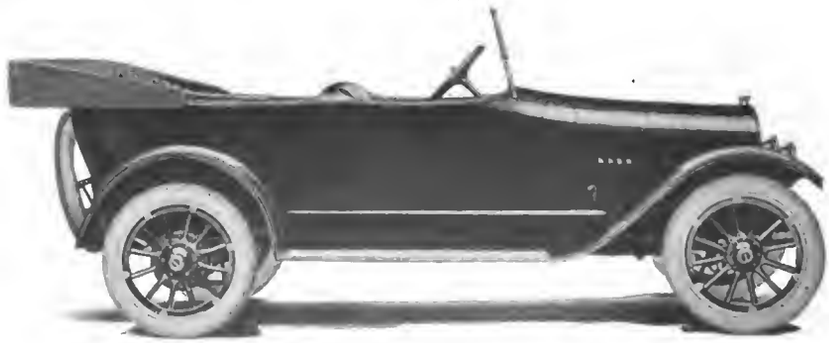
Bodies Are Larger

In the body, perhaps the most notable differences are the new lines and the wider and longer dimensions which add to the roominess of the vehicle. At the back of the front seat the double cowl idea has been meritoriously worked out in conformity with the general lines of the car, and the straightness of the lines has been accentuated by raising the radiator and hood 1½ to 2 in. As an added touch of modernity the windshield has been given a slight slant, the mistake of making the incline too great not being committed. To give more leg-room for the front seat passengers, the front seat has been moved back a few inches, and to further add to the car's comfort and good looks, the upholstery is of the type in which there are parallel plaits instead of the tufted form. Auxiliary seats to fit in the tonneau can be furnished if desired, thus giving ample room for seven should the purchaser wish to convert the car into a vehicle of larger capacity.

Standard Units Used

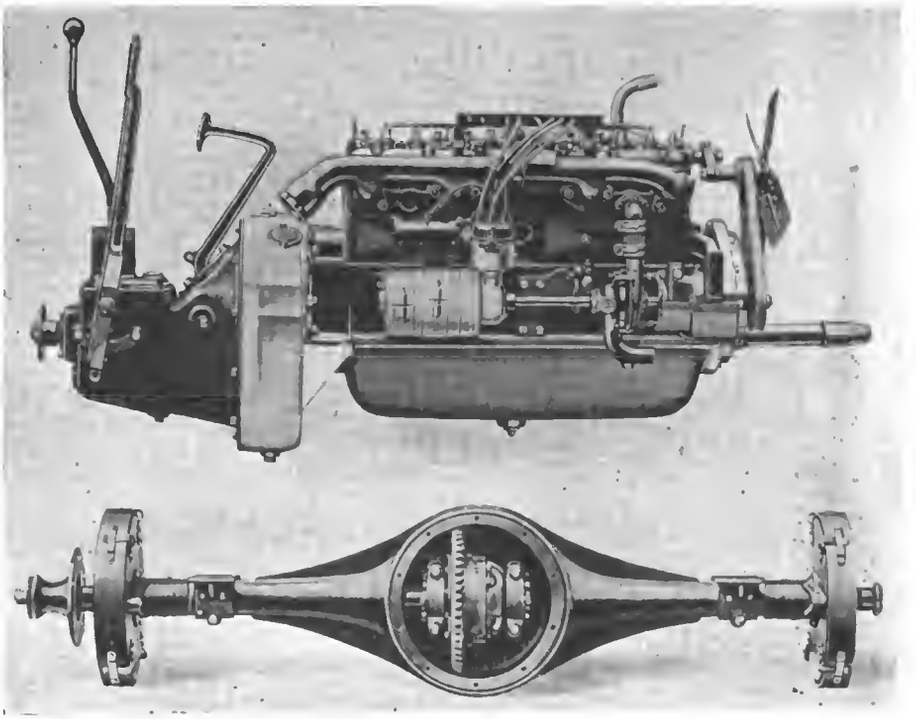
There is nothing of the radical about the Paterson car. It adheres to conventional design, utilizing standard units. A Warner gearset bolts directly to the motor to make a unit power plant, and a leather-faced cone clutch is also utilized, the action being so worked out that very little effort is necessary to press out the clutch pedal for gearshifting. The new axle is fully demountable, with a one-piece pressing, webbed outwardly, serving for the deffefential housing and the axle tubes as well. It is fitted with spiral-bevel driving gears, the advantage of which is now too well known to be needful of further discussion here. Springs are three-quarter elliptic in the rear, and attached to the rear member of the frame is a large gasoline tank that supplies its fuel to the carbureter through the Stewart vacuum feed system. Tires are 32 by 4 on demountable rims, with the rear pair provided with non-skid treads, and the wheelbase for either body model is 117 in.

Electrically, the car is Delco, employing separate starting and lighting units, with the ignition distributer mounted at the forward end of the generator. The new type of Stromberg carbureter is fitted.



New Paterson touring car with double cowl. It sells for $1,065

It is not necessary to go into a detailed description of the 3¼-in. by 4½-in. Continental engine. It might be said, however, that the cylinders and upper half of the crankshaft are cast in one piece, with the cylinder head detachable as a unit. Valves, exhaust manifold, water pump and electric unit are all on the right, which leaves the left side exceptionally clean. In fact, nothing is carried on this side with the exception of the carbureter, this bolting directly to the casting, well up in the center. Distribution of the incoming gases to the several intake ports is done within the casting itself, affording excellent heating of the incoming gases and eliminating the necessity for an elaborate jacket arrangement for the carbureter.



Six-cylinder Continental engine, which forms a unit power plant with the Warner gearbox, and the new Hess floating axle used in the 1917 Paterson

Solid Engine Support

Suspension of this engine in the frame is by means of arms extending out from the flywheel housing at the rear, and by hanging the front end of the crankcase from a forged crossmember which is bowed upward to allow the forward end of the motor casting to pass beneath it. Thus, while a three-point suspension in the accepted sense is not used, its advantages are obtained, and at the same time the engine is very solidly carried.

Three-Bearing Crankshaft

Three bearings carry the crankshaft, and three more are employed for the camshaft. On both sides of the front bearing of the mainshaft there are flanges which take any end thrust which may be imparted to the shaft by the clutch or other outside mechanism. This is a precaution against untrue running of the shaft and consequent noises. Bearings are of nickel-babbitt, being bronze-backed, and as this material is a good conductor of heat, it aids materially in keeping the bearings cool. A plunger pump feeds oil through copper tubes within the crankcase direct to the main bearings, and also to the helically-cut timing gears housed at the front.

Nothing unusual is presented in the pistons nor in the connecting-rods, both being sturdily built, and that set which goes into any particular motor is accurately weighed so that each piston and rod assembly is of the same weight as the rest, a big factor in reducing vibration and consequent smooth running.

The pump and generator shaft on the right is also utilized to drive the fan, through a flat belt connection. The fan is a four-bladed pressed-steel affair, supported by a rocking bracket which seats in a hole cast in the front end of the cylinder head plate. Moving this bracket up or down takes care of the belt tension as required. The centrifugal water pump is located ahead of the generator unit, and it delivers the water to a single opening into the cylinder block, which is directly above the pump, thereby reducing the length of the supply pipe to the minimum and making it a straight passage. The distribution of the water within the packets is arranged so that each cylinder gets amply cooled.

Tool compartment in the left front door of the new Paterson touring car. Each tool has a pocket and the flap protects the compartment from the weather. This arrangement makes it easy to keep track of the various tools and does away with groping under the seat for them

Chassis Is Lighter

Due to the use of the open type of driveshaft without torque members of any sort, the chassis is materially lightened, and is brought up to most modern of engineering ideas. Besides the driveshaft, the only rods running back from the forward part are the two brake rods controlling the two sets of brakes. The equilizers for these are placed on the rear axle housing, with brake control rods just ahead of the axle tubes.

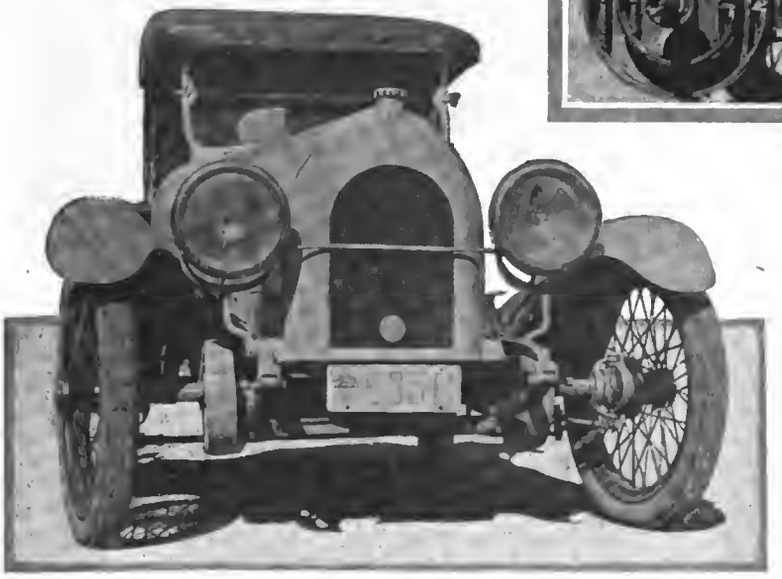
A slight taper is given the frame from back to front so as to properly support the body throughout its length. Yet while this frame is very sturdy, being especially strengthened by wider flanges at its center, it is quite light, and indicates that much engineering skill has been put on its layout. There is a single cross member besides strengthening given by the engine at the front and the use of a strong member at the rear. This intermediate member is located at about the center of frame length, where it is obviously of most advantage. Attached to the rear member are brackets which serve the double purpose of supporting the gasoline tank and holding the spare tire and rim carrier.

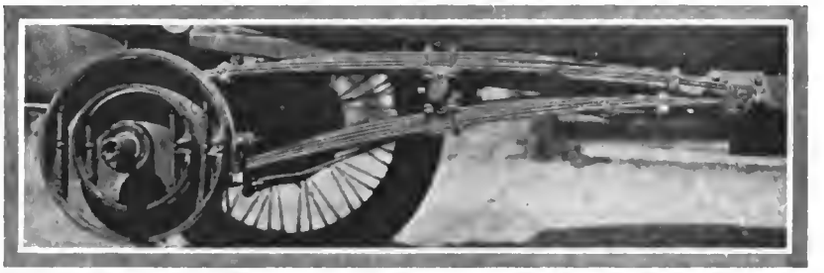
Equipment Is Complete

The car is equipped with Stewart speedometer, extra rim, full tool set, one-man top, attractive universal-acting windshield, quick adjustable side curtains, and Willard storage battery. In connection with the tool equipment, special attention should be drawn to the handy arrangement of these necessities in a compartment in the left front door, close to the driver's hand. Here each tool has its own pocket, and the arrangement is an incentive to keep the tools where they belong.

Below—Front view of the Homer Laughlin eight-cylinder roadster, showing stream lines. Note drive chain housings on front axle

Right—Double cantilever rear springs used on Homer Laughlin eight, showing also brake construction





Homer Laughlin Light Eight

Front Drive by Chains to Jackshaft, Friction Transmission and Double Cantilever Rear Springs Are Featured

AN eight-cylinder light roadster will be the 1917 offering of the Homer Laughlin Engineers Corp., Los Angeles, Cal., which is that city's only passenger car factory.

For more than 2 years the engineers of the corporation have been working on the car which has been placed on the market to sell at $1,050. The car is known as the Homer Laughlin eight. It is a front-drive creation equipped with a 25-hp. engine, designed and built at the Los Angeles factory of the company. The car has a friction transmission.

10,000 Miles in Tests

Three experimental models were put out by the new factory before the engineers were satisfied. After the third model had been driven approximately 10,000 miles in tests, all over the California and Arizona deserts and through the Sierra Nevada mountains, the car was pronounced finished and the factory began building cars for the market.

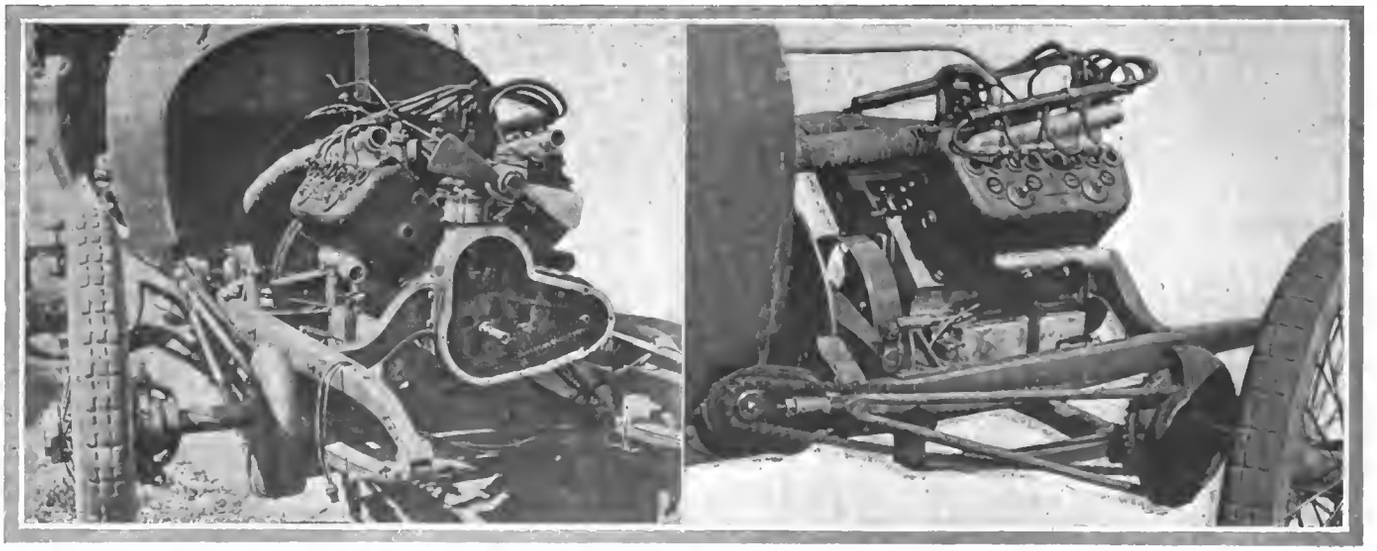
There are a number of sterling features incorporated in the construction of the Homer Laughlin eight. The body design is attractive, and on account of the dual spring arrangement, the car is one of the easiest riding machines to be found.

Front Drive by Chains

The front wheels are driven by means of chains rigged from sprockets on a jackshaft to sprockets on the front axle. The power is transmitted out to the wheels through patented universal joints which make the car extremely easy to steer, and it is impossible to lock the wheels. The drive chains are incased in a light metal housing and these are taken up or let out by means of set-screws which work on the jackshaft sprockets, leaving the front axles always in line.

Friction Transmission Features

The friction drive clutch is released by pushing down on the pedal and engaged by letting it in, like an ordinary gasoline car clutch. A powerful spring holds the drive against the disk and by releasing the spring, the clutch is released.



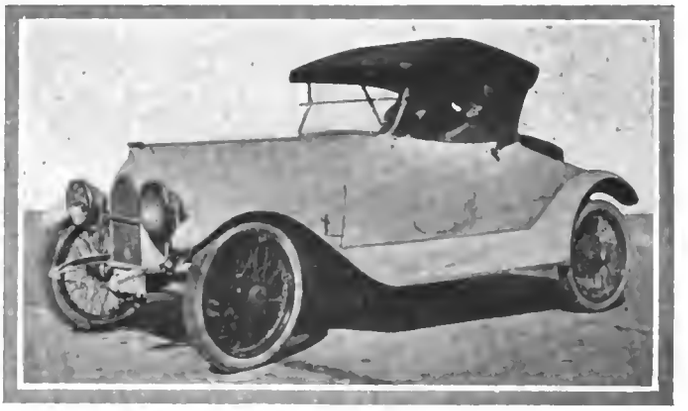
Front and side views of the eight-cylinder engine used in the Homer Laughlin roadster. These views also show the two-bladed fan, chain-driven timing gears and the front-drive assembly. Note the set screw arrangement from frame to axle sprocket. The patent universal joint used is visible in the illustration at the left

The friction disk is made of a composition which the engineers worked out with the intention of using it for friction disk purposes, and it is proving highly successful in the cars now in operation.

Factory Is Well Equipped

As soon as new machinery is installed the factory will have a capacity of 50 cars a month and the factory has many orders booked ahead so that the plant will be worked overtime to keep up with the demand which is not entirely local.

At the company's factory there is equipment for every kind of casting and all the machine work necessary on the cars. In the past no passenger cars have been built in Los Angeles except special models assembled in that city for racing purpoes; but the Homer Laughlin is to be built entirely in Los Angeles with the exception of the wire wheels, which are built to order by the Houck company.



Side view of the Homer Laughlin eight-cylinder roadster which sells for $1,050

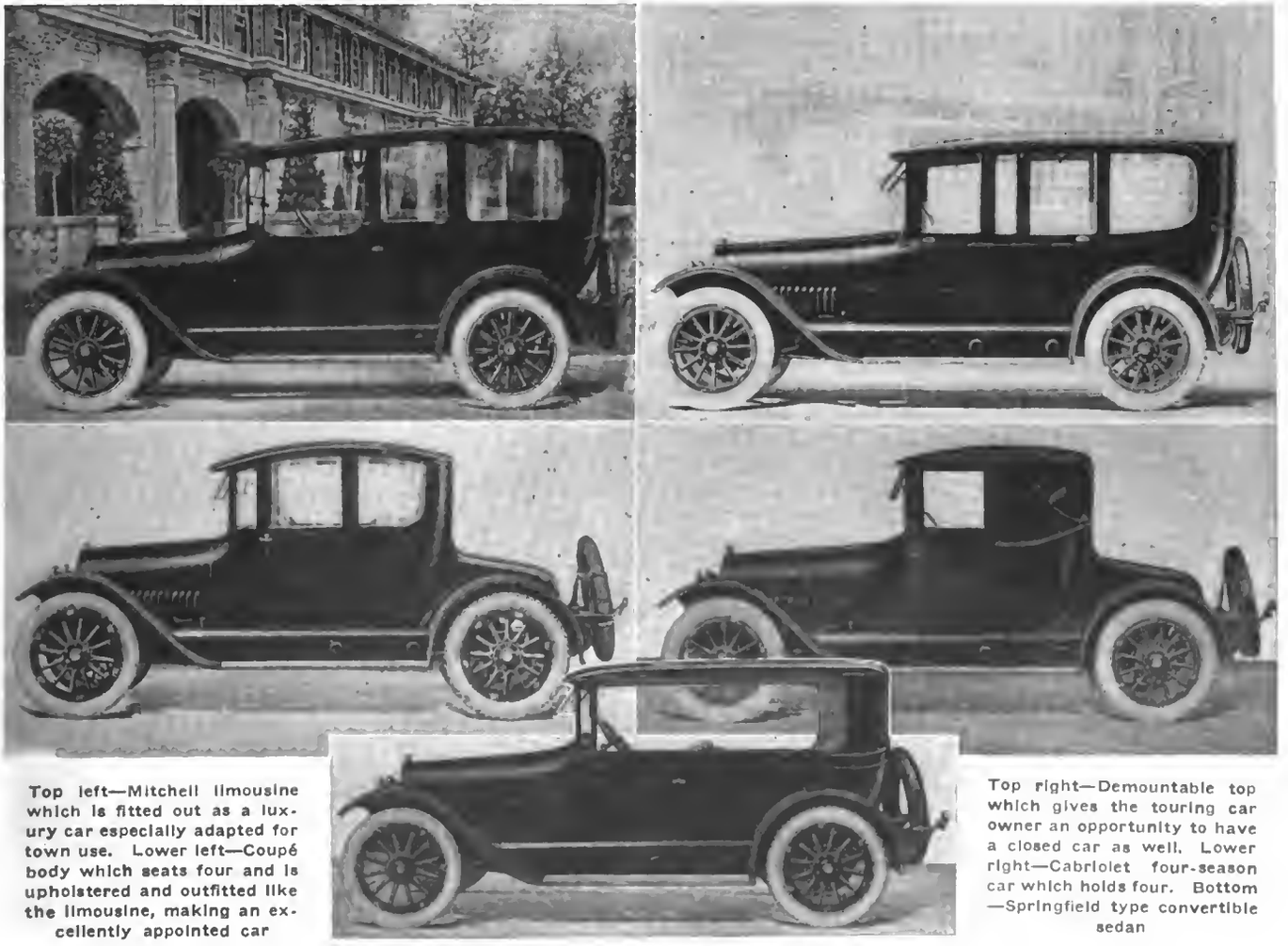
Smart Four-Season Bodies for Mitchell Chassis

THE Mitchell line of Four-Season bodies is now out and shows very clearly the trend toward bodies that can be used at all times of the year in all kinds of weather. The sedan is an especially attractive job, being a Springfield type, finished and upholstered like a high-class limousine, but with the seats all inside, so that the driver is with the other members of the party, making an ideal family car. The plate glass sides completely disappear when so desired, transforming the car into a touring design with a permanent top.

Another attractive design is the cabriolet, which should prove very popular with physicians. It has room for three passengers and an auxiliary seat for a fourth. With the top up, it is a coupé, and with the top down, a roadster. In transforming the car into a roadster, the top drops back and the side windows drop down into the doors.

For a luxury car there is the limousine which is all finished in whipcord with silk drop curtains. There are three electric lights, telephone, toilet and vanity case, flower vases, smoking sets, Waltham clock arm rests and seats that can be made to face any way.

In addition to these bodies, there is a coupé and also a demountable top that can be attached to the touring body.



Top left—Mitchell limousine which is fitted out as a luxury car especially adapted for town use. Lower left—Coupé body which seats four and is upholstered and outfitted like the limousine, making an excellently appointed car

Top right—Demountable top which gives the touring car owner an opportunity to have a closed car as well. Lower right—Cabriolet four-season car which holds four. Bottom—Springfield type convertible sedan

Effect on Industry of Standard Truck

Military Requirements in England Raise Problems of Expediency—Commercial Drawbacks Observed in Military Standard Design Made by Different Manufacturers

THE view has recently been expressed in England that the best way to get British trucks for the army is to have a standard design or series of designs and to force different automobile firms to make different parts, assembling the vehicles in some other factory. *Motor Traction* (England) makes an editorial comment on the proposal which is worthy of note in America, for similar conditions might possibly arise here, should the government decide to buy very large quantities of vehicles.

First, this editorial states that there is little doubt as to the advantage of the scheme, solely from the military viewpoint. The army would like to have all its trucks alike without variation, and is quite right in its desire to have them so, provided that there is no weak spot in the design chosen. The matter which concerns our contemporary is the effect upon the markets of the world of the existence of large numbers of these trucks for which no one firm is responsible, especially supposing that they are thrown on the used car market, as they are practically certain to be sooner or later.

The editorial continues:

"The effects of any such assembly scheme, assuming that the vehicles put together will go into a country where a very considerable potential peace-time market exists, are very difficult to assess. Viewing such schemes from the standpoint of the British industry, it is undoubtedly desirable that new and growing markets should be fed from this country in the first instance, and the goodwill connected with them thus prevented from slipping out of our hands. Very much depends on whether the cars provided as a result of official initiative prove thoroughly satisfactory in use. If they do, they will act as a useful advertisement for British industry. If, on the other hand, they are not uniformly satisfactory, harm may be done to our national reputation as motor engineers. It is always a difficult matter to design a complete chassis which will give good results without undergoing a long period of preliminary trial. The difficulty is increased when the designers have their hands more or less tied by the need of working along lines to some extent laid down in advance. It may be presumed that in any such scheme now under consideration, an endeavor will be made to utilize components readily available rather than to force the manufacturers of components to adopt new designs possibly entailing the use of fresh machine tools. Past experience, in this country and elsewhere, does not inspire very rosy hopes of the ideal character of any assembled machine, much less one assembled under such considerable difficulties.

After the War

"If, however, we take it that the endeavor to produce a satisfactory type of assembled vehicle will be successful, we have next to consider what will happen if a considerable number of these vehicles remain available for general service after the war. The official scheme of assembly would presumably only be temporary, and would not be perpetuated in competition with recognized manufacturers. The vehicles remaining on the road might or might not be retained in government service by our allies. If so retained, no doubt a considerable store of spare parts would be available from the first, and adequate arrangements would be made for the provision of further supplies of such parts whenever they might be required. If, on the other hand, allied governments were to dispose of their vehicles to traders and others when the war is over, it is quite conceivable that the time would arrive when the owners of the machines would find themselves in difficulties with regard to spares and renewals. It would be very awkward for a user to have to apply to one manufacturer for engine parts, to a second for steering gear parts, to a third for back axle parts, and so on. Consequently, it would be necessary that somewhere or other a large stock of spares should be kept in existence, until the number of official type vehicles remaining in service had become quite negligible. Without such precautions, the most well-intentioned effort to supply, by the creation of assembled cars, from this country rather than from abroad would cause more harm than good to British industry in the long run. We have never had a very great reputation for watching the interests of users of British machines in distant countries, and if we are to extend our markets effectively to absorb our much increased output, we have got to show general improvement with regard to service of this kind.

"On the whole, the arguments in favor of the temporary adoption of some assembly scheme under official auspices seem to be fairly strong, but so also are the arguments against it. If the real object of such a scheme is to be primarily to advance the interests of the British industry, and not merely to provide useful experience for a few favored individuals, there are numerous precautions which must necessarily be taken in good time. Given these precautions, no great harm may result, but on the whole we cannot express ourselves enamored of the principle involved in the creation of what might be called the national assembly chassis."

Compressed Coal Gas for Trucks

Comment has recently been made on the effects of gasoline shortage in England on the stimulation of kerosene experimentation. Another suggestion which emanates from France is to use coal gas compressed in steel cylinders, and anent this the *Motor Trader* (England) makes a very interesting comment as follows:

"Persons in touch with the self-propelled street vehicle movement of the early and middle "eighties" of last century will remember the attempts to adapt coal-gas engines of the Otto (Crossley make) type for driving street tramcars. We believe there is a surviving example of this style of propulsion at Neath in Glamorganshire, though we can only recall one of the last attempts in that direction, namely, a tentative installation at Blackpool.

"Attention having been drawn recently to the possibilities of this form of propulsion, using compressed coal gas in cylinders easily removable for recharging and replacement, it may be useful to append some data contributed in 1913 by a French gas engineer to the Proceedings of the Institution of Gas Engineers of France.

"Owing to the exceedingly high degree of compression which the gas undergoes—over 100 atmospheres—certain of

the heavy hydrocarbons, such as benzine and its homologues, are thrown down in liquid form, thus causing a direct loss in thermal value of from 6 to 10 per cent. Taking the average price of gasoline at 42 cents per gal., its calorific power being about 140,000 B.t.u., it is seen that approximately 80,000 B.t.u. are obtained for 24 cents. On the other hand, assuming the average calorific value of the compressed gas to be about 480 B.t.u. per cu. ft., with this selling at 72 cents per 1000 cu. ft., including compression, the thermal units obtained for 26 cents would be 160,000. It is suggested that ten gas cylinders could be carried on each vehicle, these being 6 ft. 6 in. long by 8 in. in diameter, and involving a dead weight of about ¾ ton. Between them they would carry about 2500 cu. ft. of gas, or the equivalent of about 11 gal. of gasoline in the case of gas as obtainable in Paris.

"It may be inferred from these figures that the prospects of coal gas are not great for vehicle use, and that without reference to the effect to be anticipated from substituting a calorific for a lighting standard of efficiency, as recently sanctioned by Parliament."

Westcott Adds Springfield Touring-Sedan Body

THOUGH built under the Springfield patent, many improvements have been incorporated in the new Westcott Touring-Sedan body. The only windows that it is necessary to entirely remove are those at the sides of the rear seats, as the others telescope into the sides of the body. There they are completely hidden. The pillars, too, fold down and are concealed in a similar manner.

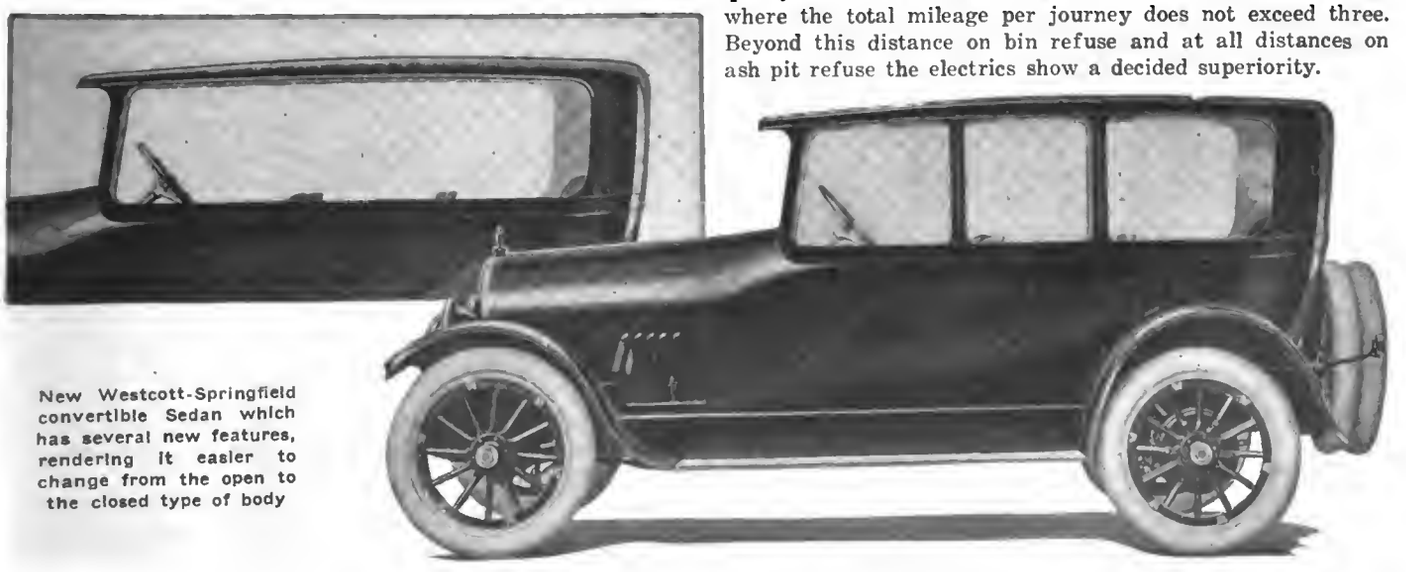
The windows at the sides of the rear seat, however, may be dropped three-quarters of the way into the sides of the car for the purpose of ventilation, and the other windows may be lowered to any desired point.

This body type is built on the standard 125-in. wheelbase chassis. This has a Continental 3½ by 5¼-in. motor with an S. A. E. rating of 29.4 hp. A Fedder's radiator with thermostatic control comprises the cooling system, the latter tending to better the performance of the motor. A few of the other specifications of this model include a two-unit Delco system, Spicer universal joints and Timken axles and bearings. The rear springs are made from chrome-vanadium steel and are of the cantilever type.

The aisle between the front seats has been widened to 9 in., and the rear seats have been made correspondingly wider. The rear seats now measure 50 in., instead of 47, as was the practise last year. The generous leg-room, both in the front and rear compartments, has been maintained, and the cars are more attractive than heretofore.

It is predicted that this season will see a considerable improvement in the all-season and all-weather types of bodies, as the trend which started about three years ago has been carried through until some sort of a convertible body is incorporated in practically every line. The Westcott-Springfield types illustrated on this page show one direction that the development is taking, in that the conversion from a summer to winter type is easier made by a person who is not a mechanic.

To combine the utility of the convertible job with sightliness is one of the hardest tasks that confronts the designer of this type of body. This has been met very successfully in some of the newer types that are coming out this season. The Westcott bodies have some of these developments, as they have been worked out in their own plant, and the improvement is marked. The prices at which these bodies are sold are also low enough to make all-year motoring more attractive than it was when it was deemed necessary to have two cars, or at least two entirely separate bodies which could be interchanged.



New Westcott-Springfield convertible Sedan which has several new features, rendering it easier to change from the open to the closed type of body

Electrics Cheaper than Horses in Garbage Haulage

THE street-cleaning department of Sheffield, England, has found electric vehicles to be more economical than horses in hauling garbage. The cost per ton of refuse collected showed in practically every case a marked advantage on the side of the power wagon. Two vehicles have been in operation for some time. Taking a period of 22 weeks one electric vehicle working during daylight cost $1.41 per ton of refuse collected. For a corresponding time under similar conditions the cost of the horse was $1.83 per ton. For night work the cost of the electric vehicle was 56 cents per ton and for the horse 79 cents.

On the second vehicle on another kind of service the cost was $1 per ton as compared with 93 cents for the horse system, while at night on this same service the cost by electric vehicle was 25 cents per ton as against 62 cents for the horse. The tests have led to the conclusion by the municipality of Sheffield that horse labor shows an advantage where the total mileage per journey does not exceed three. Beyond this distance on bin refuse and at all distances on ash pit refuse the electrics show a decided superiority.

Truck and Tractor Engines—Part II

Establishing a Rational Basis for Motor Application—Details of Design of Crankshafts, Valves, Bearings, Flywheels, Connecting-Rods, Camshafts and Pistons

By H. L. Horning
Engineer and General Manager Waukesha Motor Co.

MANY formulas have been put forth for establishing a rational basis for motor application based on M.E.P. obtainable in engines and many attempts to use these formulas up to this time have failed because there are so many variables and designers have had little experience in applying them. American conditions vary so much, as quantity manufacture dictating standard models in trucks to cover a wide range of conditions and make it seem advisable to hold to what has been found good practice. Engine designs and sizes have varied widely in the past; present practice finds engine design and sizes converging toward common practice.

Truck and Tractor Engine Specifications

The following specifications represent what appears to be good practice in engine design and material for trucks and tractors. This was arrived at after examination of all foreign and American specifications available for successful trucks and their engines and American practice in tractors:

Cycle—four.

Number of cylinders—four.

Cylinder type—in pair or cast in block—L head or valves in head.

The L head seems to be less sensitive to ignition troubles and most commonly used, though the valve in head has decided theoretical as well as actual points of excellence.

Material—Semi-steel.

Elements of design—Cylinder design for truck and tractor motors is mostly involved in an efficient combustion chamber, for it is here that the basic process of the motor occurs and where most defects are evident. Perhaps the difficulties may be best illustrated by stating that at full load and with poor fuel such difficulties as compression pound, cracking of fuel, steaming of waterjacket and pre-ignition occurs. A typical case may be cited of a pleasure car engine, by means of a preheated intake manifold, burning either a poor fuel or kerosene and delivering full load. But under these conditions the following bad symptoms occur:

(1) The exhaust is not clear, being light-colored or steamy.
(2) The engine is pounding excessively.
(3) The power is off at least 20 per cent.
(4) The water outlet from engine is boiling.
(5) Fuel economy bad.

A thorough examination will show the combustion chamber as having a hot spot—most likely a valve plug, a spark plug or a part in the neighborhood of the exhaust valve.

It is important to remember that 70 per cent of the heat loss to jacket water occurs in the neighborhood of the exhaust. To locate the offending spot it is well to start with valve plug, and a very striking demonstration will occur if this is causing the difficulty.

With an oil can keep the plug under water so that it will boil violently and cool the spit.

In about 30 sec. the exhaust changes and becomes almost invisible, the pounding stops and the power-output goes up, the magneto can be slightly advanced. Economy improves and the outlet water ceases to boil.

As nearly as we can tell, this is what happens:

1—The hottest spots have been so cooled that cracking of the fuel which comes in immediate contact with the spot has stopped, as indicated by the clearing of the exhaust.

2—The spot has so cooled that circulation water can come in contact with the walls nearest with the resultant proper dissipation of heat.

3—Pre-ignition has ceased, because the temperature of the hottest spot has been brought below ignition temperature.

If now we cease cooling the hot plug all the old processes will have gone through various stages of development in about 2 min. and the engine will start working as at first, which proves conclusively the source and cause of the difficulties. If the hot spot be a valve or the center of a piston, it can be ascertained by the color of the metal toward the center.

Generally speaking, we have recalled by this demonstration the following principles:

1—The maximum temperature of any spot in the cylinder must be kept below the pre-ignition point.

2—The maximum temperature of any spot in the cylinder must be kept below the cracking point of any part of the fuel.

3—Any one spot will determine the performance of the engine.

4—That one spot capable of cracking fuel or pre-ignition spreads over an area and causes so-called steam pockets in the circulation which further extends the disturbance in the performance.

5—Economy of fuel consumption is established by a high average temperature of combustion chamber walls.

6—The limit of practical compression, hence power, output, economy and of fuel quality which can be successfully burned is established by a high average temperature of the combustion chamber and low maximum temperature of the hottest spot.

Crankshaft Design

Crankshaft diameter 0.45 to 0.50 of cylinder diameter. It should be heavy and short with long cheeks. Material, 40-45 carbon steel; heat-treated to give ultimate strength of 90,000 to 100,000 lb. For heaviest service chrome nickel or 3½ per cent nickel steel, 0.35 carbon heat treated for ultimate strength of 140,000 lb. per square inch. These crankshaft sizes and specifications mentioned are for three-bearing shaft. Bearing lengths as follows are according to common practice: Connecting-rod bearing length may be put down as 0.65B. Making this unity, then the length of main bearing is as follows: Front end, 1.20; middle, 1.15; flywheel end, 1.50. Tabulating service experience and analyzing actual pressures the following has given better results: Front end, 1; center, 1.40; flywheel end, 1.50.

The importance of the center main bearing is illustrated by the constant attention it requires when of normal length.

Where two-bearing cranks are used, the same general specifications obtain with the exception that the shortening of engine as much as possible is desirable to develop the stiffening of the crankshaft. Inasmuch as the valves govern the engine length and that with a given lift effective valve areas vary directly as their diameter while displacement drops approximately as the cube of the diameter, shortening of the smaller sizes of motors is easily obtainable. General experience with two-bearing shafts suggests that nothing short of counter-balancing will correct the whip and lack of stiffening in shafts having common dimensions. Crankpin and main-bearing sizes should be not less than 0.70 B. The stiffness of the shaft should be conserved by attaining bearing area through the large diameter of the shaft rather than by length and by getting the greatest longitudinal thickness of cheeks possible. The connecting-rod bearings should be 0.6 B length; end cheek 0.42 thickness, while the long cheeks should be 0.6 B.

Number of Bearings

Some recent designs have gone to four and five main bearings. The four-bearing shaft should give satisfaction but make a long engine; a five-bearing shaft makes a still longer engine and robs the connecting-rod length to give length to crank bearings and have been mostly found inferior in general all-around results to a well designed three-bearing shaft. In designing the severity of service compared with usual provisions made to meet it, make the order in which bearings need attention as follows: 1, Crank pin; 2, center main; 3, flywheel end; 4, front end.

Crankshafts do not wear cylindrical, the greatest wear coming on the inside of the crankpin and on the opposite side of the main bearing. The use of alloy steel in cranks is justified only by the desire to retain the true form of journal for a reasonable length of time. Alloy steels and particularly chrome-nickel variety have shown admirable ability to withstand abrasion but, roughly speaking, the elastic limit seems to give a measure of resisting ability of the material, other things being equal.

The factor which seems to determine largely the quality of the crankshaft material is most readily expressed by the saying that "crankshafts must last in spite of the oil they are apt to get in truck and tractor service."

Notwithstanding the poor initial quality of oil that engines get, the lubricating quality is still further reduced through the rapid increase in gasoline or kerosene content covering a 10-hr. run in tractor service. Where open-type breathers were used, the writer has seen ½-in. of mud and sand in the bottom of a crankcase and has seen leaves taken out after 3 months' service. In this particular case the crank was found to have worn 0.003 average, while the cylinders wore 0.030; piston rings were worn to a knife edge and width of ring grooves to 0.030 clearance on side ring for top, 0.018 clearance for second ring and 0.005 for bottom groove. This cannot be considered a reasonable condition under which a mechanism could be expected to work, but the demands are such in tractor service that the motor that receives little damage should conditions get bad, certainly illustrates the old law of the survival of the fittest. Dust in the combustion chamber can be eliminated by various methods of dust removal, the most successful type being one made by a well known carbureter company.

Dirt in the crankcase can be kept to a minimum by the use of a check-valve breather which allows pressure to escape but checks the flow of air into the crankcase.

Lowered lubricating value of oil due to fuel leakage passed the rings can only be eliminated by removing oil every few days, filtering same carefully, distilling off the gasoline and kerosene and using the remaining oil half-and-half with new oil; or by the old methods of force feed oil leads to each cylinder and bearings.

It is almost universal practice to attach crankshafts to flywheel with a flange at least two and one-half times the diameter of crankshaft. Numerous methods are adopted on crankshafts to prevent oil from leaking out both front and rear end of the crankcase. Practice has not converged to any one method.

Valves

Valves—Clear diameter = 0.45 B. to 0.50 B.
Type of valve—poppet.
Material—High carbon alloy steels hardened all over.
Type of seat—45 deg. angle.
Valves inclosed.
Piston pin—hollow.
Material—0.20 carbon steel, case-hardened and ground and polished.
How held—either to piston or in connecting-rod.
Type of bearing—bronze.
Valve tappet—Mushroom or roller type. All wearing surfaces case-hardened and ground.
Timing gears—Crankshaft gear 0.30 carbon steel.
All others—Semi-steel.
Teeth not less than 8 pitch helical.

Crankcases

Crankcases whenever possible should be of aluminum with 8 per cent copper, commonly known as No. 12 alloy—firstly, because of its lightness; secondly, because of the rapidity with which it can be worked, and, thirdly, because of its high heat conductivity.

The design of crankcase usually revolves about the question of rigidity and that crankcase is the best which is the stiffest and the best conductor of heat. Usually the problem of compromise comes, in sacrificing stiffness to provide for a door into the crankcase for inspection. This can be met by making the doors oval rather than rectangular. Through bolts should be used wherever possible, and where aluminum is used, thread lengths should not be less than twice the diameter, and washers should be provided under the bolt heads and nuts that will distribute the pressure over as wide an area as possible, the area of washer to be three times the area of the bolt if possible.

In larger engines the crankcases are split horizontally, while in two-bearing crankshafts the barrel form of crankcase produces a very stiff case. A very stiff form of crankcase is that in which cylinder and upper case is cast in one. Combustion chamber should be formed in a removable head which, aside from the effective holding of the gasket, presents no serious problems but makes an admirable design for truck and tractor service.

Bearings

Bearing design, especially for connecting-rod crank end, is almost universally of high tin babbitt alloy in a comparatively thin layer backed up by various designs of backing held to the bearing material by tinning and other mechanical means. Great pains are now being taken to have accurate fits between connecting-rod and back of bushing to insure rapid heat dissipation.

Main-bearing bushings are held to the crankshaft case with accurate fit, but experience has taught that the better heat conductivity of the crankcase is such that die castings are used, if of good design and the same bearing material as the connecting-rod bearing.

One of the most difficult parts to hold is a bearing bushing on the crankshaft and especially the connecting-rod bearing. Brass screws are usually used to hold the bearings in place for assembling but are never sufficient for working conditions. For motor running up to the limit, great care must be taken to make the take-up shims assume the roll of keys and sufficient bearing on the shims and bushing must be pro-

vided to hold everything firmly in place without undue wear. A solid shim is the best, but few users can take up bearings except by removing their shims. Laminated shims are being used to a greater degree.

Flywheel Design

Experience has taught that a flywheel having a stored energy of 30 per cent more than is usual in passenger car service is a positive benefit in truck service and a great protection to the engine. Likewise, tractor engines should have about twice the stored energy that trucks have, this being figured at the average speed of passenger car engine against the speeds of maximum torque for truck and tractor engines. This is seldom attained in service up to this time, owing to limiting dimensions in the design of trucks and tractors.

In trucks, clutches have been converged down to three types, these being the cone, plate and multiple disk. This has determined the flywheel design to a large extent.

There is one fundamental difference between truck and tractor clutches. A truck clutch is engaged when the foot is off the pedal; while in tractor service the clutch must be engaged or disengaged or left in either condition while the foot is off the pedal. The most common tractor clutch is an expanding shoe clutch, counter-balanced, easily removable in part or whole without disturbing other parts of the tractor.

Connecting-Rods

These should be made of 0.35-0.45 carbon steel, heat-treated for an elastic limit of 70,000 lb. per sq. in. The design should be absolutely as light as possible. Recent investigations show that prevalent rod design is 33 per cent too heavy. While not always necessary, the trade demands four bolts in the crank end. These make adjustment of bearing more difficult. No doubt with stiffening of crank shafts, shortening of bearings with increase in diameter will brink back connecting-rods with one-bolt construction.

Bolts are of alloy steel, heat-treated to a strength of 120,000 lb. elastic limit.

In truck and tractor engines, the desirability of having rod bearings in line with the piston center is greater than in passenger cars. Connecting-rod length must be twice the stroke.

Camshafts

Camshafts in truck and tractor engines are different from passenger-car camshafts in that they are subjected to harder service and must be designed so that the surface on the cams and bearings will have ample area; in fact, more by 0.25 per cent than in automobile practice.

Camshaft material is usually 0.20 carbon steel, case-hardened and ground.

The timing on truck and tractor engines is very close to passenger-car engines, the main difference being in the closing of the intake. This is earlier than on passenger-car engines, due to the fact that maximum speeds of touring require higher motor speeds than those of truck or tractor service. Ability at lower speeds is very desirable in commercial service.

The bearing areas for the bearings in a camshaft based on satisfactory service are as follows, with cylinder area as unity, A:

Gear end, 0.20 A.
Center bearing, 0.30 A.
Flywheel end, 0.15 A.

Pistons

Pistons are usually made of semi-steel and are generally too heavy. Between 3½ and 5¼-in. bores pistons should not weigh over the amount indicated by the formula

$$W = 0.05\ B\ 3 \text{ lb.} \qquad (4)$$

This weight in the smaller sizes is entirely within the skill of foundry and machine-shop practice and these are the governing factors. One shop is now in quantity production in which piston weights are 10 per cent lighter than indicated by the formula.

The influence of piston, connecting-rod, piston pin and ring weight on the life of connecting-rod bearing is so definitely settled at all speeds that no designer can afford to have one grain more weight than necessary on any one of these parts.

No tendencies seem to be shown toward aluminum pistons in commercial engines, though it may be very much of an advantage to have a piston whose structure is aluminum, with bearing surfaces of some better material. Tractor pistons, because of the higher temperature at which they work, must have more clearance and this is also true of the gap in the ring. The following formula gives results of wide experience and has the advantage of being satisfactory for the following range of work:

Truck engines, light or heavy service, burning gasoline.
Tractor engines, light or heavy service, burning gasoline.
Truck or tractor engines, kerosene work.

$$Cs = 001\ B$$
$$Cm = 003\ B - 0.005$$
$$Ct = 003\ B$$
$$Ro = 003\ B$$

In which Cs is the clearance in diameter at the skirt, Cm clearance at the land between the top and second ring, Ct being the clearance at the top land; Ro opening of ring in a standard size cylinder at room temperature.

It must be said that the clearances indicated above presume an efficient system of lubrication and cylinder wall cooling. It must be urged that details of design in piston and cylinder such as good engineering will recognize also govern the clearance.

The piston ring fits and sizes recently adopted by this Society represent the best practice.

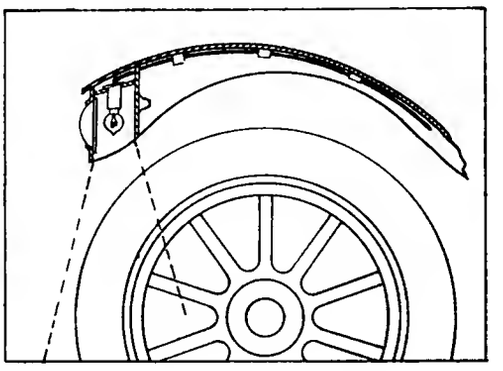
Inasmuch as the greatest friction losses in an engine are due to the piston, it is important that the piston have ample means of conveying and distributing oil along the cylinder. Usually three oil grooves are provided and a relief in the center wider than the piston pin drain is carried.

In the larger sizes, or from 5-in. up, cooling ribs are placed under the head running down the side of the piston. In some engines pins are cast in the head of the piston to facilitate cooling by oil.

A practice is becoming commoner of having a taper on the top land of the piston to insure an oil pocket or seal, so to speak, for the surplus oil pushed up by the piston and ring. While no definite proof has been found that this is superior construction, yet engines having the taper are giving superior heavy-duty service.

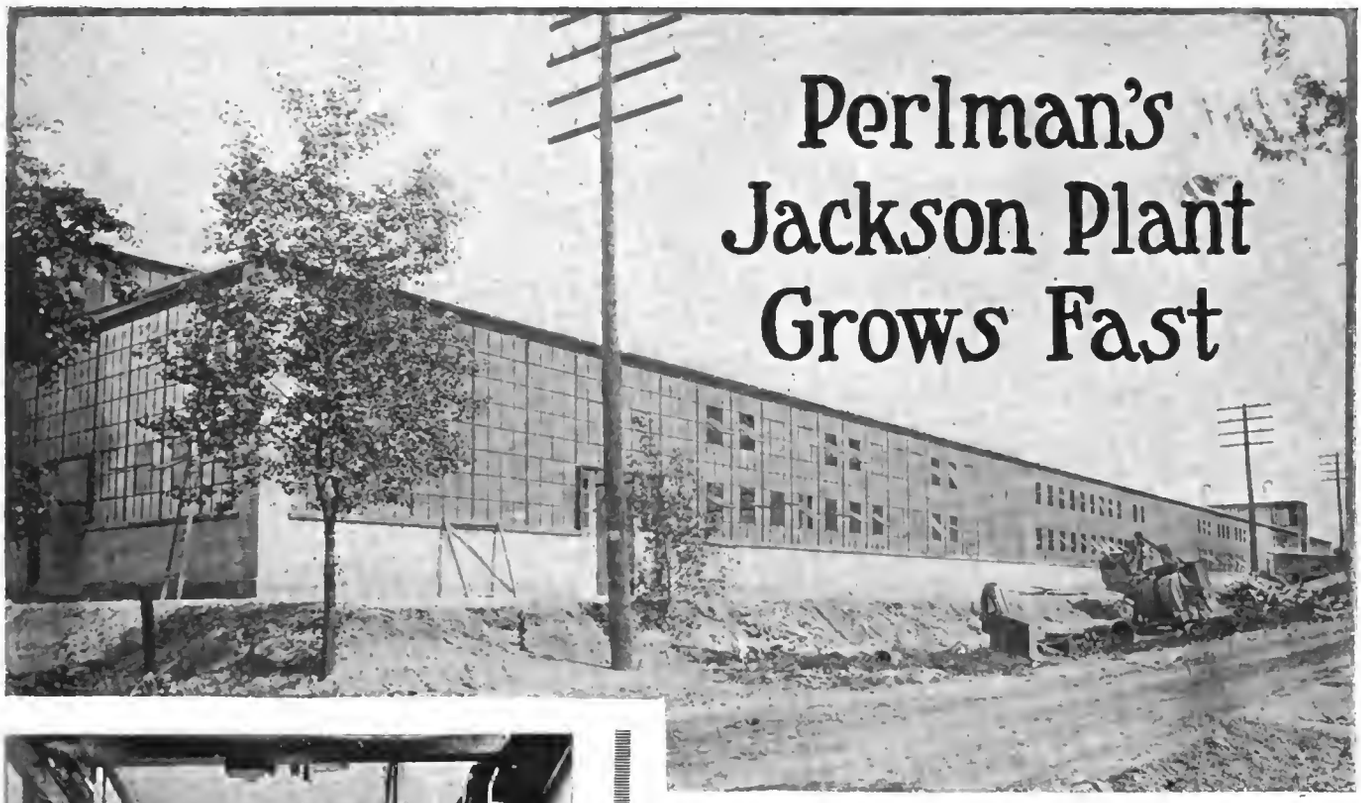
(To be continued)

A Sidelamp That Lights the Tire



An ingenious side lamp design recently patented by E. D. Shaw, Syracuse, N. Y. It throws a light ahead and also illuminates the front tire, which is a great convenience when driving into a garage or in city traffic

Perlman's Jackson Plant Grows Fast



Perlman Rim Corp's. completed plant at Jackson, Mich.

Finishing the floors and ceilings in record time

Ready for the final touches, Perlman rim plant in Jackson, Mich.

IT took 2 months and 14 days to put up the new plant for the Perlman Rim Corp. in Jackson, Mich. Thursday, April 6, the Austin Company got word to go ahead on a new building for this corporation at Jackson, Mich., 100 ft. wide by 320 ft. long. The complete structural steel for the job was there April 10, 4 days after the contract was signed. Before going ahead it was necessary to build 1300 ft. of railway siding, and there had to be a lot of shovel excavating before the sidetrack could be put in. Thursday, April 13, the Austin Company's steam shovel was on the job. Seven thousand yards of material had to be excavated. Monday, April 24, the lumber for purlins and roofing was on hand. Wednesday, May 3, they started steel erection, and Wednesday, May 10, 300 ft. of the steel was up complete. The roofing was very close behind when the completion of the brick work for the walls was more than half done.

The time in which the brick, steel sash and roof work were completed is exceptional. On June 1, all the main structural work, together with the steel sashing and wood roofing, was complete. Ten days more completed the composition roof and concrete flooring and by June 15 the glazing was done and a hemlock sub-floor added 2 days later. The maple flooring for the top was completed June 20. Thus in 19 days after the structural work was finished, the entire job was terminated.

Standardized Industrial Building

The building was done by the Austin Co., Cleveland, Ohio. This concern makes a specialty of standardized design, quick delivery industrial building. The Torbenson Gear & Axle Co. is having one of these standard buildings erected at a cost of $20,000. It is to be completed in 30 days and to be then ready for the manufacturer of passenger car and commercial vehicle axles.

The Rostrum

Correct Timing for a Hupmobile 20

EDITOR THE AUTOMOBILE:—What is the correct timing for a Hupmobile model 20? The engine has new rings with good compression. Maximum speed of car 20 m.p.h. and has not enough power to pull a 1 per cent grade on high. Evidently something is wrong. What carbureter would be good for this car? On the level the car will roll easily.

2—Why does not the battery ignition, for instance Delco, have a safety spark gap like the magneto to protect the windings? I refer to the true high tension.

3—Has Rickenbacher a foreign or American engine in his Maxwell?

Dayton, Ohio. H. A.

—The simplest manner of timing a model 20 Hupmobile motor is to turn the motor over by hand until No. 1 and No. 4 pistons are at extreme top center. With the crankshaft in this position, turn the camshaft over until the exhaust valve of No. 4 cylinder is just closing and the intake valve on No. 4 just opening. You will find there is a slight distance to travel between the moment that the exhaust valve closes and the intake valve opens. We would advise setting the camshaft as near the center of this distance as possible. Should you find it necessary to move the camshaft gear one-half tooth one way or the other in order that the gears may mesh properly, we would suggest that you retard the camshaft gear the necessary one-half tooth.

In setting the ignition we would advise that the magneto should be set so that the points in the breaker box should separate when the motor is 5/8 in. past the dead center flywheel travel. In other words, while the motor is in the position that it is when you finish timing the valves, turn the crankshaft so that you have 5/8 in. past the dead center line mark upon the flywheel. Then the magneto should be set so that the points in the breaker box are just breaking with the distributer brush, making contact with that terminal which leads to No. 1 cylinder.

A great many mechanics who are well acquainted with that type of spark which can be advanced and retarded will time the model 20 Hupmobile engine so that the spark will occur before dead center is reached. When this is done you will find that it will be practically impossible to obtain any power from the engine. Do not time this set spark type of magneto before dead center.

If the adjustments are properly made upon the Breeze carbureter you will obtain excellent service.

2—Battery systems have safety spark gaps in the high-tension coils.

3—The motor in Rickenbacher's car is American built.

Knocks Below 8 M.P.H.; All Right Above

Editor THE AUTOMOBILE:—I have a Buick D-45 1916. When I run it below 8 or 9 miles there is a knock in the engine. It is equipped with a Stromberg carbureter which I get from 17 to 18 miles to the gallon of gasoline. The engine works well above 8 or 9 miles.

Grant, Mont. J. N. M.

—It is probable that this knock is caused by one or more of the cylinders missing at low speeds and it may be that in installing the new carbureter this has been so adjusted as to cause this missing. It might be that a change in the adjustment of the carbureter will cure all of the trouble. If this does not do it no doubt the location of the cause will be found in the valves or ignition.

Sometimes it happens that a valve does not seat all the way, causing the motor to misfire in the same way as it would if the valves needed grinding. This may be due to too close an adjustment in the clearance. A misadjustment in the ignition will give the same kind of trouble. The timing should be set so that when the spark lever is in full retard position the spark occurs on upper dead center.

In all probability, though, the trouble will be found in the carbureter which is providing, in all likelihood, too lean a mixture at low speeds. The fact that you are getting as high an economy as you are may also signify that the setting is a little too lean.

Ammeter Probably in Damaged Condition

Editor THE AUTOMOBILE:—I have equipped my 1914 model Hudson six-40 with a model 301 Weston ammeter, with the following results: The ignition current goes through the instrument and does not seem to be as good as before. The lights do not burn as brightly, for if I place a screwdriver across the two terminals on the outside of the motor generator the lights immediately brighten up. Kindly advise me how to remedy this and still get a charge and discharge reading.

Richmond, Va. J. L. V.

—It is quite difficult to account for your trouble unless the instrument has been connected in circuit improperly at some time and the heavy current that is required for starting the engine has passed through it. The model 301 instrument is not intended for such service and might be badly injured if not wholly destroyed if such a connection has been made. Without knowing what terminals you refer to on the generator it is hard to explain what the effect of short-circuiting them will be but it is quite possible that other parts of your circuit besides the ammeter may be giving trouble. This refers to such things as brush contacts, cutout relays, etc.

Had to Make 75 M.P.H. at Omaha

Editor THE AUTOMOBILE:—What were the qualifying speeds of the cars in the Omaha, Neb., race of July 15, 1916?

2—What causes a 1916 Mercer motor to knock after the carbon has been removed and valves ground?

Flemington, N. J. O. M. V.

—At the Omaha race the cars were required to make a lap at an average speed of 75 m.p.h. before being allowed to compete.

2—There are a great many other causes for a motor knocking other than carbon and valves. Any loose part throughout the moving elements of an engine may be responsible for a knock. The most common causes are in loose bearings at either end of the connecting-rods, loose main bearings, worn pistons, etc. The camshaft bearings are sometimes responsible for a knock which cannot be found in any other

part. The bearings at each end of the connecting rod are the most common sources. If you would give more data regarding when the knock occurs and regarding its sound it would be easier to aid you in tracing the trouble.

Installing Ammeter on Hudson 54

Editor THE AUTOMOBILE:—Would you please inform me if it is possible to install an ammeter on a model 54 Hudson? If so kindly furnish a wiring diagram stating how the installation is made.

New York City. J. E. S.

—It is possible to install an ammeter on the model 54 Hudson and the manner in which the work is carried out is shown in the accompanying wiring diagram, Fig. 1. Remove the existing wire from the cutout terminal *A* and attach to one of the ammeter wires at *B*. The other wire from the ammeter is then connected to *A*. Should you notice that the ammeter reads "Charge" when it should read "Discharge," change the terminals about.

Full Retard on Top Center Position

Editor THE AUTOMOBILE:—What is the quickest and best way to find out whether a 22-72 Mercer engine is correct as to magneto setting? That is, if it is firing when it should. In other words, what is the best way to set the magneto?

2—Does the spark in a magneto occur when the points are together or just breaking?

Oshkosh, Wis. L. W. H.

—The magneto should be set so that in full retard position the spark occurs on upper dead center.

2—The spark does not occur until the instant that the points separate. It is the separation of the points which are in the low tension circuit that induces the current in the high-tension circuit. Therefore, no current is flowing to the high-tension circuit until after the breaker points are separated.

The reason for the spark being set at upper dead center at full retard is that a later spark than this is never required. When the engine is turning over very slowly, requiring the latest possible spark, if the setting is such that it occurs on upper dead center, the engine will not knock because before the spark could have taken place and ignited the gases the piston will have passed over the dead point and be again on its way down.

Engine May Be Loose in Frame

Editor THE AUTOMOBILE:—The distinctive clink commonly known as carbon knock developed in my motor and I had the carbon burned out. This did not seem to improve matters very much as the knock still occurs when the accelerator is depressed. Occasionally, while on the road this will cease for an hour or two and then recommence without my having touched anything. The trouble is less pronounced when the motor is very hot, as after a stiff climb. What can be the cause of this?

2—When running on first or second speed the gears make a terrible noise. At times, for no apparent reason, they can scarcely be heard. The trouble here seems to be connected with the engine trouble mentioned above as the two occur at the same time. Can you state the reason for this?

New York City. W. G.

—Your two questions seem to run together and give a clue to the nature of the trouble. It certainly would seem from what you submit that the engine is misaligned in the frame or loose. At times the alignment may be correct, thus causing the gears to act silently, whereas, at another time, the engine may become dislocated, throwing everything out of line, causing the knock you speak of as well as the growl in the gears.

It is suggested that you look into the fastenings of the engine to see if any of the bolts have loosened.

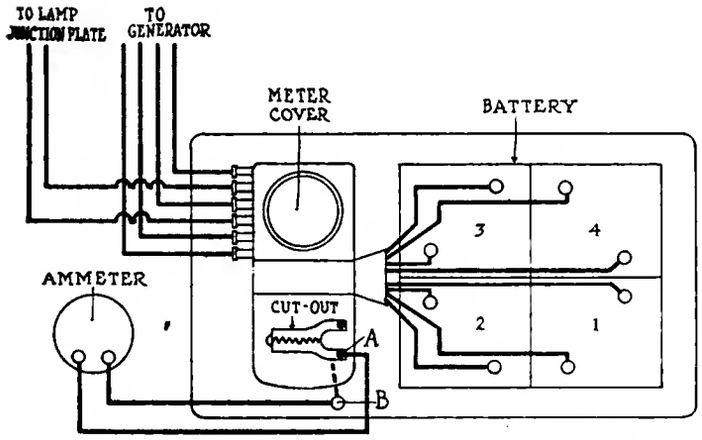


Fig. 1—Wiring diagram showing method of installing an ammeter on a Hudson model 54

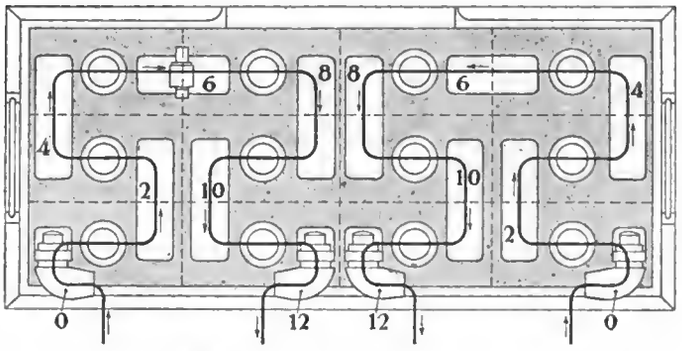


Fig. 2—Wiring diagram showing voltages and cells of battery in U. S. L. electric system used on Rambler cross-country and 1913 Oakland

Diagram Showing Voltages in U-S-L System

Editor THE AUTOMOBILE:—Kindly give wiring diagram showing voltages and cells of battery in the U-S-L electric lighting and starting system on the Rambler cross-country car and the 1913 Overland.

2—Kindly advise whether or not the electric lighting and starting companies would furnish various wiring diagrams of their wiring system by writing for them.

Trinidad, Col. W. H. O.

—While it is not quite clear what wiring diagram you desire, it is probable that you wish the diagram of the U. S. L. type EL-1207 battery which was used on these cars. This is given in Fig. 2. The cells are marked off on the battery by dotted lines, and the current is traced through the battery when discharging by the full lines with the direction of the current indicated by arrow heads. The cells are assembled in two separate groups of 12 volts each and on each length is marked the nominal voltage with relation to the negative terminals of the group in which it is contained. It is important to note, in connection with the voltage readings of the batteries, that this varies considerably, depending upon whether the battery is being charged or discharged and it will also vary with the rate of charge or discharge. The voltage as given will be obtained unless the battery is in a badly discharged condition, while the battery is undergoing a light discharge as when delivering the full lamp load. Under severe starting conditions the voltage may only be three-quarters of that given while the starting current is flowing. Should this not cover what you desire more complete diagram can be secured through the Rostrum department.

2—They probably would in most instances.

ACCESSORIES

Bo-Hart Switch Lock

A SWITCH lock capable of being fitted to a switch plate is just being put on the market. The device is shown in the accompanying illustration attached to a Delco switch faceplate. The lock is comprised of a three-tumble Yale barrel provided with a small gear transmission to interconnect the Yale barrel with the regular locking bar of the switch, and when the lock is applied the Yale barrel and the locking bar of the switch are so interrelated that it is impossible to shift one without shifting both, thus preventing the throwing of the locking bar of the switch through any other means than by the use of the Yale key. These locks are applied to the switchplate at a cost of $4 each retail.—Bo-Hart Auto & Machine Co., Lancaster, N. Y.

Bo-Hart switch lock as fitted to Delco switch faceplate

Featherweight Pistons for Fords

These pistons are of aluminum alloy and are designed to meet the demand for durable light-weight pistons for the Ford engine. Each piston weighs but 1 lb., this feature of the installation tending to reduce vibration and to decrease the wear on the engine parts. Pistons are made in four sizes: the standard, 0.0025 oversize; 0.031 and 0.033 oversize for rebored cylinders. Price, $15 per set, including pins and rings. Featherweight Piston Co., 11 Guyman Way, Pittsburgh, Pa.

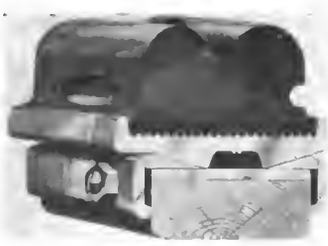
Featherweight aluminum alloy piston for Ford cars. These pistons are made in four sizes

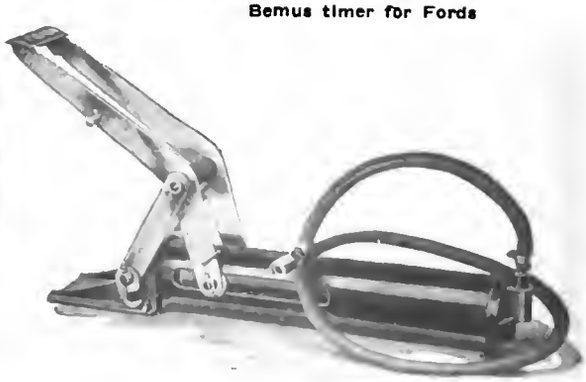
Goodyear Fire Truck Tire

The Goodyear new hand-attachable cushion fire truck tire supersedes the company's cushion demountable type largely used in commercial and fire service. This tire is designed for motor truck and fire apparatus use also, but is stated by the Goodyear company to be tougher, more resilient and able to resist road punishment better than the previous design. The tread is illustrated herewith in section and as a complete unit.—Goodyear Tire and Rubber Co., Akron, Ohio.

Twombly Foot Pump

This pump, as the name signifies, is operated by the foot and the simple leverage action employed multiplies the air pressure delivered to the tire, while at the same time minimizing the effort required on the part of the operator. The manufacturer states that a 34 by 4-in. tire can be inflated to 80-lb. pressure without causing even slight fatigue, due to the fact that no bending of the body is required, the easy action of the pump and the frequent and powerful impulses. A special attachment is provided which locks the pump connection to the tire valve so positively that leakage in pumping is eliminated and the connection is not broken by high air pressure. The pump is 17 by 3-in. over all and is easily packed in the tool box. It contains no parts which will become broken easily under hard service. Price, $4.50.—Schlesinger-Redburn Corp., 1834 Broadway, New York City.





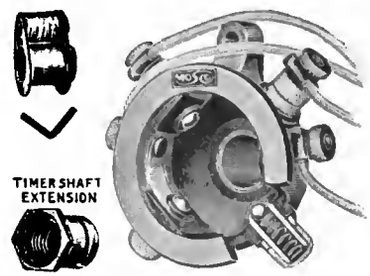
Above—The new Goodyear hand-attachable cushion tire designed for use on automobile fire trucks. Right — Twombly tire pump which is operated by the foot

Ft. Wayne Battery Charger

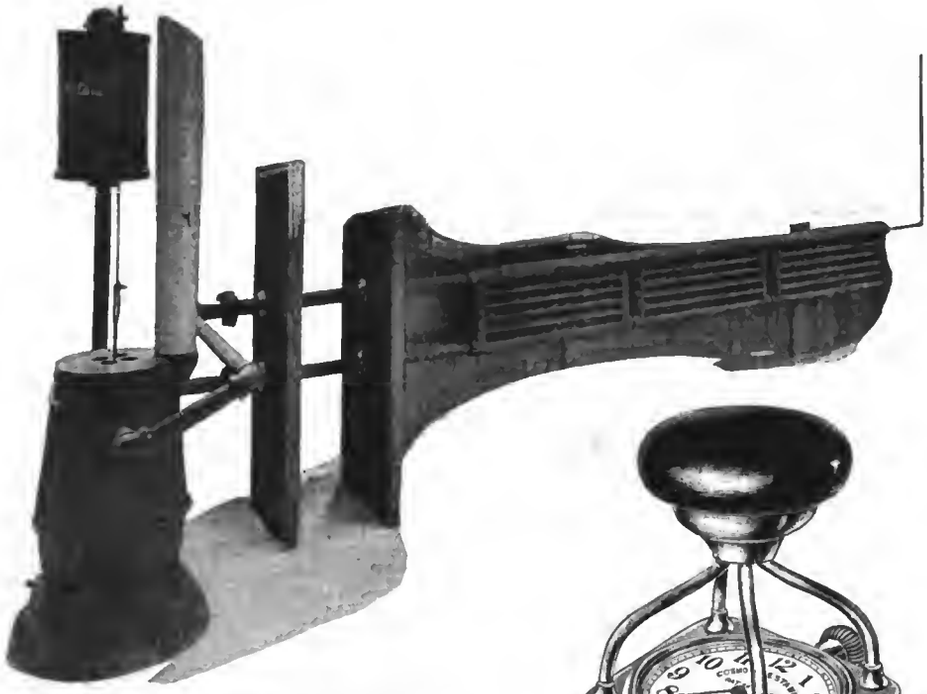
This outfit consists of a motor generator designed to deliver current at 12, 18 and 24 volts and operating from 110 or 220 volts, 60-cycle, alternating current or direct current line. The switchboard panel is mounted on the machine and carries on it the ammeter and voltmeter. Lamp boards are used for resistance. There is a snap switch on the switchboard in the line circuit for the purpose of starting and stopping, the snap switch for opening and closing the charging circuit, a voltmeter for reading the voltage delivered to the generator, an ammeter for reading the charging current, and a field rheostat for raising or lowering the voltage of the generator. The rheostat provided on the switchboard has sufficient capacity to reduce the voltage to 6. The outfits are supplied in 175 and 250 watts capacity.—Ft. Wayne Electric Wks. of the General Electric Co., Fort Wayne, Ind.

Bemus Timer for Fords

In this device contact is made by a hardened steel brush engaging steel balls, the brush and balls turning each time so that new surfaces are continually in contact. Little oil is required, as friction between the balls and the roller is mini-



Bemus timer for Fords



The Wasco private garage heating system can be supplied for one to six-car garages. The heater burns either hard or soft coal of chestnut or pea size, and is fitted with an automatic regulator

mized. The roller is long enough to permit each ball to have a path, lengthening the life of the parts. The shell is made from one piece of an insulating material designed to be strong and impervious to oil and grease. The timer sells for $2.50.—Motor Specialties Co., Waltham, Mass.

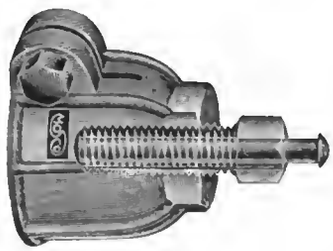
Wasco Garage Heater

The Wasco is a hot-water heating system for private garages. It is equipped with an automatic regulator that is said to give an even heat under varying climatic conditions. The complete outfit consists of a cast iron hot-water heater, one-piece radiator and hot-water cylinder and piping cut to fit. The heater burns either hard or soft coal of pea, chestnut or stove size. Heaters are built for garages housing from one to six cars, the small single radiator system being suited to the 10 by 12 ft. garage. Prices, $35 to $75, depending on the size of the garage. —W. A. Schleit Mfg. Co., Inc., Syracuse, N. Y.

Cosmo Time Stamp

Stamps the time card with the time at the beginning and end of the job, giving the elapsed time accurately. A small metal case holds the watch and carries the stamp indicating the day, hour and minute. Four different models are made, model A having a twelve-hour dial, stem winding and setting. The model AA is the same, except that it has key wind. Model B has a twenty-four hour dial, as has the model BB, the former being stem wind and the latter key wind. This

The Cosmo time stamp is convenient to use, promotes efficiency and protects both the owner and the repairshop man

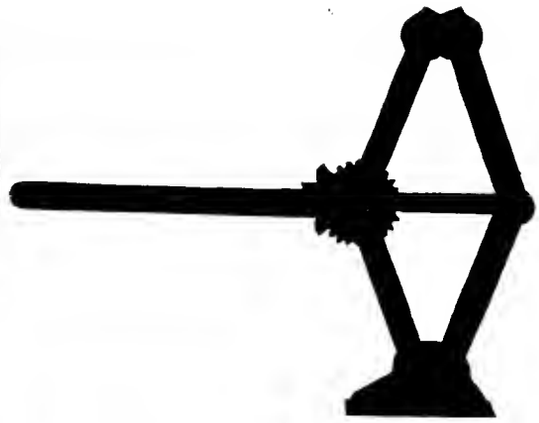


Wheel puller for Ford

time system promotes efficiency, and furnishes the repairman with evidence that cannot be disputed. Price, $7, plain dial. —A. D. Joslin Co., 221 W. Erie Street, Chicago, Ill.

Hi-Lo-Jack

By the use of the toggle joint principle this jack enables the operator to lift a heavy weight with minimum exertion. As shown in the illustration, the upper joints of the toggle are fastened to the top of the jack and the lower joints to the base. The horizontal screw connects the two other joints and applies the leverage which raises or lowers the jack. The side pressure is taken by a ball thrust which eliminates friction and makes lifting easier. When closed the jack is 5 in. high and will lift the load



Hi-Lo-Jack extended

Hi-Lo-Jack in closed pose

to 17 in., the lifting power increasing with the height. A graduated scale shows tons in inches that can be lifted with safety.—Hi-Lo-Jack Co., 140 Green Street, Worcester, Mass.

Wheel Puller for Fords

A loose plunger extending through the center of the screw enables this device to loosen a wheel which is frozen to the axle. The hub cap is removed, the puller screwed on and the set screw tightened. A sharp blow with a hammer on the end of the plunger starts the wheel. Pullers of the same type are made for Overland, Buick, Maxwell, Saxon and Chevrolet cars. The Ford model sells for $1.—Motor Specialties Co., Waltham, Mass.

Wausau Abrasives

Flint paper, emery paper, garnet paper and Wausite are made in various degrees of fineness to suit different work. A handy product is the Wausau waste-proof strip, which consists of a 50-yd. ribbon of emery cloth wound on a spool so that it may be placed conveniently above the bench.—Wausau Abrasives Co., Wausau, Wis.

Resistoil Air Hose

This compression air hose has special oil resisting qualities. The walls are made up similar to the common five-ply hose, which it resembles in outward appearance. The interior of the hose is lined with a special compound that is said to have oil resisting properties, and to resist the action of any oil or oil fumes that may be in the air. Prices, 3/16 in. inside diameter, 16 cents per ft.; ¼ in. inside diameter, 18 cents per ft.; ⅜ in. inside diameter, 27 cents per ft.—Brunner Mfg. Co., Utica, N. Y.

The Automobile

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Overdoing Accessories

THE past few years have seen the automobile accessory field extended to an enormous degree and the signs indicate that the limit of what may be called for as stock equipment has been reached. As an example, one prominent Detroit firm has been asked by some of its dealers to supply electric motors on its closed cars whose sole mission in life shall be to open and close the windows on the pressure of a button. Accessories of this sort have no useful purpose. They are merely toys and rank with the big dolls which some fashionable ladies have carried in their arms at the shore resorts this summer. The production of such things is perfectly legitimate, but no manufacturer with a legitimate claim to a place in the industry would seek business on the strength of such accessories.

Small Spark Plugs

IT has become obvious that the S. A. E. will very shortly be compelled to standardize a spark plug of smaller size than the present standard because the larger plug will not stand up in aviation engines or other engines with a very high mean effective pressure and correspondingly high internal temperatures. Makers of aviation engines are unanimously in favor of the metric size of plug and at the other end of the engine scale it is being found that the small plug operates better in tractor engines burning kerosene. On racing engines the small plug is essential and for very high duty touring car motors the small plug has a longer life than the S. A. E. standard plug.

Since engine pressures, speeds and temperatures are generally on the increase, it seems probable that the small plug will become desirable for a wider field than that provided by the aeroplane and tractor requirements, so there is little doubt that the society will have to standardize a small plug in addition to the existing standard. If this is done it is to be hoped the metric plug be chosen and not a plug of similar size with an inch thread, because the metric plug is in universal use in many other countries. Most of the cars exported to British colonies and to South America by several leading manufacturers are supplied with metric plugs.

Adding a small standard would possibly lead to the gradual abandonment of the large plug now standard, but it will be a long time before a complete change takes place, if indeed it ever does. However, so many spark plug makers are now producing metric plugs for export that there should be no difficulty in supplying a sufficiency of the small type to meet any domestic demand that may arise.

The Ford Race

WHY did 10,000 people go to see the Ford race in Chicago? There is a lesson beneath the surface in the interest taken in this event, a lesson that may possibly be applied to all racing and not only to those where a single factory is represented. What is the psychology behind the enthusiasm of these spectators? Certainly not the speed, for even though this was high, it did not approach that of the classics at which the enthusiasm of the spectators has not increased in ratio with the speed made.

There was a human interest feature present that has been lacking in some of the major events which have not been proportionately greater in attendance when the thousands of dollars spent on advertising is taken into account, and the caliber of the drivers is considered. Any man with $400 can buy a Ford. They are on the open market and not beyond the pale of possibility for the ordinary individual. Any man is naturally interested in the performance of a machine which is like one he owns or one he could own if he desired.

Here is a contest for cars that a man can buy. Even if they were made over, and tuned up, the foundation started from a car that is available to the ordinary citizen. In other words, a *stock* car, one produced by a well-known factory. This is the point which puts the interest into the race for the average motorist. If our classics to-day carried the names of our well-known factories in the entry lists, there would be a wonderful revival of interest.

Races as they stand now have not got the personal interest. Talk about Fords and you talk straight to every motorist. Talk about Peugeots and Sunbeams and you do not hit him nearly as hard.

U. S. A. Cars Most Popular in British South Africa

European-Built Cars Not Available and American Machines Win Favor By Performance on Rough Roads and Because of Low Prices

NEW YORK CITY, Sept. 8—One of the largest and best known dealers in British South Africa is at present in this country making arrangements for distributing U. S. A. accessories throughout that country, as well as traveling over the majority of the United States. This person is Wm. Campbell of Johannesburg, who is the Maxwell dealer in that city and also represents Prest-O-Lite batteries, Simms magnetoes and other U. S. A. products.

Mr. Campbell, a Scotchman by birth, has the reputation of being one of the shrewdest dealers in that country. In the last 9 months he distributed over 600 Maxwell cars, and will exceed that figure very materially this year. He sold 50 to the government for war purposes in German East Africa.

According to Mr. Campbell, the U. S. A. cars are selling in greater quantities than any other cars in British South Africa. This is partly due to the fact that European cars are not available, and also to the fact that our cars are low-priced and well suited for the rough roads of British South Africa.

Farmers Good Buyers

The majority of U. S. A. cars are sold to farmers who reckon their land in morgens instead of acres. A morgen equals 2.5 acres and many of the farmers own 10,000 or more morgens. South Africa thus resembles Argentina in that it is not a land of small farmers as in our Mississippi River valley, this being due to great areas and sparse population.

At present Ford is the biggest seller in British South Africa, with Maxwell a close second. Other large sellers are Overland, Buick, Studebaker, Hupmobile, Chevrolet, Dodge and Cadillac. Cadillac has been the largest seller of U. S. A. high-priced cars. From four to six times as many of these cars have been sold since the war as prior to it, a condition largely due to the inability to secure European cars.

Roads Are Lacking

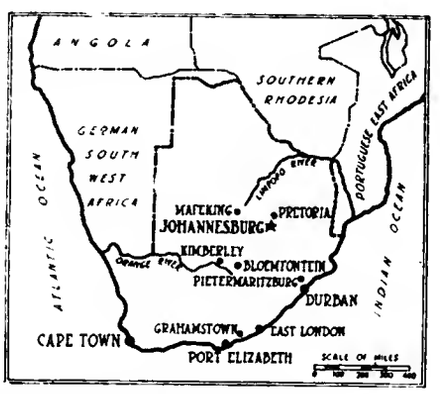
British South Africa is a country without roads. In this respect it is worse than Australia, worse than Argentina and practically as bad as Brazil. In Johannesburg, a city of 200,000 whites, there are good roads no further than 5 miles out in the country. In British South Africa the population of cities is generally estimated on the number of whites, as they represent the potential purchasing capacity of the city. In addition to these whites there are 500,000 colored people in the Greater Johannesburg area, giving a total population of 750,000.

Outside of the cities the roads are mere trails, two ruts, and often between these the ground is often 6 to 8 in. high, which demands cars of good clearance, 10 in. being best suited for the work. In many places the cars are driven directly across the veldt or plains. Recently Mr. Campbell made a trip of 1826 miles, driving from Cape Town at the south end of the continent to Johannesburg. The distance between these two towns is 1000 miles by direct route. Generally speaking there are few if any bridges, making fording essential.

Pass to the Left

According to the rules of the road in British South Africa you pass to the left, instead of to the right, as we do. This calls for cars with steering wheel on the right hand side, the same as required in South America, Australia and England.

The five-passenger touring car is the big seller. The sale in roadsters is perhaps 10 per cent that of touring cars. There is a very limited demand for coupés, but practically none for sedans or cabriolets.



British South Africa, showing the larger population centers—Johannesburg is destined to be the great automobile and supplies distributing point

Only 15,000 Cars

Mr. Campbell can place no estimate on the total number of cars in British South Africa. The figure is somewhere near 15,000. The country has a total population of 1,250,000, or a little less than Uruguay in South America.

At present there are approximately the following number of automobiles in the following cities:

Johannesburg	6,000
Cape Town	4,000
Durban	500
Bloomfontain	500
Port Elizabeth	400
East London	300
Kimberly	200

The high price of gasoline is a big factor in South Africa, where the imperial gallon retails at 88 cents in Johannesburg, and but a little lower at Cape Town and other coast cities. The imperial gallon is approximately one-sixth larger than the gallon used in the U. S. A. With gasoline at this price it is essential to have cars that will show good performances, and 30 to 35 miles per gallon is necessary. Gasoline is handled in British Africa much the same as in England, namely in crates of two 5-gal. cans each. Handling it by bulk has not yet taken hold.

Accessory Market Good

The possibilities for U. S. A. accessory manufacturers are good in British South Africa. Already many of our leading accessories are handled there. Some of them are sold through New York exporting houses, and others are handled through large distributors who deal direct with the U. S. A. manufacturers. There is a big market for pumps of all kinds, head lights, shock absorbers, searchlights, dash lights, and in general all car fitments, that is, little devices that really improve the value of the car to the owner.

Unfortunately U. S. A. accessory trade in British South Africa has suffered because our accessory makers have not been dealing direct with the big distributors in that market. As a result some lines of goods that should be in much demand there are in ill favor. This is not due to the goods themselves but

Studebaker Plans Expansion

Will Expend $1,500,000 on Factories in Detroit and South Bend

DETROIT, MICH., Sept. 8—Plant expansion to cost $1,500,000 has been announced by the Studebaker Corp., this applying to the factories here and at South Bend, Ind. When these extensive undertakings are completed the capacity of the combined factories will make it possible for the corporation to exceed a $100,000,000 annual turnover, according to A. R. Erskine, president.

Already contracts have been let for the construction of a large modern foundry and an extensive machine shop to be erected on part of the land now occupied for lumber storage at the South Bend factory. The foundry will be 1100 ft. long and 150 ft. wide, with four cupolas and 250 tons daily melting capacity, and it is to be completed by July 1 next. The machine shop is to be about 900 ft. long by 300 ft. in width, and will double present machine shop facilities at South Bend.

Detroit contracts are now being let for the construction of a one-story building with about 25,000 sq. ft. of floorspace, adjoining plant No. 3, which is located on the west side of the city. It will be devoted to final assembly work. Another floor, measuring 50 by 300 ft., is to be built on one of the three-story buildings now used as a warehouse for materials. This latter addition will enable the still greater stocking up of materials in advance of immediate needs. Other extensive additions to the Detroit plants are to be made, but details of these are not given out at this time.

Automobile Gain the Cause

It is pointed out that these plant extensions of the corporation are made necessary because of the development and growth of the Studebaker automobile business during the past 5 years. In 1911 the sales of the concern amounted to $28,487,000 and included 22,555 automobiles. In 1915 the sales had increased to $56,539,000, during which year 46,850 automobiles were sold. It is predicted by President Erskine that in the current year Studebaker sales will approximate $70,000,000, and the number of cars 75,000. During the 5 years under review, the real estate and plant investment account of the corporation has increased from $10,554,000 to $12,400,000, or nearly $2,000,000, so it appears the corporation was able to increase the production capacity of the factories without increasing the investment in proportion to the increase in business.

At South Bend alone the new buildings will mean the adding of 1000 men to the working force, and at Detroit the number will be swelled to 7000.

Few persons realize the extent of the automobile operations now carried on at the South Bend factories, the public generally regarding this part of the big corporation as being devoted to carriage, wagon and harness business entirely. Prior to 1912 the South Bend works were devoted exclusively to the manufacture of horse-drawn vehicles and harness, but in the latter part of that year the making of automobile springs and some castings was commenced. In 1914 the automobile body factory was installed, and last year some light stampings were first manufactured in South Bend. Now the plants in that city are manufacturing automobile parts for the Detroit plants of the value of over $10,000,000 per year, and the average number of employees has increased from 2701 in 1912 to 5023 at the present time, due to the use on motor vehicle work of available facilities at South Bend.

H. A. L. Plans Greater Business

CLEVELAND, OHIO, Sept. 11—Following the elevation of A. Ward Foote to the presidency of the H. A. Lozier Co., plans have been made for an increased production. The company was formed last Winter, made first deliveries of the H. A. L. in May and plans to have delivered 1000 by the end of the present year. Merchandise orders have been placed for material for 2000 cars for the 1917 calendar year. A change in the corporate name is contemplated. The company as now constituted includes:

President, A. Ward Foote, president of the Foote-Burt Co., Cleveland, machinery maker; vice-president, Charles C. Homan, former Overland purchasing agent; secretary, Frank H. Ginn, attorney; treasurer, E. G. Tillotson, of Tillotson & Walcott, bankers; the directors are the officers and the following: George E. Randles, vice-president, Foote-Burt Co.; Amons N. Baron general manager, National Carbon Co.; Morris Towson, president, Elwell-Parker Co., machinery maker, and also director in Anderson Electric Car Co. George H. Bowler is general sales manager. Jay Lee Cross has gone with the company as manager of the advertising department. Practically all of the stock is owned in Cleveland. The capitialization now is $700,000.

Harvey Adds Heat Treating Building

RACINE, WIS., Sept. 7—The Harvey Spring & Forging Co., this city, has broken ground for a new fireproof building, 100 by 200 ft., of steel construction, to be used exclusively for forming and heat treating automobile springs.

Italian Tire Plants Are Busy

Conditions Little Affected by War—American Cars Not in Demand

NEW YORK CITY, Sept. 8—The tire industry in Italy is at present in a very prosperous condition. G. A. Pirelli, son of the owner of the Pirelli Tire Co., which employs 10,000 in its various factories, is visiting this country to make purchases of machinery and other supplies for his father's plants in Bicocca, Italy; Barcelona, Spain, and Southampton, England. This company is the largest producer of tires in Italy and has been in the tire business 15 years. Over 1500 pneumatic tires and tubes are turned out daily and truck tires number about 800 daily.

As there are only two other large tire concerns in Italy, namely, Michelin and Tedeschi, the tire production is one of the most important branches of the automobile industry there, as it supplies nearly 130,000 cars and has little competition from other countries.

War Orders a Factor

The Italian tire, automobile and truck firms are busy at the present time with war orders, which constitute most of the business. Industrial conditions have been little hampered by the war and the factories have kept busy supplying the government and domestic wants. New plants are being built to take care of this large demand.

Mr. Pirelli states that there is little demand in Italy for our automobiles, especially the low-priced cars. The purchasing of cars is by the wealthy class, who want expensive bodies and high-class finish, regardless of the price. The middle and poorer classes who cannot afford cars are satisfied to ride in the street cars, or if a long trip is made, to ride in a taxicab, which may be had at a very reasonable price.

Self-starters and electric gear shifters are not in demand in Italy. This is explained by the fact that very few cars are driven by the owners and as a consequence such labor-saving equipment is not considered necessary.

Keller Tool Moves to Grand Haven

FOND DU LAC, WIS., Sept. 9—The Keller Pneumatic Tool Co., Fond du Lac, has decided to move its works and general offices to Grand Haven, Mich., and will maintain the present plant as a branch. The Chamber of Commerce of Grand Haven has provided a free site and local capital will become interested to the extent of $60,000. The first of a new group of shops will be undertaken at once. It will be 90 by 300 ft.

S.A.E. Memberships for Aero Men

Dues Cancelled if A. S. Members Join S.A.E. Within Next 90 Days

NEW YORK CITY, Sept. 12—At today's meeting of the council of the Society of Automobile Engineers it was decided to admit membership of the Aeronautical Society into the S. A. E. without payment of annual dues, providing these memberships are taken out within a period of 90 days. This action is a natural step in the development of the Society of Automotive Engineers, which will be the new name of the S. A. E. after the first of the year. The aeronautical engineers were the first to express a desire for co-operation with the S. A. E. under its new name, and already upward of thirty of their leading engineers have applied for membership. It is anticipated that other engineering societies will amalgamate in the Societiy of Automotive Engineers. Already the National Gas Engine Association has expressed interest in the possibilities of one large engineering society such as the Socety of Automotive Engineers. Overtures have been under way with the Society of Tractor Engineers and interest has been shown by the marine and motorboat engineers. It would be greatly for the benefit of all these societies for them to pursue their work under the one title of Society of Automotive Engineers.

100 Per Cent Financial Gain

The success of the S. A. E. during the present fiscal year, which will end Oct. 1, was well indicated by the treasurer's report, which approximated that the profits for the year would be close to $14,000, or nearly double the profits of the 1915 year. The total asscts at the end of the 1916 fiscal year will approximate $30,000, as compared with slightly over $8,000 at the end of the last fiscal period. During the present year the society has made several investments, one being the purchase of approximately $10,000 worth of bonds, which investment has been handled by the finance committee. The society has other investments in the form of certificates of deposit approximating $19,000. On its various investments it will earn over $1,100 interest this year.

100 New Members

It is rare that so many new members are taken into the society at any one time as was the case at to-day's meeting. A round total of 100 were admitted to membership into the different grades, as follows: Membership, fifty-three; associates, thirty-seven, and junior, eleven. In addition, there was considerable student enrollment. C. W. McKinley, engineer of the Willys-Overland Co., was elected to membership in the council to succeed past President Harry M. Leland.

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Kettering to Talk on Temperature

DETROIT, MICH., Sept. 9—Motor Temperature Control is the very interesting title of a paper to be presented at the next meeting of the Detroit Section of the Society of Automobile Engineers by C. F. Kettering, vice-president and general manager of the Dayton Engineering Laboratories Co. The meeting is scheduled for Sept. 14, and is to be held in the convention hall of the Pontchartrain Hotel. The society predicts a record-breaking attendance at this first meeting of the new season. Mr. Kettering is eminently qualified to give an authoritative paper on this subject, which is engrossing the engineering fraternity at the present time, and some valuable information will undoubtedly be forthcoming.

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Pushing Work on Dann Factory

CLEVELAND, OHIO, Sept. 11—Work on the new factory for the Dann Products Co. is progressing and E. G. Dann, general manager, states that the plant will be operating at full capacity by Oct. 1. This company manufacturers the Dann Insert and the new bearing metal Dannite.

The new building adjoins the plant of the Jordan Motor Car Co. and is 150 ft. by 300 ft., including unusual lighting facilities, and every possible convenience for the welfare of the workers. The company is moving to Cleveland from Chicago and has recently raised its capitalization from $60,000 to $600,000.

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Firestone Making 12,000 Tires a Day

AKRON, OHIO, Sept. 11 — Statements published in connection with the announcement of the contemplated stock dividend of the Firestone Tire & Rubber Co. show that the plant is now turning out 12,000 tires a day.

Last year the output increased 78 per cent and 50 per cent more dealers were added so that production has not yet kept pace with sales.

The Firestone Tire & Rubber Co. is now building one of the best equipped club houses in the country for its employees. The first and second floors will contain a restaurant, while the basement will have a swimming pool, shower baths and bowling alleys. The third floor will be taken up with an auditorium and club rooms.

This company has also purchased several hundred acres of land and contemplates the establishment of a Firestone Bank to help its employees to finance their own home building.

Independents Meet S. O. Reduction

Texas Co. and Others Cut Prices 1 Cent in East and West

CHICAGO, ILL., Sept. 9—The Texas Co. and other independent oil concerns met the Standard Oil Co. of Indiana's 1-cent reduction in gasoline throughout the West by making Chicago tank wagon basis 16½ cents a gal.

The Standard Oil Co. in Kansas City, Mo., has reduced gasoline 1 cent a gal., to 15.8 cents tank wagon basis, and independents have cut prices 1 cent, to 16.8 cents tank wagon basis to meet the new market conditions.

The price of gasoline was cut another cent in Detroit, Sept. 7, by the Standard Oil Co., being obtainable at any of the Standard's forty filling stations in the city at 17 cents a gal. So far the independents have not met the reduction, some demanding 18 cents and others getting as high as 19 and 20 cents, the latter price being asked by individual garages in some instances.

The Texas Co. has met the 1-cent reduction of the Standard Oil Co. in the East, covering New York State, Connecticut and New Jersey. Texas gasoline in New York and Connecticut is quoting at 22 cents tank wagon basis and in New Jersey at 20 cents. The Standard Oil Co. brought its price down to 22 cents on Sept. 7.

Lower in West

Gasoline prices have been reduced 1 cent a gal., tank wagon basis, in Colorado, Montana, Wyoming and New Mexico. Current prices are: Colorado, 21 cents minimum to 25 cents maximum; Montana, 23 cents minimum to 24½ cents maximum; New Mexico, 20 cents minimum to 24½ cents maximum; and Wyoming, 1912 minimum to 23½ maximum.

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Irwin Leaves Adams Truck to Join Allen M. C. Co.

FINDLAY, OHIO, Sept. 7—Murray Irwin has resigned his position as general manager of the Adams Foundry, Machine & Truck Co., and joined the Allen Motor Car Co., Fostoria. George Carter of Jackson, Mich., has been placed at the head of the Adams plant.

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Standard Traffic Code Distributed

NEW YORK CITY, Sept. 12—The Standard Code of Traffic Regulations which has been drawn up tentatively by the Street Traffic Committee of the Safety First Federation of America has been

submitted to municipalities for adoption. The code represents the work of a year and a half on the part of the committee with consultations and assistance from traffic experts throughout the United States and Canada. It is comprehensive, covering all the possibilities of traffic regulation down to its most minute detail. The headlight glare regulation is one that has been approved by the Society of Automobile Engineers and provides for an illumination up to 150 ft. in front of the car wherever the highway is not sufficiently lit by street lamps and also that no portion of the beam of reflected light when measured 75 ft. or more ahead of the lamp shall rise above 42 in. from the level surface on which the vehicle stands. The S. A. E. standard license plate is also indorsed as well as a standard gearshifting gate.

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Lansing Foundry Elects Officers

LANSING, MICH., Sept. 6—At the annual meeting of the directors and officials of the Lansing Foundry Co., the following officers and directors were re-elected: J. H. Moore, president; Ray Potter, vice-president; Mark C. Knight, treasurer, and S. P. Spaulding, secretary. These officers and W. H. Newbrough, E. W. Goodnow and E. W. Harper make up the board of directors.

The foundry is being operated to its full capacity and has so many orders on its books that it has refused to take on more business. It is likely that the plant will be enlarged within the next year.

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Marathon Tire Convention Starts

CUYAHOGA FALLS, OHIO, Sept. 8—The Marathon Tire & Rubber Co., this city, will hold its annual sales convention at its factory during the week commencing Sept. 11, under the direction of H. H. Replogle, sales manager.

6501 Vehicles Exported in July

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5258 Passenger Cars and 1243 Trucks and Parts Worth $1,630,111

WASHINGTON, D. C., Sept. 9—While there has been a decided drop in the demand for commercial cars, due to the curtailing of orders from the warring nations in Europe, exports of passenger cars show a big increase during July and the 7 months ended July as compared with the same periods of last year. Statistics of automobile shipments during those periods have just been made public by the Department of Commerce, and show that during July last 1243 commercial cars, valued at $3,062,670, and 5258 passenger cars, valued at $3,663,563, were exported, together with parts, not including engines and tires, to the value of $1,630,111. During the 7 months' period of this year the exports were divided as follows: Commercial cars, 11,373, valued at $30,725,682; passenger cars, 38,407, valued at $25,897,743; parts, not including engines and tires, $13,175,266.

During July a year ago the exports were 2469 commercial cars, valued at $6,803,001, and 4118 passenger cars, valued at $3,835,347. The value of the exports of parts, not including engines and tires, was $1,663,997. For the 7 months of last year the exports were 13,428 commercial cars, valued at $37,499,768, and 22,897 passenger cars, valued at $20,454,354, while the value of the parts exported, exclusive of engines and tires, was $7,343,119.

France Leads in July

France held first place in the value of the imports of American cars during July last, 538 cars, valued at $1,354,968, being shipped there during that month, while during the same month of last year the number was 615 and the value $1,260,693. During the 7 months' period these exports increased from 4268 cars, valued at $10,547,826, in 1915 to 5655 cars, valued at $13,857,692, in 1916.

Three hundred and thirty-four cars, valued at $605,799, were shipped to the United Kingdom during July last, while during the 7 months of this year the number exported was 6281 and the value $9,857,900. In July a year ago the number of cars exported was 2619 and the value $3,836,296, while during the 7 months of that year the number was 14,494 and the value $21,998,112.

Russia came to the front in July last with orders for 298 cars, valued at $790,443, while during the 7 months' period the number exported there was 1393, valued at $3,991,594. Russia did not figure in the export returns in 1915.

Denmark's importation of American cars in July last numbered eighty-six cars, valued at $64,605, while during the 7 months' period the number was 596 and the value $434,239. That country was not listed separately in the export returns for 1915.

Canada Makes Big Gain

Our exports of cars to Canada show a decided increase. During July last 690 machines, valued at $605,897, were exported there, as against 643 cars, valued at $428,348, shipped in July a year ago, while during the 7 months' period the exports rose from 3961 cars, valued at $3,192,526, in 1915 to 8616 cars, valued at $6,027,295, in 1916.

South American countries are taking kindly to American-built cars. In July a year ago there were 315 cars, valued at $157,964, exported to all the South

(*Continued on page* 461)

Exports of Automobiles, Trucks and Parts for July and 7 Previous Months

	July				7 Months Ending July			
	1915		1916		1915		1916	
	Number	Value	Number	Value	Number	Value	Number	Value
Passenger cars	4,118	$3,835,347	5,258	$3,663,563	22,897	$20,454,354	38,407	$25,897,743
Commercial cars	2,469	6,803,001	1,243	3,062,670	13,428	37,499,768	11,373	30,725,682
Parts, not including engines and tires	.....	1,663,997	.....	1,630,111	.....	7,343,119	.....	13,175,266
	7,587	$12,302,345	6,501	$8,356,344	36,325	$65,297,241	49,780	$69,798,691
By Countries								
Denmark	.....	.....	86	$64,605	.....	.....	596	$434,239
France	615	$1,260,693	538	1,354,968	4,268	10,547,826	5,655	13,857,692
Germany	.....	.....	.....	.....	4	2,800	.....	.....
Italy	16	6,340	4	4,307	108	63,295	226	132,789
Russia	.....	.....	298	790,443	.....	.....	1,393	3,991,594
United Kingdom	2,619	3,836,296	334	605,799	14,494	21,998,112	6,281	9,857,900
Other Europe	1,144	4 033 680	221	279,043	4,822	13,089,008	2,351	3,107,909
Canada	643	428,348	690	605,897	3,961	3,192,526	8,616	6,027,295
Mexico	19	22,001	31	24,683	61	56,306	335	308,221
West Indies and Bermuda	377	197,292	628	407,315	1,704	916,448	3,380	2,124,870
South America	315	157,964	.....	.....	1,212	643,718	.....	.....
Argentina	.....	.....	888	419,512	.....	.....	3,653	1,777 155
Brazil	.....	.....	54	43,116	.....	.....	251	169,732
Chile	.....	.....	125	81,815	.....	.....	551	361,433
Venezuela	.....	.....	84	59,872	.....	.....	361	221,334
Other South America	.....	.....	146	85,494	.....	.....	567	335,376
British East Indies	.....	.....	419	342,226	.....	.....	2,265	1,706,594
British Oceania	382	335,698	.....	.....	2,369	2,046,047	.....	.....
Asia and other Oceania	252	189,227	515	501,349	2,178	4,309,410	4,835	5,987,054
Other Countries	205	170,809	176	175,472	1,144	1,088,626	2,651	1,801,499
Australia	.....	.....	1,264	880,317	.....	.....	5,813	4,420,739
	6,587	$10,638,348	6,501	6,726,233	36,325	57,954,122	49,780	56,623,425

G. M. C. Feature Securities

Reaches New High Record, Setting Mark for New York Stock Exchange

NEW YORK CITY, Sept. 13—General Motors common sold yesterday at $642 a share. This is not only a new mark for the stock itself, but actually sets a high record for the New York Stock Exchange. In the panic of 1901 Northern Pacific sold at $1,000, but that was a quotation forced by a corner.

During the last week securities quotations were slightly off. Firestone Tire & Rubber common which had increased 25 points the week previous fell off this week 30 points. Other tire stocks, however, were stronger, Goodyear increasing by 7 and Kelly-Springfield by 2⅝. In the main all the motor stocks were quite strong. Packard was up 5 and Paige-Detroit up 7.

Dunlap Leaves Hupp

DETROIT, MICH., Sept. 8—C. H. Dunlap, export manager of the Hupp Motor Car Corp., has resigned to become interested in another enterprise. He has headed the Hupp export business for several years, and is familiar with nearly all of the world's shipping points.

Truck Makers Draw Together

NEW YORK CITY, Sept. 11—The Cook Attachment Patents, Inc., has been formed here with $10,000 capital to bring into closer relationship manufacturers of attachments for converting passenger cars into commercial vehicles. Albert E. Cook, whose patent No. 1,180,475 on such devices now is in process of litigation in Chicago, heads the company, the other officers elected so far being, president and treasurer, Mark W. Norman, a New York lawyer, and secretary, B. H. Barber. The organization will issue manufacturing licenses under the Cook patents, the Redden Motor Truck Co. at present being the sole licensee.

Paige May Increase Capital by $1,500,000

DETROIT, Sept. 11—The Paige-Detroit Motor Car Co. will hold a special stockholders' meeting on Sept. 19, at which action will be taken upon a recommendation of the directors that the capitalization of the company be increased from $2,000,000 to $3,500,000, through the issuance of $1,500,000 in preferred stock. On Sept. 2, the Paige company increased the capitalization by the declaration of a 50 per cent stock dividend to holders of record Sept. 9, and the recommended issuance of preferred stock is another step in the company's financing.

S. S. E. Co. to Build

PHILADELPHIA, PA., Sept. 8—The S. S. E. Co., Philadelphia, has awarded the contract for the first of a series of buildings to be erected in this city. The plant is one story of brick and concrete and measurers 360 by 90 ft. The company will make a $5,000 chassis.

Atlas Forge Declares 100% Dividend

Second Melon Within 10 Days Due to Business Being Twice as Good as in 1915

LANSING, MICH., Sept. 6—For the second time within less than 10 days the Atlas Drop Forge Co. has declared a dividend. The first one was a cash dividend of 20 per cent, while the second one, declared this week, is a 100 per cent stock dividend. The business of the company is said to be more than 100 per cent better now than it was 1 year ago. Two shifts are working at the plant.

Armstrong Tire Plant to Operate

NEWARK, N. J., Sept. 7—The Armstrong Rubber Co., this city, is equipping its factory in this city for the manufacture of the Armstrong red inner tubes equipped with the Kahn valve.

Dividends Declared

Directors of the Chandler Motor Car Co. last week declared the regular quarterly dividend of 2 per cent and an extra 1 per cent. This compares with an extra three months ago of ½ of 1 per cent.

Electric Storage Battery Co., quarterly of 1 per cent on preferred and common, payable Oct. 2, to holders of record Sept. 18.

Allis-Chalmers Mfg. Co., quarterly of 1½ per cent on preferred, payable Oct. 16, to holders of record Sept. 30.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co. (new)	..	..	62½	64	—1½
J. I. Case pfd	..	..	83½	84½	+3½
Chalmers Motor Co. com	105	..	145	160	—5
Chalmers Motor Co. pfd	95	100	95	98	..
*Chandler Motor Car Co	..	..	108	109	+5½
Chevrolet Motor Co	..	..	190	193	+2
Fisk Rubber Co. com	..	..	99	106	—11
Fisk Rubber Co. 1st pfd	..	..	107	116	..
Fisk Rubber Co. 2d pfd	..	..	100	110	..
Firestone Tire & Rubber Co. com	530	535	990	1025	—30
Firestone Tire & Rubber Co. pfd	111	..	110	112	—2
*General Motors Co. com	255	256	560	599⅞	+10
*General Motors Co. pfd	113	115	125½	126½	+ ½
*B. F. Goodrich com	61	63	72	72¼	+ ½
*B. F. Goodrich pfd	106	108	113⅛	113⅞	..
Goodyear Tire & Rubber com	284	288	247	252	+7
Goodyear Tire & Rubber pfd	108½	109½	107¼	108	+ ¼
Grant Motor Car Co	..	..	7	8	..
Hupp Motor com	..	..	6	6½	..
Hupp Motor pfd	..	..	80	100	..
International Motor Co. com	27	30	6	10	..
International Motor Co. pfd	56	58	15	20	..
*Kelly-Springfield Tire & Rub. com	204	206½	83¼	83⅛	+2⅛
*Kelly-Springfield Tire & Rub. 1st pfd.	89	91	99	100	+4
*Lee Rubber & Tire Corp	..	..	47½	48	+1¼
*Maxwell Motor Co. com	42	43	81⅝	..	—1⅜
*Maxwell Motor Co. 1st pfd	86	87	83¼	83¾	—1¼
*Maxwell Motor Co. 2d pfd	36	37	52½	54	—2
Miller Rubber Co. com	190	194	223	237	+3
Miller Rubber Co. pfd	107½	..	104	106	—1
Packard Motor Car Co. com	120	130	165	175	+5
Packard Motor Car Co. pfd	100	..	..	100	..
Paige-Detroit Motor Car (old)	..	450	53	56	+7
Peerless Truck & Motor Corp	..	..	23½	24½	+ ½
Perlman Rim Corp	..	..	..	..	..
Portage Rubber Co. com	46	48	152	156	+2
Portage Rubber Co. pfd	93	94	150	155	..
Regal Motor Co. pfd	..	21	20	25	+3
Reo Motor Truck Co	17	17¾	44	45	+7¾
Reo Motor Car Co	32	33½	44	45	+3¼
Saxon Motor Car Co	..	..	72	75	+1½
Standard Motor Co	..	..	6	7	— ½
Stewart-Warner Speed. com	65	66	114	115	+3
Stewart-Warner Speed. pfd	105	107	..	..	..
*Studebaker Corp. com	114	116	123⅞	124½	+ ⅛
*Studebaker Corp. pfd	105	106	109	110	+1½
Swinehart Tire & Rubber Co	88	90	92	95	—3
United Motor Corp	..	..	61⅜	61⅞	—15⅝
*U. S. Rubber Co. com	48¾	50	58	58¼	+1
*U. S. Rubber Co. pfd	103⅜	105	111¼	112	+1¼
White Motor Co. (new)	110	..	53	54	+1½
*Willys-Overland Co. com	187	189	47⅞	48	+5⅜
*Willys-Overland Co. pfd	107½	108	103¼	105	..

*At close Sept. 11, 1916. Listed New York Stock Exchange.
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
ACTIVE STOCKS					
Auto Body Co	..	..	36¾	..	..
Chalmers Motor Co. com	103	..	..	151	..
Chalmers Motor Co. pfd	95	97	..	103	..
Continental Motor Co. com	..	300	35	35¾	..
Continental Motor Co. pfd	84	..	9½	10½	..
Ford Motor Co. of Canada	..	1525	305	330	..
General Motors Co. com	259	263	545	585	+40
General Motors Co. pfd	114	116	126	129	+1
Maxwell Motor Co. com	42	44	83½	86½	+1
Maxwell Motor Co. 1st pfd	86	89	84½	87½	+ ½
Maxwell Motor Co. 2d pfd	36	39	55	58	+1
Packard Motor Car Co. com	120	130	165	171	..
Packard Motor Car Co. pfd	100	101	..	102	..
Paige-Detroit Motor Car Co	..	450	49	52	—3½
W. K. Prudden Co	20½	22	44	45½	+1½
Reo Motor Car Co	33	33¾	44½	45½	+2¾
Reo Motor Truck Co	16¾	17½	44⅝	45½	+8⅜
Studebaker Corp. com	114	116	122	125	..
Studebaker Corp. pfd	104	107	105	..	..
C. M. Hall Lamp Co	..	..	25	30	..
INACTIVE STOCKS					
Atlas Drop Forge Co	29	31	35	..	+5
Kelsey Wheel Co	205	..	55	60	..
Regal Motor Car Co. pfd	..	21	18	..	+1

Fosters Trade with Argentina

American Commercial Club of Buenos Aires To Give Information

BUENOS AIRES, Aug. 6.—Automobile concerns doing business in Argentina can be greatly assisted by the American Commercial Club, an organization of U.S.A. business men in this city. This commercial club has as its object the improving of trade relations with the United States of America. Recently this club has associated itself with the United States Chamber of Commerce, Washington, D. C., and has established itself as a clearing house for information of U.S.A. manufactures of all kinds.

In addition to being prepared to give any U.S.A. manufacturers information regarding any conditions in Argentina, the American Commercial Club is playing the rôle of an arbitration board for the purpose of adjusting complaints made by Argentine merchants against firms in the United States. These complaints are often due to delayed shipments, goods not corresponding with samples, etc. In a word, this club is endeavoring to facilitate and improve the commerce between the two countries, all of which is highly necessary if U.S.A. is to secure that control of the Argentine trade which it should.

In carrying on this work the American Commercial Club is put to considerable expense, the cost being approximately $10,000 a year. The business merchants here, who are members of the club, are willing to give their time and some of their money for the purpose of carrying on this work, but cannot meet the entire financial responsibility. U.S.A. automobile manufacturers who are now intensely interested in Argentine can assist by subscriptions of $25 or more per year. It is possible to obtain memberships in the chamber for a nominal sum, and thus get advantage of all information collected by it. The officers of the club are all U.S.A. people, and hold responsible positions in the city. They all hold power of attorney for their respective companies and represent the best business blood of the U.S.A. in Argentina.

The officers and directors are: President, J. L. Wheatley; vice-president, Louis C. Young; secretary, Alfred Eichler; treasurer, A. T. Brooks; and governors H. E. Finney, W. J. Pilant, and S. D. Allchin. Mr. Finney is manager of the Armour meat packing industry, which has the most modern slaughter-house in the world; and Mr. Pilant is manager of the International Harvester interests for Argentina, Chile, Brazil, Uruguay and other parts of South America.

The club is located in the Plaza Hotel, Buenos Aires.

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Vail Tractor Uses Gasoline or Kerosene

HAMILTON, OHIO, Sept. 8 — The Vail-Rentschler Tractor Co., Hamilton, now being organized with an authorized capital of $100,000 to build and market the medium weight Vail tractor, which will operate with either gasoline or kerosene. The incorporators and stockhoders are: G. A. Rentschler, chairman, of the Hooven, Ownes, Rentschler Co.; Col. C. B. Wing of Cincinnati; J. A. Vail, formerly chairman of the board of directors of the Maxwell Motor Co.; G. S. Rentschler, vice-president of the Hamilton Foundry and Machine Co., and C. Vail of Chicago.

A plant is now being equipped opposite the Butler County Fair Grounds in Hamilton.

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Materials Market Steady

NEW YORK CITY, Sept. 13—No important changes were recorded in the materials market during the past week. Aluminum held its 60 cents a pound level, due to the great demand among automobile manufacturers. Fine up-river Para rubber advanced 2½ cents per pound. Tin, which has been falling off in price for the last 2 weeks, has dropped another 75 cents per 100 lb., being down to $38 even at the market close on Monday. The copper prices, which have been 28 cents for some time, are steady.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.60	.60	.60	.60	.60	.60	...
Antimony, lb.	.12¼	.12¼	.11½	.11½	.11½	.11½	— ¾
Beams & Cbannels, 100 lb.	2.76	2.76	2.76	2.76	2.76	2.76	— .01
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb	.28	.28	.28	.28	.28	.28	...
Copper, Lake, lb	.28	.28	.28	.28	.28	.28	...
Cottonseed Oil, bbl	10.00	10.13	9.90	9.85	9.76	9.70	...
Fish Oil, Menhaden, Brown, gal	.58	.58	.58	.58	.58	.58	...
Gasoline, Auto, bbl	.22	.22	.22	.22	.22	.22	— .01
Lard Oil, prime, gal	1.00	1.00	1.00	1.00	1.00	1.00	...
Lead, 100 lb	6.70	6.70	6.70	6.70	6.70	6.70	...
Linseed Oil, gal	.72	.70	.70	.70	.70	.69	— .03
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.30	2.30	2.30	2.30	2.30	2.30	...
Rapeseed Oil, refined, gal	.90	.90	.90	.90	.90	.90	...
Rubber, Fine Up-River Para, lb	.69½	.73	.72	.72	.72	.72	+ .02½
Rubber, Ceylon, First Latex, lb	56½	.57	.57	.57	.57	.57	+ ½
Sulphuric Acid, 60 Baume, gal	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb	39.00	39.00	38.87½	38.75	38.75	38.00	— .75
Tire Scrap, lb	.05⅜	.05⅜	.05⅜	.05⅜	.05⅜	.05⅜	...

Hupp Car Averages 18.96 M. P. G.

301 Miles, Albany to Buffalo, in Test—1204 M. P. G. of Oil Used

COLUMBUS, OHIO, Sept. 12—The Hupmobile car, which is making a capital-to-capital tour throughout the United States, arrived in Columbus, its twelfth State capital, this evening from Cleveland. After pausing at the capitol building and visiting the local dealers, the party left for Xenia on the way to Frankfort, Ky. The car is going by way of Cincinnati, and after leaving Frankfort will go to Indianapolis.

On the way from Albany to Buffalo an economy test under the sanction of the American Automobile Assn. was made, and on the 301 miles the average fuel consumption was 18.96 miles per gallon. The average mileage per gallon of oil was 1204, and per gallon of water 602. The only work done on the car between Albany and Buffalo was to clean the dirt from the bottom of the spray nozzle. The A. A. A. has guaranteed the stock status of the car which corresponds to catalog dimensions in all respects. In equipment a spotlight is carried and Goodyear all-weather tread tires are used on the front wheels as well as the rear. The amount of gasoline used on the trip was 15 gal. and 7 pt.; oil, 1 qt., and water, 2 qt. An overnight stop was made at Syracuse, which is about midway between Albany and Buffalo. The roads are in excellent condition and the country of a rolling nature.

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Gaso-Kerosene Tractor Embodies Many Features

LODI, WIS., Sept. 9—The first models of a new gaso-kerosene tractor manufactured by E. J. McFarland and J. C. Westmont, Lodi, Wis., are now being exhibited at state and county fairs and given demonstrations on northwestern farms. The tractor is an assembled machine, the units being purchased from specialists. The use of a Bennett carbureter makes it possible to use gasoline, kerosene, distillate or motor spirits as fuel. The tractor pulls three 14-in. plows and has belt power for 18-in. silage cutters and 28-in. threshers. A 50-hp. motor also is furnished. The engine is a Waukesha, with Eisemann magneto and Perfex radiator. The builders also use Clark universals, Foote gears, and Hyatt bearings. The axles, frame, wheels and drawbar are provided by the Electric Wheel Co., Quincy, Ill., and the clutch is a Borge & Beck dry disk. The universals are unique, being of the steamship type and new to tractor design.

Astor Cup Will Be 250 Miles

Sept. 30 Event Carries $25,000 in Prizes—To Start at 2.30 P. M.

NEW YORK CITY, Sept. 8—The Astor Cup Race will be held on the 2-mile Sheepshead Bay Speedway here on Saturday, Sept. 30. The race will be for 250 miles instead of 350 as used last year. The shorter distance has been selected to increase the popularity of the event. With 250 miles it will be possible to start the race at 2:30 p. m., thus giving all Saturday afternoon holidayers an opportunity of witnessing the start and the entire race.

The prizes total $25,000, or at the rate of $100 per mile. This is divided as follows:

First prize...	$10,000	Sixth prize....	$1,200
Second prize.	5,000	Seventh prize..	1,000
Third prize...	2,500	Eighth prize...	900
Fourth prize.	1,600	Ninth prize....	800
Fifth prize...	1,300	Tenth prize....	700

For some time there has been some question as to whether this race would be held or not because of certain internal troubles with the track organization. These were all clarified at a meeting yesterday when complete arrangements for the race were perfected.

No list of entries has as yet been compiled, but promises are on hand for fourteen entrants and it is expected that the usual elimination trials will be held previous to the race so as to reduce the field to meet the speedway requirements.

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U. S. A. Cars Popular in South Africa

(*Continued from page* 455)

to the houses handling them. There are some houses that have rather unsavory reputations in that country and it is certain the sale of products is going to suffer because of such. In South Africa, the same as in Australia and South America, the motor car trade is sufficiently large to warrant our manufacturers dealing direct with the large houses in that country.

Light Car Opportunities

There is a good chance in British South Africa, according to Mr. Campbell, for a U. S. A. light-type car, built on the lines of the English Singer. It should be a two-seater that would sell for $1000 and show 35 miles per gallon of gasoline. Such a car would have to have good lines and be well built.

Owing to the high price of gasoline there is a good demand for electric passenger and commercial vehicles. With gasoline at 88 cents per gallon and electricity at 2 cents per kilowatt, there is good opportunity, particularly in Johannesburg for selling electrics.

At present the commercial vehicle business in Johannesburg is largely confined to fitting delivery bodies on such chassis as Overland, Studebaker, Maxwell, Ford, etc. Much of this has been done in the past year and the market is increasing.

Johannesburg is destined to be the great motor car distributing center for British South Africa. It has by far the largest population and is surrounded by a productive country. The city is located on a plateau 6000 ft. high, 1000 ft. higher than Denver, Col., and has a climate practically the same as Los Angeles. Some of the staples in the surrounding country are corn, cotton, tobacco, oats, other cereals, and fruits.

At present business conditions are very satisfactory. Immediately after the opening of the war there was a shrinkage of general business for a few months, but since then prices have been so good that the country is more prosperous than in times of peace.

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6501 Cars and Trucks Exported in July

(*Continued from page* 458)

American countries, while during the 7 months' period of that year the number was 1212 and the value $643,718. This year these exports have increased in value to such an extent that the leading countries of South America have been listed separately in the export returns. Argentina's importations of cars in July last amounted to 888 cars, valued at $419,512, while during the 7 months of this year the number was 3653 and the value $1,777,155. The cars shipped to Chile in July last numbered 125 machines, valued at $81,815, while during the 7 months' period the number was 551 and the value $361,433. Brazil's importations numbered fifty-four cars, valued at $43,116, in July and 251 cars, valued at $169,732, during the 7 months' period. The shipments to Venezuela in July amounted to eighty-four cars, valued at $59,872, and during the 7 months to 361 cars, valued at $221,334. Shipments to other South American countries amounted to 146 cars, valued at $85,494, in July and to 567 cars, valued at $335,376, during the 7 months of this year.

Substantial gains are also noted in the export returns to British East Indies, Australia, Asia and other Oceania.

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Pettit Resigns from Case

RACINE, WIS., Sept. 8—B. M. Pettit, for 3 years advertising manager of the J. I. Case T. M. Co., Racine, Wis., has resigned to accept an executive position with the Curtis Publishing Co., at Philadelphia.

11 Owen-Magnetics on 5-Day Tour

R. M. Owen Host to Over 50 on Trip Through New England Hills

NEW YORK CITY, Sept. 13—Inviting over fifty men to go as his guests on a 5-day tour through the best touring sections of New England, R. M. Owen of this city added a second chapter to his original move started a year ago. These fifty men were carried in eleven Owen-Magnetic cars furnished by Mr. Owen, who took control of the Entz patents 5 years ago and since has been developing and perfecting the Entz system as used in the Owen-Magnetic cars. Mr. Owen paid all the expenses of all his guests.

A year ago Mr. Owen conceived the idea of an invitation tour, inviting those people he wished to demonstrate his car to go along and see the electric-magnetic transmission system operate on the roads, on the hills and under all touring conditions. He went further and gave many of his guests opportunities to drive the cars on the trip. Last year three small trips were staged and they proved so successful that a 5-day tour with eleven cars was successfully carried out this year. The tour ended in this city today and was most successful.

Among the fifty invited guests were several Owen-Magnetic private owners who drove their own cars, several Owen-Magnetic dealers from New York, Philadelphia, Boston and other cities who drove their cars and brought friends along, and also many of the officials of the Baker R. & L. Co., Cleveland, which is manufacturing two models of the Owen-Magnetic cars. The party included Chas. L. F. Wieber, president of the Baker R. & L. organization; J. B. Entz, Sr., inventor of the Owen system; Stephen Bourne of Philadelphia, who is manufacturing a truck using the Owen system, etc. The class and daily press was well represented.

180 Miles a Day

Approximately 180 miles per day were covered on the tour, the itinerary including New York City, through the Berkshires by way of Pittsfield and Greenfield, and thence to the White Mountains by way of Franconia, thence back to Boston and to New York via Springfield and Hartford.

The tour offered two exceptional hill-climbing tests, one over the famous Mohawk trail near North Adams, Mass., over a road built 2 years ago, and one that is looked upon as one of the best climbs in New England. There is 7 miles of climbing with a sharp S turn in the steepest part. The road in many places

is cut into the solid rock in the mountain side.

The other hill-climb was up what is known as 3-mile climb near the Profile House in Franconia, the heart of the White Mountains. This climb is steeper than that over the Mohawk trail, and is over a rather poor road through the wooded mountain. The road rises in a series of very rapid climbs, with several water breaks.

A Severe Test

The hill-climbing ability of the electric transmission received its severest test. The cars demonstrated that the electric-magnetic system possesses superior qualities for this kind of work. The fact that the power is applied continuously when changing from one electric position to another and that there is not a moment when the power of the motor is cut off from the rear wheels proved a real factor in hill-climbing. This continuous power is quite apparent in such severe hill-climbing work. Not only is there the advantage of the continuous power, but the absence of any mental problem in connection with gear shifting. That problem is quite eliminated, for it is as easy to shift from one electrical position to another as to move the throttle lever on the steering wheel.

Mr. Owen has provided in his cars for such severe hill-climbing work a lower gear ratio, which was used by practically all of the drivers. On this lower ratio it was possible to make the ascents with good motor speed and have the electric-magnetic transmission system in what would correspond to a high-speed position in a sliding gearset. The cars always had several reserve electrical positions for the work.

Electric Brake's Value

The mountain work of the trip demonstrated the value of the electric brake which, when applied, immediately slows the car to 15 miles per hour. This brake is applied by the small lever on the steering wheel by which you start the motor, give the different electrical connections for the gearset and apply the electrical brake, all three on a lever but little longer than the throttle lever generally used. The electrical brake is not only easy to operate, but conserves the two sets of rear wheel friction brakes very materially. There was not a single instance of any trouble with the electric-magnetic systems of the cars on the entire trip.

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Slaker Stover Sales Mgr.

JANESVILLE, WIS., Sept. 9—C. S. Slaker, head of the sales department of the Janesville Machine Co., Janesville, Wis., has resigned to become general sales manager of the Stover Engine & Mfg. Co., Freeport, Ill., which is the recent consolidation of the Stover Engine Works and Stover Mfg. Co.

Trucks Transport 2000 Troops

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Carry Men and Equipment 200 Miles in 32 Hours—Use 132 Motor Trucks

SAN ANTONIO, TEXAS, Sept. 8—One of the most notable tests of army motor trucks was finished this morning when two thousand men and officers and equipment of the First and Second Kansas Infantry regiments arrived at Fort Sam Houston from Eagle Pass. The distance of approximately two hundred miles by the route traveled was covered in thirty-two hours actual running time. The transportation train consisted of 132 motor trucks. It is stated that this movement establishes a new record for rapid overland transportation of troops. Two all-night camps were made on the trip—one at La Pryor and the other at Castroville. The finish to Fort Sam Houston could easily have been made last evening, but it was decided to spend the night at Castroville, about thirty miles out, and bring the troops into camp fresh this morning.

Major General G. Frederick Funston met the troops at Castroville last evening. He expressed himself as delighted with the success of the truck movement.

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Maxwell Earnings Gain 135 Per Cent

(*Continued from page* 425)

well Motor Co., Inc., during the past fiscal year shows an increase of 88 per cent over the sales of previous year. The manufacturing facilities of the factories at Dayton, Ohio, Newcastle, Ind., and Detroit, Mich., have been increased so that the company is now in position to produce more than 100,000 cars per annum.

Sales in August, 1916, the first month of the present fiscal year, show a substantial increase over the same period last year.

Consolidated General Balance Sheet of the Maxwell Motor Co. Inc.

ASSETS

CAPITAL ASSETS:			
Real Estate, Buildings, Machinery and Equipment, at July 31, 1915	$5,192,625.86		
Additions during the year (Net)	553,909.64		
	$5,746,535.50		
Less—Reserve for Depreciation	1,580,373.40	$4,166,162.10	
Investments in other Properties		1,300,603.64	$5,466,765.74
GOODWILL, PATENTS, MODELS, TRADE MARKS AND TRADE NAMES		$26,500,000.00	
Less—Amount of Surplus appropriated for retirement of First Preferred Capital Stock		309,530.46	26,190,469.54
CURRENT WORKING ASSETS:			
Inventories		$8,971,355.84	
Accounts Receivable		743,325.37	
Notes Receivable		395,056.75	
Mortgage Receivable—Due on Contract of Sale		167,500.00	
Cash	$3,269,552.50		
Sight Drafts, with Bills of Lading attached, out for collection	1,597,095.13	4,866,647.63	
		$15,143,885.59	
Less—Reserve for Accounts Doubtful of Collection		131,769.12	15,012,116.47
SINKING FUND—Central Trust Company of New York, Trustee:			
Cash		$8,283.25	
Securities (First Preferred Voting Trust Certificates)		163,606.00	171,889.25
Total			$46,841,241.00

LIABILITIES

CAPITAL LIABILITIES:			
First Preferred		$13,764,120.51	
Second Preferred	$11,000,000.00		
Less—In Treasury	872,532.01	10,127,467.99	
Common	$13,000,000.00		
Less—In Treasury	221,942.42	12,778,057.58	
		$36,669,646.08	
Dividend Warrants—First Preferred Stock		279,741.75	$36,949,387.83
DEFERRED LIABILITIES:			
Real Estate Mortgage			12,709.46
CURRENT LIABILITIES:			
Accounts Payable—Audited Vouchers		$1,226,715.98	
Accounts Payable—Unvouchered Invoices		696,176.77	
Wages—Accrued		124,107.32	
Taxes, Insurance, Etc.—Accrued		98,651.29	
Customers' Deposits		483,016.10	
Due on Contracts, Etc.		735,409.93	
Sight Drafts on Customers—Discounted		944,290.96	4,308,368.35
RESERVE FOR CONTINGENCIES			60,000.00
CORPORATE SURPLUS:			
Undivided Surplus—July 31, 1915		$3,171,794.00	
Net Income for the Year Ended July 31, 1916		5,426,635.59	
		$8,598,429.59	
Deductions—			
Dividends declared and paid on First Preferred Stock during the year	$2,750,013.02		
Sinking Fund Appropriation	137,641.21		
Inventories Reduced	200,000.00	3,087,654.23	5,510,775.36
Total			$46,841,241.00

Aitken Makes Clean Sweep

Takes 20, 50 and 100-Mile Hoosier Events — Rickenbacher Breaks Wheel

INDIANAPOLIS SPEEDWAY, Sept. 9 — Johnny Aitken won all three races here to-day. Going into the 100-mile event, the third on the card, after having taken both the 20-mile and 50-mile dashes, his Peugeot showed the way, and with the confidence gained in his two earlier wins, Aitken jumped into the lead. However, Rickenbacher had kept his Maxwell out of the first two races purposely to save it for the one in which points toward the season's championship were to be awarded. Aitken found Rick crowding him hard and it was a battle royal between the two, who paced the field and kept well in the lead most of the time.

Aitken lead, but never for more than 100 ft., up to the end of the twenty-third lap, when Rickenbacher plunged out in front for one circuit of the track, Aitken heading him on the next circuit. Aitken held the lead until the thirty-third lap, then Rickenbacher led for one circuit, Aitken going into the lead again for two laps, or up to the 90-mile post.

It was on the next lap after this that the steering arm on the right wheel of the Peugeot broke and Rickenbacher began to walk away from Aitken as if the latter was tied. Pit attendants had signalled Rick to watch his right rear wheel, which was wobbling considerably and proved his undoing just when victory seemed within his reach, for Aitken was in serious trouble.

With but little more than 5 miles to go and when he was leading Aitken by almost a mile, Rick came out of the west turn into the homestretch at high speed and his right rear wheel collapsed and this caused the left rear tire to go. Much credit is due Rickenbacher for his masterly control of the Maxwell under these conditions. His car careened first right, then left, then right again and just when four cars seemed about to hit him broadside, for he was directly across the track, the Maxwell began sliding backwards and just in the nick of time gave the right of way to the cars bearing down upon it. Rickenbacher and his mechanic, George Henderson, were in their seats when the car came to a standstill and the cheers that greeted them as they walked to the pits was equal to that ever accorded any winner. Aitken drove the last eight miles with only one

Start of 100-mile race at Indianapolis. Carl Fisher is pacing the field in a Packard

Times for the 20-Mile Event

Car	Driver	10 Mi.	20 Mi.	Speed	Prize
Peugeot	Aitken	6:26.54	12:37.35	95.08	$400
Premier	Wilcox	6:26.94	12:37.68	95.03	300
Sunbeam	Chevrolet	6:41.65	13:12.88	90.81	200
Hoskins	Hughes	6:55.36	13:36.90	68.74	100
Premier	Lewis	7:09.80	14:03 85		
Peugeot	De Palma	7:16.00	14:04.62		
Duesenberg	Busane	7:10.90	14:11.34		
Ostewig	McNey	7:32.96	15:62.18		

Henderson and Klein both out early.

Times for 50-Mile Event

Car	Driver	10	20	30	40	50	Speed	Prize
Peugeot	Aitken	6:36.92	13:11.19	19:42.45	26:12.91	32:40.33	91.83	$700
Hoskins	Hughes	6:37.50	13:11.95	19:44.42	26:14.60	32:40.61	91.81	500
Sunbeam	Chevrolet	6:37.26	13:12.58	19:44.95	26:15.03	32:41.10	91.79	400
Duesenberg	D'Alene	6:38.38	13:19.33	20:00.40	26:38.57	33:25.85	89.75	300
Premier	Lewis	6:57.92	13:43.96	20:31.52	27:12.70	34:05.46	87.99	100
Premier	Wilcox	6:36.55	13:11.19	20:55.68	28:44.00	35:24.89		
Duesenberg	Busane	7:14.60	14:15.67	21:25.55	28:25.68	35:32.87		
Peugeot	De Palma	Out—Dirty plugs—7th lap						
Duesenberg	Klein	Out—Dirty plugs—7th lap						

Times Every 10 Miles in the 100-Mile Event

Car	Driver	10	20	30	40	50	60	70	80	90	100	Speed	Prize
Peugeot	Aitken	6:29.92	13:04.37	19:47.75	26:31.93	33:16.90	39:59.40	46:39.99	53:25.25	59:51.84	1:07:05.04	89.44	$3500
Hoskins	Hughes	6:43.69	13:27.15	20:14.17	27:17.80	33:58.45	40:38.54	47:22.20	54:08.60	1:00:50.24	1:07:24.96	89.01	2000
Duesenberg	D'Alene	6:45.54	13:34.96	20:12.72	26:62.89	33:35.53	40:13.47	46:52.28	53:40.88	1:00:40.73	1:07:43.73	88.60	1200
Duesenberg	Busane	7:02.21	13:57.45	21:07.62	27:59.80	34:44.50	41:32.28	48:21.45	55:06.66	1:01:47.54	1:08:37.66	87.44	1000
Premier	Lewis	7:01.31	13:47.76	20:33.71	27:17.34	34:01.39	40:50.44	48:49.89	55:31.21	1:02:17.71	1:09:07.30	86.81	600
Omar	Toft	7:16.90	14:28.15	21:59.34	29:16.93	36:30.75	43:48.13	51:07.40	58:24.30	1:05:35.19	1:12:40.80	82.56	400
Maxwell	Henderson	7:06.68	14:11.76	21:33.21	28:58.89	36:18.78	43:42.84	51:03.57	58:22.70	1:05:36.41	1:12:43.45	82.51	300
Peugeot	De Palma	7:01.66	13:56.60	21:06.65	27:58.17	34:43.30	.....	49:21.83	56:26.54	1:05:49.61	1:13:12.62	81.96	
Maxwell	Rickenbacher	6:30.37	13:04.93	19:48.56	26:32.36	33:17.44	39:59:72	46:40.59	53:25.85	69:52.27	Wrecked 38th lap		
Ostewig	McNey	7:49.17	15:49.76	23:51.30	31:57.30	39:42.68	47:45.68	55:36.35	1:03:37.71	Flagged, 36th lap			
Premier	Wilcox	6:56.48	15:22.58	21:59.62	29:50.90	Out 8th lap, quit							
Duesenberg	Milton	6:50.36	14:04.46	Out 8th lap, ignition trouble									

Aitken and Hughes in sensational finish of 50-mile event, 27/100 seconds apart

front wheel attached to his steering apparatus.

Attendance Not Large

Indianapolis appeared to have been surfeited with entertainment, the State fair having closed yesterday, for there did not seem to be over 10,000 to 12,000 present at the races, which were the fastest ever seen on the Indianapolis track up to the time Aitken broke his steering knuckle and had to slow down. At that the 100-mile dash was considerably faster than the 300-mile event last Memorial Day and nearly equalled De Palma's speed when he won last year. The 20 and 50-mile events were won at 95.08 and 91.83 miles per hour, respectively.

The 100-mile race was characterized by two battles, that of Rickenbacher and Aitken and one between D'Alene and Hughes. From the thirtieth to the ninetieth mile Hughes had been fighting D'Alene for third place and when Rickenbacher wrecked Hughes jumped into Rick's place, passing D'Alene in the home stretch.

George Buzane, one of the surprises of the Cincinnati derby, where he won fourth place, repeated to-day. He had the pole position at the start, having drawn No. 1, and was soon in eighth place after the race started. However, at the end of 20 miles Milton docked his Duesenberg with ignition trouble and Buzane jumped into seventh place, just inside the prize money. De Palma's and Lewis' stops for tires at the 72-mile point gave Buzane fifth position and the falling of Rickenbacher put him in fourth, where he finished.

In the 20-mile event Aitken took the lead from the start and won at 95.08 miles per hour, although Wilcox gave him a hard battle, finishing only 0.33 sec. behind. Chevrolet drove the Sunbeam that Galvin took third money in at Cincinnati last Monday into third place.

In the 50-mile dash Wilcox, in a Premier, lead the field for six laps, then gave way to Aitken. Hughes lead the field in the fifteenth lap, but relinquished it to Aitken after one circuit of the track, but crowded the Peugeot close and finished 0.27 sec. behind Aitken.

It was an afternoon of spectacular finishes for each race. Not more than a car length decided between first and second places in the 20 and 50-mile events, and then in the 100-mile race Aitken stopped at the first pit on his last lap, coasting across the line when he got the checkered flag. Ralph De Palma, who drove Merz's Peugeot, kept running, but said after the race that it seemed to want to climb over the rail all the time. It seemed odd to see De Palma in the Peugeot blue; it made one lonesome for the Mercedes, which was too badly broken at Cincinnati last Monday to participate here. Christiaens did not start, his Sunbeam being disabled.

Aitken used Oilzum in the Cincinnati race last week instead of castor oil, as reported.

Specifications and Details of Equipment of Cars Entered in the Harvest Racing Classic at Indianapolis, Sept. 9

Car	Driver	Bore	Stroke	Dis.	Carb.	Ignition	Plugs	No. Plugs	No. Valves	Valve Location	TIRES		Wb.	Wheels	Pistons	Oil	Shock Absorbers	Other Equipment
											Make	Size						
Peugeot	De Palma	3.70	6.65	274.0	Zenith	Bosch	K L G	4	16	Over	Silvertown	35x5	106	R.-W.	Levett	Oilzum	Hartford	Moto-Meter
Premier	Wilcox	3.65	6.63	274 5	Miller	Bosch	K L G	4	16	Over	Goodyear	33x5	105	R.-W.	Levett	Oilzum	Hartford	Moto-Meter
Omar	Toft	3.75	6.75	298.2	Miller	Bosch	Rajah	8	16	Side	Goodyear	35x5	106	R.-W.	Levett	Oilzum	Hartford	Moto-Meter
Peugeot	Aitken	3 65	6.65	274.0	Zenith	Bosch	K L G	4	16	Over	Goodyear	35x5	106	R.-W.	Aluminum	Oilzum	Hartford	Moto-Meter
Maxwell	Rickenbacher	3.75	6.75	298.2	Miller	Bosch	K L G	4	16	Over	Silvertown	35x5	106	Houk	Levett	Castor	Hartford	Moto-Meter
Duesenberg	D'Alene	3 75	6.75	298 2	Miller	Bosch	Rajah	8	16	Side	Silvertown	33x5	106	R.-W.	Levett	Oilzum	Hartford	Moto-Meter
Maxwell	Henderson	3.75	6 75	298 2	Miller	Bosch	K L G	4	16	Over	Goodyear	33x5	106	Houk	Levett	Castor	Hartford	Moto-Meter
Sunbeam*	Chevrolet	3.28	6.14	294.2	Miller	Thomson	K L G	6	24	Over	Silvertown	35x5	113	R.-W.	Alum.Al.	Castor	Hartford	Moto-Meter
Duesenberg	Milton	3 75	6.75	298 2	Miller	Bosch	Rajah	8	16	Side	Silvertown	33x5	106	R.-W.	Levett	Oilzum	Hartford	Moto-Meter
Duesenberg	Buzane	3.75	6 75	298 2	Miller	Bosch	Rajah	8	8	Side	Silvertown	33x5	106	R.-W.	Levett	Oilzum	Hartford	Moto-Meter
Duesenberg	Klein	3.75	6 75	298 2	Miller	Bosch	Answer	8	16	Side	Silvertown	33x5	106	R.-W.	Levett	Mobiloil	Hartford	Moto-Meter
Hoskins	Hughes	3.75	6 75	298 2	Miller	Bosch	Rajah	8	16	Side	Silvertown	35x5	106	R.-W.	Aluminum	Monogram	Hartford	Moto-Meter
Premier	Lewis	3 65	6 63	274 5	Miller	Bosch	K L G	4	16	Over	Silvertown	35x5	105	R.-W.	Levett	Oilzum	Hartford	Mso-Mreot
Osteweg	McNey	3 34	5 00	295 2	Miller	Bosch	Rajah	8	16	Side	Silvertown	33x5	102	Houk	Magualite	Oilzum	Hartford	Moto-Meter

*Six cylinders; all others four cylinders.

How the Ford Racers Were Rebuilt

Some Resembled Peugeots and Others Wired Together

By Wallace Blood

Taking the steeply banked curve on the Chicago track. The rebuilt Fords sailed high up on the incline

Harvey's rebuilt car. It looked more like a Peugeot than the original Detroit one-a-minute creation

CHICAGO SPEEDWAY, Sept. 10 — Hay wire, binding twine, trunk straps, junk parts and mechanical ingenuity, combined with more-or-less semblances of Ford cars, went to make up the creations which took part in the Ford race to-day, and a more motley assortment of reconstructed flivvers has never been seen. The springs were underslung and overslung—two cars were entirely without springs. There were distributers, special magnetos and ordinary Ford magnetos, cast-iron pistons and aluminum pistons, skeleton bodies and streamline racing types. Even that which was previously considered impossible was accomplished. Fords were disguised so that all evidence of their birthright was effaced.

The greatest interest hinged on car No. 1, which took first money in two of the races and showed close to 80 miles an hour in practice. It is a Bob Burman and Jack Gable designed replica of a Peugeot, built in his father's garage at Oak Park, Ill., by Paul Harvey, the driver. It was this garage in which Burman and Gable kept their cars prior to the 1915 Chicago race and credit is given them for much of the car's design. The car got into the race because it has a Ford block, gearset and axle. Otherwise it was a special racing job all the way through. A sum amounting to well over $1,500 is said to have been spent on its construction. More credit should be given the entries who had limited capital and spent their sums on alterations which gave their Fords the most speed.

Harvey's Car a Masterpiece

Harvey's car was a masterpiece of workmanship and is prophetic of what may come in cars with small motors capable of attaining high speeds. In action it was like a Schubert symphony, smooth and harmonious. The block bore the Ford stamp. Internally, however, the motor had more bore and stroke, larger valves, racing camshaft—in fact, is so altered that there was little Ford left. The frame is hung low on heavy cantilevers. The exhaust is carried out through four straight pipes into an exhaust tube on the side which is large enough to take care of a 300 cu. in. motor. The magneto is Bosch, there is a Master carbureter, Rudge-Whitworth racing wheels and Goodyear cord tires.

The car which bore No. 37, built and driven by B. F. Davis, Paris, Ill., is a typical representative of how a Ford motor may be coupled with hybrid parts to make a car which is capable of close to 70 miles per hour. Davis won the 30-mile Illinois State championship, but unfortunately broke a rod in the free-for-all when he was running close second to Harvey.

The motor is a Ford. The bore is the same and the stroke. Valves were enlarged to 1⅝ in., Rich tungstens being used. The carbureter is a Master and the magneto a Bosch. The camshaft was not altered. A Monroe frame is used to undersling a Scripps-Booth axle on the front and a combination Ford and Scripps-Booth axle on the rear. This combination includes a Ford differential and housing with Scripps-Booth floating axle. The high Champion radiator and formidable-looking streamline body gave the car a full-fledged racing appearance.

Another car of similar lines was No. 39, built by H. B. Wilson, Dewitt, Ill. Mechanical trouble made it a poor contender in the races, but in preliminary trials it showed commendable speed. Here, too, a Champion radiator heads a symmetrical streamline body. Bosch and Master equipment is evident and Universal Welding Co. wire wheels are fitted. The builder ground his camshaft to quicken the lift and drop and installed lynite pistons.

Methods of Lowering Frame

The most varied of all alterations were the methods of lowering the frame. Car No. 38, Chic Wheeler, Des Plaines, Ill., lowered the front with a special axle, as shown in Fig. 1. In the rear, refer to

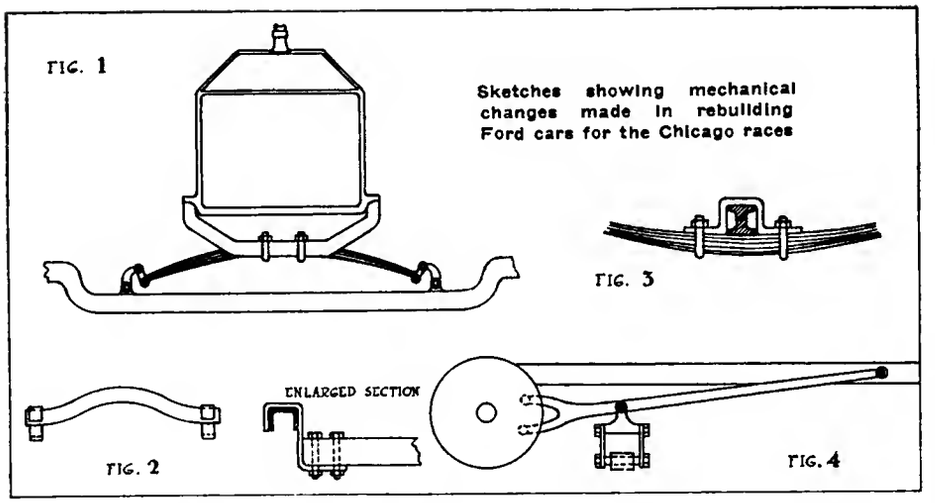

Fig. 2, he sawed off 4 in. from the frame on each side and suspended the regular Ford rear-spring hanger on two goosenecks made out of flat bar steel. This gave him a frame 4 in. lower than is found in the stock Ford. He also used Bosch for ignition and the carbureter is a Rayfield.

Another unique method of lowering the frame was found in car No. 10, driven by Hugo Zeeh, Oak Park, Ill. As shown in Fig. 3, the front axle was underslung by the use of a U-shaped piece of flat steel stock over the axle and fastened to the springs with clips as shown. In the rear, he utilized the brake arm studs in the rear axle hub to fasten a forked bar from the axle to the frame as shown in Fig. 4. About two in. forward from the fork he bolted shackles and suspended the transverse spring from these. These alterations gave him about 4 in. drop.

Car No. 6, which finished third in the free-for-all, certainly performed differently than it looked. It was an old Ford in the first place, and had seen much service. There was nothing much special about it except that the axle was geared up and the timing set ahead. Underneath the gearset was a battered sheet metal pan, "to keep the oil from the track," according to Henry Mueller, Chicago, the driver and owner. This pan was fastened to the frame with hay wire—all in all a crude looking job. But the car had the stuff and the prize won certainly bought that battered pan and the hay wire.

Hay Wire Holds Hood

Car No. 3, V. W. Jury, Chicago, promised to be a strong contender. One little oversight put it in the discard, and that was that the driver relied on hood fasteners instead of a strap. He made four stops in the 50-mile event to fasten down the hood and finally secured it in place with a dose of the ever-present hay wire.

Car No. 24, driven by Emil Laznasky, Mt. Prospect, Ill., which got second place in the big race, had about as little done to it to make it fast as any of the contenders who placed. The driver, who was also the builder, against the advice of friends, removed the magnets from the flywheel of the Ford motor and installed an Atwater-Kent distributing system. He attributes his success to this disregard of his friends' advice. About the only other change from a regular Ford was the use of a Master carbureter and a V-shaped tank soldered to the front of the radiator to give additional water capacity.

A majority of the cars in the race were provided with some kind of an extra carrying space for water. There were tanks soldered on the front and rear, of all shapes and degrees.

What few there were who did not alter the radiators were frequent visitors to the pits for new water supply.

One Burned Kerosene

Car No. 40 was entered by J. W. Duntley, originator of pneumatic tools and well-known inventor. It embodied his latest invention, a kerosene burning atomizer. The device will start a Ford cold on the second or third turn of the crank. It weighs but 1¼ lb. There are sixteen parts which go to make up the complete device. Kerosene is admitted to the atomizer into an ordinary float chamber, but that is all of the device which resembles a carbureter. The fuel is sucked into a tube in which there are a series of slits for atomizing. Over this tube is another sleeve with more slits. Mixture is made rich or lean by matching up the slits, for a lean mixture and all of them for a real rich mixture. This operation is controlled by a lever on the steering column. The throttle is a dished disk which slides over the outside sleeve, thus regulating the amount of fuel admitted to the motor. The car entered the race on three-quarters kerosene and one-quarter gasoline, but the atomizer will handle straight kerosene with good results. Duntley offered $200 for any other kerosene burning Ford which would race him, but did not get an acceptance.

As a summary, speed seemed to have been attained by the use of special magnetos or distributers, carbureters of larger capacity than the Ford, lowered frames, higher gear ratios, and timing set ahead, with a few of the camshafts special and some of them ground to sharper points by the builders.

Effect of the War on Aeroplane Engine Design

(*Continued from page* 433)

to allow for the increased engine load when laying his plans.

Several of the foremost engineers have had under consideration for some time the construction of huge battle planes, but have had to let them rest until the certainty of their getting an engine of the power capable of driving a machine of this size. In most cases, the question of final drive for propellers is undecided, as with a unit of 400 or 500 hp., the proper location for it would be inside the fuselage, where it could be under observation and not an object of head resistance.

In this case the question of gearing would not be of moment, as in all likelihood the drive would be through shafts to two outboard propellers, similar to the Zeppelin method of drive.

On some of the smaller engines of 250 hp., the question of cooling has been worked out to very nearly the limit, and a finished radiator for a Rolls-Royce of this power only weighs 62½ to 63 lb., with a correspondingly small amount of water.

In conclusion, the writer wishes to emphasize the fact that in designing an engine for aeroplane use, consideration should be given to the service that this particular engine is intended for, and that if possible there should always be co-operation between the designers of the engine and the plane, for while it is slower work, it certainly will give greater satisfaction in the end, and should produce better results. In this way it is often possible to eliminate certain weights by lightening up on various parts, and incorporating other features that will facilitate and simplify the work as a whole. Numerous incidents can be cited where this has made a pronounced improvement.

Factory Miscellany

Lexington Adds—The Lexington-Howard Motor Co., Connersville, Ind., is planning a one-story addition 125 by 200 ft.

Duryea May Locate in Baltimore—The Duryea Motors Co., Philadelphia, Pa., is seeking a site for a plant in or near Baltimore.

Pilot to Double Capacity—The Pilot Motor Car Co., Richmond, Ind., is having plans prepared for doubling the capacity of its plant.

Alter to Build in Grand Haven—The Alter Motor Car Co., Plymouth, Mich., is planning to erect a factory, 60 by 400 ft., at Grand Haven, Mich.

Field Motor's Factory—The Field Motor Co., Grand Rapids, Mich., will build a one-story factory, 50 by 100 ft., for the manufacture of gasoline and kerosene engines.

Dunlop Tire to Build—The Dunlop Tire & Rubber Goods Co., Toronto, Ont., is contemplating the erection of a factory building to be of brick and mill construction.

Guide Lamp Adds—The Guide Motor Lamp Co., 114th and Madison Streets, Cleveland, is building a one-story brick addition to the present building which will cost about $11,000.

Sherman Carbureter Co. Formed—The Sherman Carbureter Co., Buffalo, N. Y., has been formed to manufacture carbureters and automobile supplies. W. H. Grever, 146 Hughes Avenue, and R. C. Harrison and J. F. Sherman, Buffalo, are the incorporators.

International Rubber to Build—The International India Rubber Corp., South Bend, Ind., has contracted for the erection of the first unit of its tire factory. The dimension of the building will be 382 by 80 ft., and will contain 28,700 sq. ft. of floor space.

Canadian Factory Items—A contract has been given for the erection of a factory in Oshawa, Ont., for the Chevrolet Motor Co., to cost $40,000. The Chevrolet company will also build another structure there at a cost of $50,000.

The Motor Products Co. will build a plant at Walkerville, Ont.

Mitchell Wagon Enlarges—The Mitchell Wagon Co., Racine, Wis., manufacturer of automobile bodies, is enlarging its operating departments to bring the output up to the mark required by its contracts, the principal one being with the Mitchell Motors Co. The Mitchell output is being largely increased, bringing an unusually heavy demand upon the body makers.

Tire Fabric Plant for Niles—Work is in progress in Niles, Mich., on the construction of what is said to be the first tire-fabric plant west of the Alleghenies. The plant is being built for the Towar Cotton Mills, Inc. Officers of the company include: President, S. C. Towar, who has been sales manager of the Acme Belting Co., Niles, and secretary and treasurer, G. A. Merritt, Detroit.

Wis. Factory Items—The Waukesha Motor Co., Waukesha, is having plans prepared for a new administration building, to be of fireproof construction, 36 by 132 ft. in size, two stories and basement. The completion of the new offices will release considerable floor space for manufacturing purposes, which is badly needed because of the great rush of orders.

To temporarily relieve the congestion in the plant and pending the completion of a mammoth new assembling shop, the Falls Motors Corp., Sheboygan Falls, has erected a large circus tent in which assembling operations will be carried on night and day for at least 2 months. The company added fifty skilled mechanics to the force during last week and is taking competent help as rapidly as it presents itself.

F. W. D. Tractor Seeks Plant Location—The Four Wheel Drive Tractor Co., originally organized at Antigo, Wis., and later by Clintonville, Wis., capital, is considering propositions from no less than six large Wisconsin cities for the location of the works, which is about to be undertaken. Among the bidders for the industry are Oshkosh, Appleton, Green Bay, Wausau and Fond du Lac.

Work Started on Stewart-Warner Addition—Work now is well under way on the first of a large group of new iron and brass foundry buildings at the Warner works of the Stewart-Warner Speedometer Corp., Beloit, Wis. The work of moving the equipment of the present shops to the recently enlarger main works in Chicago has been completed. Henceforth the Beloit works will devote all attention to the manufacturing of raw material, and finishing, assembling and other final processes are concentrated in Chicago. The new iron foundry will be 180 by 480 ft., and other buildings in proportion. Harold Hemenway, East Moline, Ill., has been appointed general superintendent at Beloit to succeed A. E. Moon, who is promoted to an executive position in Chicago.

The Automobile Calendar

ASSOCIATIONS

Sept. 25—Indianapolis, Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.
Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.
Oct. 2-7 — Kansas City, Mo., Dealers' Show, American Royal Live Stock Show; Kansas City M. C. Dealers' Assn.
Oct. 13—Flint, Mich., Fall Meeting National Assn. of Automobile Accessory Jobbers.
Dec. 2-9—Electricians' Countrywide Celebration.

CONTESTS

Sept. 16—Providence Speedway Race.
Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.
Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30—Astor Cup Race, 250 miles, Sheepshead Bay Speedway, Sheepshead Bay, N. Y.
Oct. 7—Philadelphia Speedway Race.
Oct. 7—Omaha Speedway Race.
Oct. 14 — Chicago Speedway Race.
Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.
Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.
April, 1917—Los Angeles to Salt Lake City Road Race.

SHOWS

Sept. 10-16 — Milwaukee, Wis., Show, Wisconsin State Fair, Machinery Bldg.
Sept. 25-30—Salem, Ore., State Fair, Joseph M. Rieg, manager.
Oct. 14 - 31 — Dallas, Texas, Show, State Fair.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 13 - 20 — Montreal, Que., Show, Montreal Automobile Trade Assn.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Jan. 27-Feb. 3, 1917 — Chicago, Ill, Show, Coliseum, National Automobile Chamber of Commerce.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb.—St. Louis, Mo., Show, Auto Manufacturers, and Dealers' Assn.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.
March 3-10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

TRACTOR

Sept. 11-16 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.
Oct. 14-29—Dallas, Tex., Demonstration, Texas State Fair.

The Week in the Industry

Baltimore Trade Items—H. S. Block, who for some years has been the Chandler distributor for Maryland, is now looking after the retail business for the Chandler in Baltimore at 1014 Morton Street.

The Beam Motor Car Co., 1114 Cathedral Street, former Chandler agent, is handling the Allen and the Premier.

The Wilson Motor Co., 605 West North Avenue, former Mitchell and Maxwell distributor, is now handling the Liberty and the Grant lines.

Day-Elder motor trucks are being handled in Baltimore, with the showrooms in the new Mid-City Garage, 29 South Charles Street. H. H. Day is the Baltimore and Southern distributor and J. A. Muir is in charge of the local sales department.

Bowser Booster Out—The *Bowser Booster* is the name of a new publication at the S. F. Bowser Tank & Pump Company, Fort Wayne, Ind. The paper is intended to deal entirely with the activities of the factory and office, as the *Bowser Booster* is printed in the interests of the salesmen.

Philadelphia Items—The Wagner Electric Mfg. Co., St. Louis, has opened a branch and service station at 1430 Vine Street, Philadelphia, in charge of N. A. McCoy.

B. F. Hoffman, sales manager for the Ford Motor Co., Philadelphia, will leave that company about Oct. 1 and open up the Hoffman Motor Co. at 235 North Broad Street, the quarters now occupied by the Buick agency. Mr. Hoffman will handle Ford cars under the new plan.

Pacific Coast News—The Al. G. Faulkner Co., Los Angeles, Cal., southern California and Arizona distributor of the Marmon, will occupy a new two-story brick and stone building at the corner of Figuroa and Seventeenth Streets on or before Oct. 1.

Both the wholesale and retail selling privileges on the Firestone tire in Portland, Ore., were conferred by F. W. Thatcher, manager of the Portland branch of the company, to B. E. Boone & Co., retail Chevrolet dealer. The Firestone branch will retain its present quarters at 65 Park Street, North, and will take care of the territory outside Portland, as in the past, and assist the new organization to obtain additional city business.

Columbus News Items—E. P. Strang, district manager of the Deneen Motor Co., a newcomer in the motor truck field, arrived in Columbus recently for the purpose of establishing an agency.

The Owen Magnetic Motor Car Co., located on North High Street, Columbus, has taken the central Ohio agency for the Velie.

E. H. Huffman, 105 East Town Street, Columbus, has taken the local agency for the Stephens Six.

Cruikshank, Son & Robinson is the name of a new retail firm at 402 Schultz Building which will handle the Argo and Pathfinder in central Ohio territory.

The Ohio Metz-Elcar Co., 211 North Fourth Street, Columbus, has taken Ohio distribution for the Metz and Elcar. W. A. Albaugh is general manager.

St. Louis Trade Happenings—A. P. Seigmund, St. Louis, has been appointed manager of the truck department of the Detroit Electric Car Co., Twentieth and Locust Streets, that city.

The Gibson Motor Car Co., the Dodge distributor in Webster Groves a St. Louis suburb, is erecting a brick and tile showroom and service department on Lockwood Avenue.

The Ebbeler Motor Car Co., St. Louis, has taken the agency for the Mitchell cars.

A. G. Cameron, Dallas, Tex., is the new manager of the St. Louis branch of the Goodyear Tire & Rubber Co. Mr. Cameron has been in the Goodyear service as Dallas manager 3 years. He succeeds W. E. Finney, transferred.

G. C. Brinkmann, St. Louis, has resumed the management of the Brinkmann Motor Co., Maxwell distributor.

The McQuay-Norris Mfg. Co., St. Louis, has added the following mechanical engineers to its sales force: H. H. Cummings, Chicago; R. B. Pratt, Milwaukee; F. L. Stevenson, Detroit.

R. W. Immasche, St. Louis, recently appointed distributor for Jordan cars, will incorporate under the name The Jordan Motor Sales Co.

G. H. Scott, Columbia, Mo., manager of the branch in that city of the Hudson-Phillips Motor Car Co. of St. Louis, has been made manager of the company's wholesale department, vice L. T. Hudson, who resigned to accept a position in Memphis.

W. C. Capen, St. Louis, manager of the White branch in that city, has been transferred to an executive position at the factory in Cleveland. He will be succeeded in St. Louis by G. E. Armstrong, who has been with the Locomobile Co. in New York City and at the factory.

Canadian Trade News—Aubrey Hurst, 32 Front Street, West, Toronto, Ont., has been appointed sole Canadian representative for the Detroit Weatherproof Body Co., Detroit.

The Breen Motor Co., Winnipeg, Man., has been appointed sole agent in Winnipeg for the Chalmers car, recently handled by Joseph Maw & Co.

Mountain Trade—The Headington Auto Co., Denver, Metz, Inter-State, Enger and H. A. Lozier distributer for Colorado and Wyoming, has added the Sun distributing agency for the same territory.

The J. S. Morrison Auto Co., Denver, Allen and Oakland distributer for Colorado and Wyoming, has given up the Oakland and is handling the Allen exclusively.

The Norton-Buick Co., Denver, Buick distributer for Colorado and southern Wyoming, has secured the G. M. C. truck-distributing agency for the same territory. The headquarters will soon be moved from 25 East Colfax Avenue to 1535 Lincoln Street.

The Turner-Deigle Motor Co., Denver, is the new name for the Turner Commercial Auto Equipment Co., formerly distributer for the Smith Form-a-Truck, at 455 Broadway, which has given up that business and taken one of the local Ford agencies.

Lee McGee, Denver, has opened a Stephens distributing agency for Colorado, Wyoming and New Mexico at 1908-1914 Broadway.

The Tibbals-Anderson Motor Co., Denver, Jackson distributer for Colorado, Wyoming and New Mexico, with headquarters at 1188 Broadway, has added the Elcar distributing agency for the same territory.

The United Motor Sales Co., Denver, has opened a Ford agency and service station at 153-155 Broadway.

The Beardsley Electric Co., Denver, is the name of a Colorado distributing agency for the Beardsley recently opened at 1431-1433 Cleveland Place. The business is in charge of G. A. Showers, and A. K. Ancker is sales manager.

S. W. News Items—C. L. Jarrett, Springfield, Mo., will distribute the Chevrolet in that territory.

The Martin Motor Co., Springfield, Mo., has been organized to handle Maxwell in the Springfield territory.

The Howard & Murphy Motor Co., Kansas City, Mo., has employed E. J. England, formerly sales manager of the Karshner Motor Car Co., as sales manager.

The Automobile

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No. 12

NEW YORK, SEPTEMBER 21, 1916

Ten cents a copy
Three dollars a year

Each nationality has its admirable characteristics. They fuse and blend in America's great melting pot, and there emerges a new national type combining the excellences of all—the American.

Motors are made in many lands, with characteristic features of design. France, England, Germany, Italy, America—each contributes, through its notable engineers, to the world's motor experience. By means of its customer-connections with over 150 manufacturers of automobiles and trucks in both Europe and America, the Continental Motors Company maintains unbroken communication with every reliable source of motor experience in the world.

Into the Continental crucible pours all this wealth of engineering achievement. Purged of dross, freed from all freakishness, refined and perfected by its own superb corps of engineering experts, there emerges that new type combining in standardized form the excellences of all — the world-famous Continental Motor.

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Our chain of direct factory branches and service stations which covers the country plus our large field organization of service men costs us more per speedometer than any reduction any other speedometer manufacturer might offer you.

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The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, SEPTEMBER 21, 1916—CHICAGO NO. 12

48,750 Studebakers in 8 Months

1710 More Than in Whole Year of 1915—Output Increasing

DETROIT, MICH., Sept. 16—The Studebaker Corp., for the first eight months of 1916, ending Aug. 31, has sold more cars than for the entire 1915 year. In number of cars, 48,750 Studebakers were sold from Jan. 1 to Aug. 31 of this year, as compared with 47,040 for the whole of last year, a gain of 1710.

At the present rate, 1916 sales will be 55.4 per cent greater than 1915, or about 73,125 cars, meaning an aggregate gain for 1916 over the previous year of 26,085 cars, if the present rate is maintained. As a matter of fact, however, it is practically certain that the balance in favor of 1916 over 1915 will be greater than the estimate just given, for the output is being steadily increased, and the factory reports sales for the last four months of this year in larger proportion than for the whole eight months of this year.

100,000 Cars Planned

It is believed that Studebaker will sell about 80,000 cars, and, with recently authorized factory extensions, including additional buildings and equipment, will enable the production of 100,000 cars, that being the mark set for 1917.

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Monteith F. & H. Manager

COLUMBUS, OHIO, Sept. 16—John C. Monteith has been named general manager of the Phelps Mfg. Co., this city, maker of the F. & H. wire wheel.

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Bill and Decou Resign from Nash Motors Co.

KENOSHA, WIS., Sept. 16—Louis H. Bill of the Nash Motors Co., formerly the Thos. B. Jeffery Co., this city, has resigned as general manager, effective Oct. 1. He expects to return to his home in San Francisco. Jerry Decou, who has been general factory manager, resigned Sept. 15 and is succeeded by John Bjorn, formerly superintendent. Mr. Bill's successor has not been announced. Bill is one of the old men in the trade having been branch manager of the H. A. Lozier Co. in the bicycle trade, becoming branch manager of the Jeffery company in 1905 and entering the factory in 1913.

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Friend Returns to Mitchell as President

RACINE, WIS., Sept. 20—*Special Telegram*—Otis C. Friend has returned to the Mitchell Motor Co., Inc., as president and general manager, succeeding H. L. McLaren, who resigned 2 months ago. John W. Bate is vice-president and chief engineer.

Mr. Friend left the Mitchell company to become vice-president and general manager of the United Motors Corp., but assumes his new duties with the Mitchell company at once.

Other Officers

W. H. Armstrong is secretary and treasurer and F. L. Mitchell, formerly treasurer, becomes comptroller. Mr. McLaren remains president of the Racine Tire Co.

Mr. Friend has been connected with the automobile industry for nearly a score of years beginning with the Chicago sales of the Locomobile. He joined the sales force of the Chicago Mitchell agency in 1900 and later handled Mitchells as the firm of Brown & Friend of Milwaukee. Mr. Friend then became purchasing agent of the Mitchell-Lewis factory and was successively assistant to J. W. Bate and general superintendent of shops. On Aug. 1 announcement was made that he had resigned as sales manager of the Mitchell-Lewis company to become vice-president of the United Motors Corp.

Saxon Stock Placed on 7% Basis

Fiscal Year Profits $1,316,272—Output 25,500 Cars, 15,651 Gain

NEW YORK CITY, Sept. 20—The dividend of the Saxon Motor Car Corp. has been increased from 6 to 7 per cent. This is put into effect by the declaration of a quarterly payment of 1¾ per cent, payable Oct. 2. Net profits for the year ending June 30 were reported as $1,316,272, or approximately $116,000 greater than the estimates made in official circles during the last quarter of the company's fiscal year, and equivalent to nearly $22 a share on the $6,000,000 stock. The first dividend was paid last July.

The output of the company during the fiscal year was 25,500 cars, an increase of 15,651 over the preceding year when 9843 cars were built.

President Harry W. Ford, in his annual statement to stockholders, reports that the company has on file contracts with dealers for 50,000 cars, with a number of territories still to be closed.

SAXON BALANCE SHEET—JUNE 30, 1916

Assets		
Plant and equipment		$73,914.18
Investments		7,500.00
Current Assets (Inc. Inventories)		
Cash	$596,722.14	
Notes and accounts receivable	392,830.17	
Inventories of materials and cars on hand	2,134,326.94	
		3,123,879.25
Deferred charges		18,142.57
Good will, models and pat. rights		4,557,229.08
		$7,780,665.08
Liabilities		
Capital stock		$6,000,000.00
Notes and accounts payable, etc.		907,222.38
Surplus:		
Being the profits earned for the eight months from Nov. 1st, 1915	$963,442.70	
Less: Dividend paid June 30, 1916	90,000.00	
		873,442.70
		$7,780,665.08

Hudson Coast-to-Coast Record

Super-Six Covers 3476 Miles in 5 Days, 3 Hours and 31 Min.

TRANSCONTINENTAL RECORDS

Car	Driver	Time Days	Hrs.	Min.	Date
Hudson	Paterson .. Mulford ... Vincent ...	5	3	31	Sept., 1916
Marmon	Stevens ...	5	18	30	July, 1916
Cadillac	Baker	7	11	52	May, 1916
Stutz	Baker.	11	7	15	May, 1915

NEW YORK CITY, Sept. 19—The transcontinental record has been lowered 14 hr. 59 min. by a Hudson Super-six. The speed from San Francisco to New York averaged 27.14 m.p.h. and the distance was 3476 miles. The Hudson car reached New York 5 days, 3 hr. and 31 min. after leaving San Francisco. The best railroad time across the continent is 3 days, 21 hr. 45 min., according to railroad officials here.

Left Wednesday, Sept. 13

The car left San Francisco with A. H. Patterson of Stockton, Cal., at the wheel at 12.01 a. m. Wednesday, Sept. 13. It arrived at Columbus Circle the following Monday at 6.31 a. m. Patterson drove to Elko, Nev., Mulford took the wheel there and drove to Laramie, Wyo. Patterson again took the wheel and brought the car to South Bend, Ind. C. H. Vincent drove the last lap of 910 miles into New York. With these men in the car were W. Sturm and L. Kalinsky.

No Tire Trouble

The trip was made on United States Royal Cord tires and came through without trouble.

Following is the check of Hudson Transcontinental car:

Left San Francisco, Sept. 13, 12.01 a. m., checked by L. J. Pinkson, automobile editor San Francisco *Chronicle* and W. C. Kieffer, general agent Wells Fargo & Co.

Carson City, Sept. 13, 7.25 a. m., 253 miles, A. C. Cunningham, blacksmith.

Ogden, Nev., Sept. 14, 10.05 a. m., 842 miles, W. W. Fleetwood, clergyman and F. W. Wheeby, dentist.

Laramie, Wyo., Sept. 15, 5.39 a. m., 1395 miles, G. T. Glessner, dentist and E. W. Johnson, undertaker.

North Platt, Neb., Sept. 15, 2.45 p. m., 1560 miles, J. L. Souder and L. A. Spencer.

Omaha, Neb., Sept. 16, 2.05 a. m., 1844 miles, A. P. Ginon, lumber dealer.

Des Moines, Iowa, Sept. 16, 10.36 a. m., 2029 miles, Dr. D. Lecon, automobile editor *Register*, and H. E. Ward, newspaperman.

Joliet, Ill., Sept. 16, 8.25 p. m., 2381 miles, G. S. Jackson, manager Baskiel Motor Co.

South Bend, Ind., Sept. 16, 12 midnight, 2491 miles, J. F. Cole, president National Co.

Buffalo, N. Y., Sept. 17, 2.30 p. m., 2971 miles, H. M. Wall, president New York State Motor Federation.

New York, Sept. 18, 6.31 a. m., James Hemstreet, American Automobile Assn.

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Signal-Commerce Truck Merger Abandoned

DETROIT, MICH., Sept. 19—The merging of the Signal Motor Truck Co. and the Commerce Motor Truck Co. here under the name of Signal-Commerce Motor Truck Co. has been abandoned. It had been the plan to take over the two properties and incorporate under New York State laws with a capital stock of $600,000, shares of no par value.

Thomas Neal, president of the Signal concern and at one time head of the General Motors Co., was to have been president of the merger and W. E. Parker, president of the Commerce company was to have been vice-president of the proposition.

The two motor truck manufacturing concerns involved in the negotiations will revert to their original individual identities and each will continue to operate separately as heretofore.

—

Ruse, Production Expert, Dies

KENOSHA, WIS., Sept. 16—John W. Ruse, one of the best known production experts in the automobile industry, died here yesterday of acute dilation of the heart after a brief illness. Mr. Ruse was for 8 years identified with the Buick Motors Co. at Flint, Mich., for the last 6 years as general superintendent. Several weeks ago he came here to become associated with C. W. Nash, president of the Nash Motors Co.

To Vote Fisk Capital Increase

Meeting Oct. 2, To Decide on Increase of $12,500,000 or Less

BOSTON, MASS., Sept. 18—Stockholders of the Fisk Rubber Co., will vote at a meeting on Oct. 2, on an increase of capital stock of $12,500,000. Of the new capital, $7,500,000 or less is to be first preferred, and $500,000 or less is to be second preferred.

The stockholders also will vote on authorizing an increase in the common stock by an amount necessary to take care of conversions of existing second preferred and proposed first and second preferred. A proposition to reduce the authorized capital of the company by $5,000,000, the amount of second preferred stock, series B, authorized a few months ago, but not issued, will be submitted.

First Preferred Convertible

The new first preferred stock, if authorized, may be converted into common stock prior to Jan. 1, 1922 at 125, four shares of common for five preferred, and from Jan. 1, 1922, to Dec. 31, 1926, at $150, four shares of common for six preferred. There is $2,000,000 second preferred stock now convertible into common up to Nov. 1, 1917, and the stockholders will be asked to approve an extension of this period until Nov. 1, 1923.

Holders of the present first preferred stock will be offered pro rata $5,000,000 of the new first convertible preferred at par and accrued dividends, while holders of the present second preferred and common stocks will be offered pro rata $2,500,000 of the new second preferred stock at par and accrued dividends.

Ralph Mulford at the wheel of the Hudson Super-six which established a new transcontinental record by traversing the 3476 miles from San Francisco to New York in 5 days, 3 hr. and 31 min.

S. A. E. Standards Men Meet

Straight Side Tires a Standards Possibility—Electric Units Mounting Problems

DETROIT, MICH., Sept. 18—Two meetings of S. A. E. standards committees were held last week. The newly formed tire and rim standards met for the first time and discussed matters relating to pneumatic and solid tires. It was agreed that there are strong probabilities that straight side tires can be made standard for the bulk of the sizes in use, though it is thought the clincher is better for the smallest diameters. There is still some debate as to whether or not the largest sizes in use can be made as satisfactorily in straight side as in clincher. The question will be discussed at the October meeting of the standards committee, which will be held in Washington probably about Oct. 18.

It was reported that the rim situation is improving and that a standard felloe band for passenger car wheels will soon be a practical possibility.

The other meeting was of the subcommittee on the standardization of starting motor and generator mountings. This committee has found its apparently simple task to be extremely complicated, and the members have some of them done a great deal of drafting room work in trying out existing engine drawings against standard mountings. Still more of this work will have to be done before a decision can be reached, but the members are giving so much time to the matter that a report is hoped for at the January meeting of the society. The main trouble is found in starting motor mountings, for the space available is usually much more limited than for the generator. It seems, however, certain that all engine makers will appreciate a standard greatly.

During the coming week the miscellaneous division will meet in Cleveland and the truck standards division meets again in New York before the end of the month.

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Hatch Heads Perfection Spring Sales

DETROIT, MICH., Sept. 19—Charles Hatch, sales representative of the Perfection Spring Co. of Cleveland for the past 8 years, has been promoted to the position of sales manager of the company and appointed a member of the executive committee.

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Hubbard Is Harris Engineering Co. V.-P.

BRIDGEPORT, CONN., Sept. 16—Franklin G. Hubbard has resigned as chief engineer of the mechanical department of the Western Electric Co. plant in Hawthorne, Ill., to become vice-president, a stockholder and director of the H. E. Harris Engineering Co., this city. The Harris company, in addition to the engineering business connected with its special machine tool and gage shops, turn out taps, dies, thread gages, ring and plug gages, tapping, grinding and notching machines, etc.

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Three More M. & A. M. Members

NEW YORK CITY, Sept. 19—The three following concerns have been elected to membership in the Motor and Accessory Manufacturers: Au-To Compressor Co., manufacturer of air compressors, bumpers, tire holders, connecting rods, etc., 233 Mulberry Street, Wilmington, Ohio; F. W. Mann Co., manufacturer of automobile jacks, Milford, Mass.; and West Side Foundry Co., manufacturer of tire pumps, Troy, N. Y.

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Buckwalter Is Timken Bearing Engineer

CANTON, OHIO, Sept. 16—T. V. Buckwalter has been appointed chief engineer of the Timken Roller Bearing Co., this city.

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Myers with Fageol Motors Co.

DETROIT, MICH., Sept. 18—Cornelius T. Myers, who is engaged in consulting work on automobiles and tractors here, has been retained as consulting engineer by the Fageol Motors Co. of California. Mr. Myers recently resigned as manager of the Timken-David Brown Co., previous to which time he was mechanical engineer of the General Motors Co.

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Woodruff Is Simplex Asst. Sales Mgr.

NEW YORK CITY, Sept. 16—The Simplex Automobile Co. has appointed A. A. Woodruff assistant sales manager, with offices at 60 Broadway. Mr. Woodruff will have charge of office routine and system and the spare and repair parts business. He will also remain manager of the body department.

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Porter Is King Asst. Sales Mgr.

DETROIT, MICH., Sept. 16—Joseph Porter, who has been manager of the King Car Corp., New York City, has been appointed assistant sales manager by the King Motor Car Co., Detroit.

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Mutual Motors Promotes Two

JACKSON, MICH., Sept. 19—D. B. Williams has been elected secretary of the Mutual Motors Co., this city, and will have entire direction and supervision of sales and advertising. Mr. Williams has been associated with President Handley of the company for several years.

W. T. Miller, formerly connected with the Willys-Overland Co., has been elected treasurer of the Mutual organization.

Beecroft Talks S. A. in Cleveland

75% of S.A.E. Section Attend —Akron and Toledo Well Represented

CLEVELAND, OHIO, Sept. 15—Over 75 per cent of the membership of the Cleveland section of the S. A. E. was present at the opening of the fall and winter season to-night, when David Beecroft, Directing Editor of THE AUTOMOBILE, gave an illustrated talk on automobile conditions in South America. Over 100 lantern slides showing roads, automobile salesrooms, garages, and country conditions in Argentine, Brazil and Uruguay, were shown. Many of the tire interests of Akron were represented, as were factories in Toledo and other outlying towns and cities.

The fact that 8.5 per cent of the entire automobile business of the fiscal year ending June 30 of the U. S. A. was export business shows the prominence which this branch of the work is attaining. The Argentine market for automobiles is particularly attractive to-day because of the poor wheat crop in Minnesota, the Dakotas, parts of western Canada, etc. A poor wheat crop in these sections means better prices for Argentine wheat. How Europe is watching the grain markets in North and South America was well illustrated by the fact that as soon as our wheat reports were published prices in Argentina started rising. One large automobile manufacturer received a cable order from his Buenos Aires representative the following day for more cars. The selling season in Argentina and Brazil opens in November and continues to March, so that any present increase in Argentine wheat is going to have a very substantial influence on the selling of our U. S. A. cars there during the next 8 months.

Larger Sales Expected

Until a few months ago Argentina had a very large percentage of her last wheat crop on hand. Argentina is not blessed with a great system of grain warehouses at railway depots, as in U. S. A., Canada and Australia. As a result, the farmer has stored much of his crop of the farm, holding it for higher prices. During the last 12 months the Argentine farmer has suffered with his wheat because Europe has been buying from U. S. A. and Canada in preference to South America, solely because of the shorter freight haul between New York or Halifax and Europe as compared with Buenos Aires and Europe. This preference toward North America has held back automobile sales in grain-producing parts of South America, but the present prices show a return to the South American field.

ACCESSORIES In South America

Part V

Co-operative Selling Must Receive More Attention—European Competition Will Follow Close of War

By David Beecroft

¶ EDITOR'S NOTE:—This is the fifth of a series of articles embodying the close observations of automobile and general trade conditions in South America made by Mr. Beecroft, Directing Editor of THE AUTOMOBILE, *during a 10-weeks' trip through Argentina, Uruguay and Southern Brazil. As a delegate of the United States Government and member of the Argentine Return Visit Committee, Mr. Beecroft had exceptional opportunities to become intimately familiar with conditions in South America, and his articles bring out the salient points forcibly.*

CO-OPERATIVE selling of U. S. A. accessories in South America will have to receive more attention than it has in the past. It is too costly for a manufacturer of one accessory to open agencies in South America, but that one maker can combine with six, a dozen or a score of other makers. Such co-operative selling would, in addition to reducing marketing cost, develop a highly-needed brotherly spirit among our U. S. A. manufacturers.

We must largely forget competition among ourselves and keep our eye on international competition. International competition is a new phrase, but it is a stern reality in South American business.

After the war unquestionably the allied nations will among themselves co-operate in every way possible. That program has already been indicated. Our tire makers instead of fighting among themselves for business will have to co-operate to meet the trade war of England, France and Italy.

It would be a good investment for our accessory and parts manufacturers to adopt general policies with regard to South American trade, supporting such policies as work for the general benefit of our goods. There will arise many broad programs of policy that have to be handled and different U. S. A. firms should be a unit in such. Such united action will give our entire accessory trade a status that cannot be otherwise obtained; without such our makers may exhaust their energies in trade strife among themselves.

We Must Reduce Prices

In the matter of prices and terms of payment this co-operation is essential. Some U. S. A. goods are being sold at too high prices. This is due to their being handled through exporters rather than by the manufacturers direct. As a result our goods are getting and already have a reputation for being high priced. Certain U. S. A. tire repairs are being used solely because the French goods cannot be obtained. The South American dealers know our prices are too high, but they must have the goods. After the war they will go back to European goods just as fast as they can unless we change our policy.

There is a chance, a good fighting chance, that we can hold this trade providing we put our prices at once where they should be. It is short-sighted policy in building up an export trade to exact high prices to-day simply because you can get them, only to lose the trade to-morrow when international competition is renewed. Our makers can arrive at better understandings in the question of price by co-operation, getting together and going into South America with a united U. S. A. price situation.

One of the greatest factors in international trade that we will find of importance in South America is the reputation of our U. S. A. goods. Every firm that gets a bad reputation hurts the entire U. S. A. business. If U. S. A. accessories have a good reputation, then it will be easy to do business there. If our goods have a poor reputation, it makes it harder for every concern to enter that market.

Enter the Market Directly

There are many U. S. A. lines of accessories on the Argentine and Brazilian markets that are not trade marked goods. There is no manufacturer's name attached to them. The goods are not always reliable. There is often no service connected with them. Often the goods do not arrive in good condition. Sometimes they never function as they are intended to. The net result is a general discredit to our goods.

This has happened in scores of cases. A few examples will suffice: We have told of the shipment of defective hand horns, of poor lubricating oil, of cheap polishes for bodies and metals, and we could cite many others. Not a single one of these lines was trade marked. The Argentine did not know who made them. To him they were U. S. A. goods and you could scarcely blame him for gaging all of our accessories on their plane. We would do the same thing. This must be avoided. How?

The quickest and best way to overcome this deplorable situation is for our makers to enter the market directly. We must let the South American people know who are our big reliable markets. We must let them know that we make goods to which we are not ashamed to attach our names. We must let them know the good brands we manufacture. We must let them know that these non-trade marked goods are our poorest lines, not our good lines—let them know that we

have a big army of accessory makers of high business caliber.

We must go further: Often some of our best U. S. A. lines are poorly handled in Argentina and Brazil, although they are excellently handled in U. S. A. This is generally due to the goods being shipped abroad through exporters. Naturally the exporter has not the same single interest in any accessory that the maker has. To the exporter any accessory is only one of hundreds of different lines he exports. The exporter does not understand the line the same as the maker. Often the exporter ships goods not well suited to the needs, and naturally the reputation of U. S. A. goods suffers. Here is an example:

A large Brazilian automobile dealer, to get the agency for a certain Detroit make of automobile cabled his exporter in New York to ship him five or six cars. If they turned out well he would secure the agency. The exporting house shipped a couple of coupés, one sedan type, a runabout and a touring car. The only model that was of any use was the touring car. There was no demand for coupés or sedans. There was no demand for runabouts. The demand was only for touring cars. The net result was that the dealer did not close the agency. He blamed our maker for the shortcoming of the exporter. Our international reputation suffered. Search revealed the fact that the exporter got a special price on the lot.

Here is an example from the accessory field: A supply house wanted hand horns, and the exporter shipped electric motor horns. The electric horns were no good without batteries, but as the supply house wanted to sell the horns for European cars using gas lighting, the motor-driven horns were no good. Here again our international reputation suffered and it always will suffer so long as our business is done through third parties who are not close enough to the needs of the industry to know best what line of goods is best suited for the case. It is for this reason that our makers must give the matter more attention.

What is true in South America in this accessory matter also applies to Australia and South Africa. Recently we talked to some of the largest dealers from Australia and South Africa and they both told us the same story. Our makers have a notoriously bad reputation as exporters. We are the laughing-stock of the world. Too many of our makers have no conception of the magnitude of foreign business. Here are two examples given in the last few weeks:

Foreign Trade Underestimated

One of our manufacturers sold the entire right of selling his accessory in all British South Africa for one trifling order of $120. This represented just twenty of the accessories in question. The South African jobber cabled for an order of several thousand within 3 months. The original order of twenty were sold in less than a week. Here our manufacturer gave away a good business investment, because he had no conception of the field.

Another example of similar bad business was where the sole right for an accessory was sold for $160 for an entire continent.

Both of these examples represent the other extreme, but they go to show what a poor grasp we have of the exporting business.

Some of our largest accessory makers in U. S. A. are not in any of the foreign markets direct, but are having their lines handled through exporters. In some cases these goods have a very unsavory reputation. In the words of one large foreign jobber, "some of your goods literally stink because of the way in which they are handled abroad." This foreign jobber mentioned half a dozen lines of accessories that are not getting established abroad for this reason. Here in U. S. A. they are our biggest firms.

As accessory makers we will have to do the same as older business concerns have done, namely, establish our own agencies direct or open our own branches. We have accessory houses that are larger than many old established lines controlling their own foreign business. Look at some of these that have their own arrangements and who are literally saving our U. S. A. reputation abroad.

Fairbanks Morse, Singer Sewing Machine, National Cash Register, Remington typewriter, Underwood typewriter, International Harvester, General Electric, Westinghouse, U. S. Steel Products Co., Corbin Screw Corp. and many others are our trade stalwarts in South America. They have found it worth while to send their best men there. These firms have not only built up a reputation, but they have spent millions to establish what standing we have as international traders.

Must Do Our Share

The automobile industry is duty bound to give these firms its support. There is no question but that we will be strong in that market, but we must carry our due share of the load. Bowser has an agency for its tanks in Argentina and already has established itself in the market. A few of our makers of dry cells have Argentine agencies and nothing but favorable comments are heard regarding their business arrangements. Our largest tire makers are establishing themselves in first-class manner, and they merit credit for what they have done. But there are too many of our accessory people who have not awakened to the situation.

Wider Representation Needed

We have not to-day a wide enough representation in such lines of accessories as speedometers, batteries, spark plugs, jacks, horns, polishes, bearings, vulcanizers, wrenches and other lines of tools. Many other lines can be added.

Before concluding this series on accessories there are a few other lines that should be included with those referred to in previous articles. There is a strong demand for top materials, providing they are cut for several of the best U. S. A. sellers. Tops wear out very quickly in Argentina and Brazil and the owner wants top materials all cut ready to be applied. This is true with regard to Ford, Overland, Studebaker, Hupmobile, Buick and a few other makes and will be true with regard to many more different makes within the next year or so.

Several of our magneto makers are already well established, Bosch and Splitdorf being represented. Eisemann has representation through France. Our concerns making electric starting and lighting apparatus are not strong. There is scarcely any carbureter representation, and as near as we could discover the European carbureter is much more firmly established than our own. Several of our own makes are scarcely known and some never heard of. With many of our cars selling in those countries there will be marked development in the carbureter possibilities. The same applies to rims, clocks, shock absorbers, and every line of accessory that is going to add to the utility of the car.

Manufacturers of raw materials will find a good market in Argentina, Brazil and other Latin-American nations. Every large supply house in addition to accessories carries a heavy stock of blanks from which spur and bevel gears of any size can be made.

There is a big supply of gaskets, assorted nuts and bolts, spring clips, bar and sheet steel stock, door hinges, door handles and, in short, everything needed in the automobile. Keep in mind that South American countries are not manufacturing nations, and so practically everything must be imported. The supply houses handle not only accessories, but raw materials as well. Often raw materials occupy as much space in a store as accessories.

In conclusion: The field is there. Let us possess it as it should be possessed.

Tractor Drives Knotty Problem

Advantages of Caterpillar, Two-Wheel and One-Wheel Drives Appear to Depend Upon Nature of Work—Difficulty of Choosing Best Place for Weight

By A. Ludlow Clayden

Left—Large Case tractor, showing the sort of treads used to give a grip on plowing land

Below—The "Happy Farmer," a tractor in which the weight is very little forward of the driving axle

¶ This is the third of a series of articles based on an intimate study of tractor requirements and the efforts of the tractor engineers to meet the problems in design and construction arising from the demands made upon the machines in active service. The author has been in close touch with the tractors and the manufacturers at the recent demonstrations, so that this series of articles accurately reflects the conditions discussed, besides giving a clearly defined idea of the principal trends in tractor engineering.

IN a previous article the writer touched upon some of the high spots in the design of engines for tractors, and H. L. Horning of the Waukeshaw Motor Co. has contributed much valuable detail information on the same subject in his recent S. A. E. paper, the third installment of which appears in this issue of THE AUTOMOBILE. A matter on which there is even more difference of opinion, and which is far more difficult to argue about is the best form of wheel or drive arrangement for tractor service.

At present we have almost all possible arrangements. One wheel with a pair of small wheels, one to steer and one to maintain balance sideways, is used by some manufacturers, this being called the drum type. Then we have two driving wheels with either one or two steering wheels that are supposed not to carry much of the weight. Then come true three-wheel and four-wheel machines with a fair proportion of the weight on the steering wheel or wheels, and finally, there is the track-laying type with the wheels inside an endless chain which is placed on the ground and rolled over by the wheels. There are also machines with a track-laying arrangement for the drive, and a wheel or wheels to steer and carry part of the weight.

The track-laying type is usually known as a caterpillar, although this particular phrase is claimed to be the property of one firm and so not available for general use. However, it is the term commonly employed and will therefore be used by the writer in dealing with all applications of this kind of drive.

It is unlikely that one form of drive is the best for all purposes; there are reasons which make different designs most suitable for different circumstances. For example, there is nothing to compare for a moment with the caterpillar for operation on very soft ground. The unit pressure is small and the tractive grip the maximum possible for the weight of the machine; so on peaty soil or sand or for hauling guns through wet dirt there is nothing which will compare with the caterpillar, yet for use on hard ground it has drawbacks which make the wheel design preferable.

However, to look at the fundamentals of the problem of choosing a drive, we have first the necessity for providing enough grip between the drive and the ground to prevent the slipping of the drive by the engine under any circumstances. The caterpillar offers the maximum traction having one surface in contact with the ground and all the weight upon it. The automobile offers the other end of vehicular range with

small surface and half the weight on it. Average tractor requirements are somewhere between these two extremes.

As a second requirement we need a drive, if we can get it, which will have a tread no wider than the strip of earth that can be plowed. If we can pull four plows, the drive ought not to be more than four plows wide, six plows and it can be half as wide again and so on.

Third, we want a direct pull for the plows, the center line of the drive should also be the center line of whatever the tractor is pulling, thus avoiding side draft, which is obviously wasteful of power.

Fourth, if we do not need the extreme limit of the caterpillar we still want sufficient area of contact on the ground to provide traction on moderately soft earth.

Fifth, we want ability to turn in a small circle, a very small circle, so as to facilitate maneuvering in confined spaces and to allow plowing to be carried as near as possible to the limits of the field.

Drawbacks of Caterpillar

Before passing on to the consideration of wheeled machines, the drawbacks of the caterpillar type may be mentioned, because this is the ideal for traction per pound of weight and for maneuvering, because by going ahead on one tread chain and astern on the other it is possible almost to spin around the caterpillar in its own length.

The difficulties are mechanical. Obviously a steel chain must have links and links must have bearings. A steel chain to be efficient and to have long life ought to be inclosed in an oil bath; it most certainly ought not to be forcibly charged with mud and sand. Thus the work absorbed by the caterpillar tread is considerable, and the life of the chain is not all that could be desired. For steering we must drive one side more than another, so that directional control is somewhat complicated, and finally, the chain tread is rather expensive, and cannot well be cheapened if it is to last reasonably well in service.

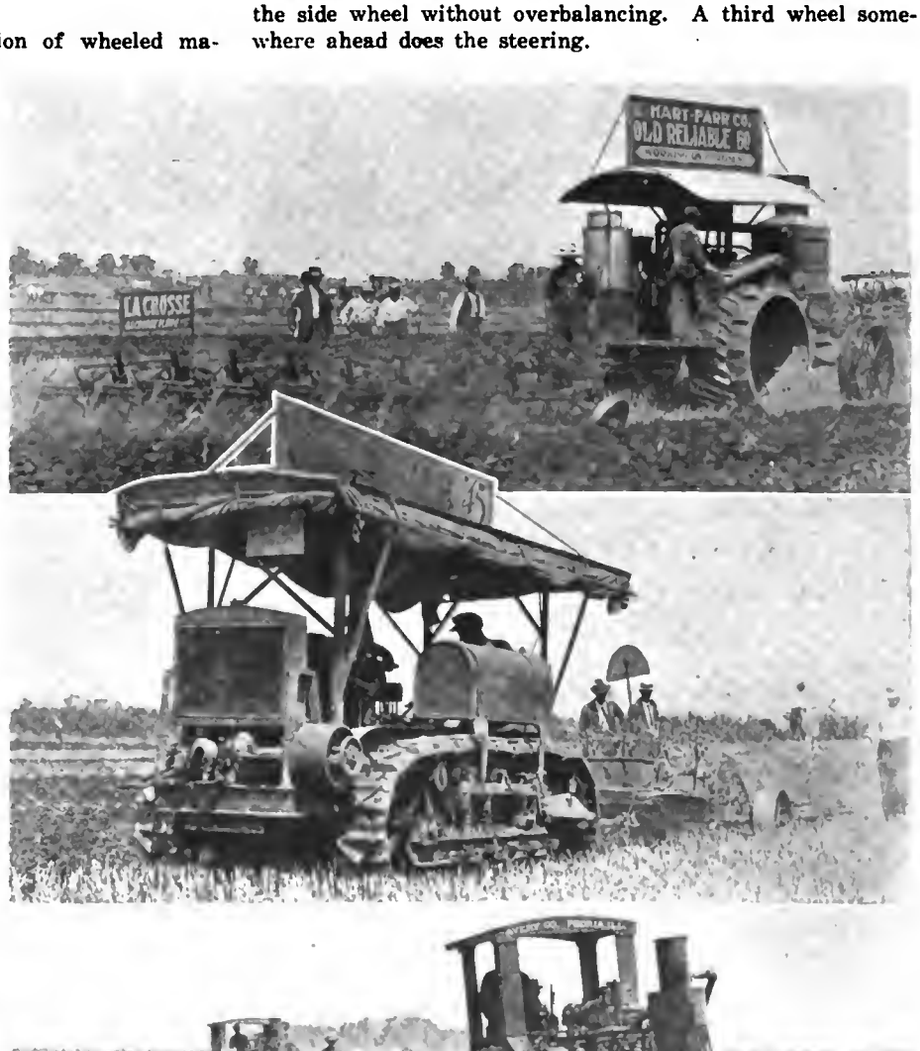
This is not an indictment of the caterpillar, it is merely a brief summary of its drawbacks. It is probable that means could be devised for rendering the bearings in the chain tread perfectly dirt-proof and thus increasing the efficiency and the life of the chain. Really the caterpillar seems to be a particularly promising type of machine which will develop into something far better than it is to-day. Numbers of the machines are being used where they are the only thing that possibly could do the work, and the experience gained will be valuable in bettering the design. Thus it is hardly possible properly to fix the place of the caterpillar in the tractor world at present; it will not be possible for some time to come, it may even be 10 years before the type is developed fully.

There is another sort of machine using a caterpillar drive in conjunction with wheels. In this a small chain tread assembly with two wheels is located suitably for driving and the weight is balanced, partly supported and steered by wheels. This system gets away from the complicated steering of the full caterpillar and provides a good driving grip without the use of a very large and wide driving wheel or wheels. The chain being smaller is less costly to renew when worn out, so that this design may possibly develop along with the full caterpillar.

A possible trouble with a large and powerful tractor might be to get enough weight balanced on the tread; in other words, there may be a limit of size where the caterpillar drive with wheels for steering would be no better than an all-wheeled machine on traction and general convenience.

Drum Suits Small Power

In the drum type of tractor there is one large wheel with the engine and gearing located as close as possible to one side of the wheel. There is then a smaller side wheel which does no driving, but carries a little of the weight, just enough to allow the tractor to lean over in the direction away from the side wheel without overbalancing. A third wheel somewhere ahead does the steering.



Upper—A large tractor hauling eight plows wider than itself. The extension pieces on the wheels to give support for the weight in soft going should be observed

Middle—The Holt caterpillar with weight distributed evenly over the whole tread of the chain

Lower—The big Avery in the foreground has the weight well in front of the driving axle of the machine

Upper—The Bates Steel Mule has a caterpillar rear drive and the two front wheels are for balancing the weight and steering. Only a part of the weight is on the driving member, yet the traction is sufficient for all purposes

Lower—An example of the drum type where the drive is taken through a single large wheel, the weight being balanced by a side wheel and partly supported by a front wheel which does the steering

The advantages of this design for small power is that the one big wheel does not need to be wider than the strip that is covered by the plows the machine can pull, which means that no driving wheel has to run on ground already plowed. Against this advantage may be balanced the drawback noticeable in drawing harrows or other cultivating machines, for then the drum packs the earth in strips a few yards apart and the light dragging of the wide machine being towed is not enough to unpack the soil. This, however, is also true of all other types of tractor, and the packing caused by a drum is no worse than that caused by two wheel drives if the unit pressure is the same.

Another advantage of the drum type is that there is no need for a differential, there is no rear axle in the ordinary sense and the engine and gearing can be arranged compactly. Also, not being between two big wheels, the power-plant can be very accessible and yet have the bulk of its weight concentrated on the driving surface.

Required Driving Pressure

Before proceeding with this analysis of drives, it may be well to mention the amount of unit pressure required to give the requisite tractive effort. At present this must remain something of a guess, it is not possible to say that it must be just so many pounds per square inch. However, it is a fairly safe rough and ready rule, with wheeled drives, to say that the weight must be equal to the tractive effort.

In considering tractor engine requirements it was suggested that at least 1000-lb. drawbar per plow was necessary, so this means for each plow pulled the weight on the driving wheels should be 1000 lb. Some engineers think this amount too much, others say it is too little, and this again is a matter that experience must decide.

However, whether we accept the 1000 lb. or not, this does not help to settle the proper width of wheel. The traction depends upon the pressure, not upon the area, so a large area with small unit pressure has just the same tractive ability as a small area with higher unit pressure, as long as the nature of the surfaces in contact is the same. What is necessary is to have the wheels so wide that they will not sink into soft earth nor have too powerful a packing action on freshly plowed soil, which means they should be as large as possible. Against large size is weight, for the big wheels are not light and there is everything to lose and nothing to gain by making the total weight on the drivers more than that required to give traction enough for the plows.

Of course, the co-efficient of friction between the wheel and the earth is very high, and it is customary to increase it greatly by putting studs in the treads or bars across them. There is no difficulty in using high unit pressures and small wheels on dry earth, but a small wheel will soon dig itself in on soft going. Here we see the advantage of large diameter as compared with great width, for the big wheel will roll out of a deep hole that might engulf a smaller one. Getting a tractor weighing 4 or 5 tons out of a hole in a soft field is somewhat of an undertaking if another machine is not on hand to do some towing.

Really for wheel diameter and width little more can be done than to refer to current practice and then experiment, but a good deal can be done in utilizing the weight of the engine and transmission to better advantage. In the diagram, Fig. 1, suppose that the driving wheel has a center O and that the drawbar pull P is applied at radius r. Then, if there were no other wheels, but the power plant had all of its weight on the one axle O, obviously it would have to be located back of the axle with the center of gravity at W, so that $Wr1 = Pr$.

If the weight is further forward and there is a front wheel to support part of it, the effect of the P is to throw a reactive pressure on the front wheel. In Fig. 2 obviously $Pr + Wr1$ must equal $pr2$ where $r2$ is equal to the wheelbase of the machine. In Fig. 3 we have the steering wheel behind, and then the effect of the pull P is to lift the rear wheel; when $Pr = Wr1$ then $p = O$.

We can thus say that we are utilizing the weight best when it is back of the driving axle, but if it is in this position it must be a good way back so as to maintain enough pressure on the steering wheel to give a grip and prevent the wheel from being lifted off the ground. Even then striking a stump might cause the whole mass of the tractor to revolve around the axle.

If the weight is in front it is not being utilized to best advantage, but we have safety and can be sure of steering grip. If the weight were right over the rear axle so that it was balanced there with no drawbar pull, we should have the condition of $r1$ equaling O which is the best compromise. Here again it must not be completely balanced or there will be no steering grip when the tractor is running by itself and no stability to prevent it turning backward around the axle should the front wheel strike a bump. Therefore the conclusion reached is that the best place for the center of gravity of the engine, transmission, etc., is just sufficiently forward of the driving axle to give steering on the front wheel.

From this elementary bit of mechanics it is possible to see where the caterpllar scores with its small wheels, for small wheel diameter means that the radius r is also very small. If we could get r down to O, the pull P does not disturb the balance of the weight in the slightest. It also follows that

the larger the wheel the more difficult it is to find the best place for the center of gravity, to suit all conditions and without wasting weight that might be utilized in obtaining tractive effort. There appears to be something in favor of a four-wheel layout with two driving wheels and two steering wheels, one in front and one behind. Here the weight could be poised so as to have the best effect at the maximum drawbar, and one or other of the small wheels would balance the machine under other conditions. There is no doubt, though, that three or four wheels with the steering in front and the center of gravity a little forward of the driving axle makes a quite satisfactory compromise.

In practice there is a very great deal of variation, and it is impossible to escape the conclusion that not all tractor engineers have given this question of weight distribution the attention it deserves. As long as there is enough weight for driving and steering every additional pound is dead weight, costing many dollars a year to carry about and something in first cost. In most cases the wheel size necessary will force the wheels to be fairly heavy in themselves and the rest of the machine should only add just enough more weight to bring the total up to the amount of the maximum drawbar the machine can exert.

Turning to a matter of detail, it is noteworthy that the suspension form of wheel is greatly used for tractors, though the tangent spoke principle has apparently been neglected. If a wheel is to be a tension wheel it can be built lighter for the same strength if it is on the tangential spoke principle.

Improving Wheel Tread

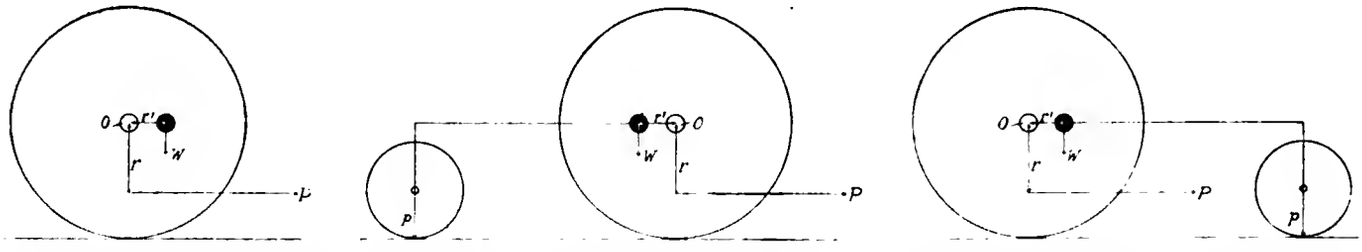
A wheel detail that seems capable of improvement is the method adopted for attaching the bars or studs to give traction on softish dirt. If tractors with studded wheels are run on macadam or other hard roads the destruction caused will be indescribable, yet the farmer wants to be able to use his tractor on road or farm. Thus it ought to be easy to change from the field tread to a smooth tread quickly. Many tractors have angle iron tread bars about 12 in. apart all around the driving wheels, each being attached by two or three bolts and nuts, to remove which would be three hours' work or more for one man. Similarly the studs often employed are each fixed individually. There ought to be some way of applying the whole rough tread for field work in two or three sections per wheel, so that the tread could be put on or removed in minutes instead of hours. There is no great mechanical difficulty to be overcome and such provision would meet the road destruction question before it actually arises; surely this is well worth while.

A way of fitting a rough tread which suggested itself to the writer and seems to have some possibilities, would be to make the tread in sections say a foot long, the sections being linked together by hinge pins so that the whole tread made a kind of chain. This could be laid on the ground flat and the tractor driven onto it, then the ends could be lifted up and the tread tightened on the wheel by some sort of turnbuckle which would cause it to grip. Probably some driving catches or dowels would be necessary at several points on the tread, to prevent the wheel tending to turn within it. Even if this suggestion is not practical, and very likely it is not, there ought to be some equally simple method that could be developed.

A typical four-wheel tractor with the weight well forward of the driving axle

At present all the two-wheel drive machines have a differential, and they could not be operated without one, but there is a prevalent opinion that a differential lock is an essential attachment, and that few tractors will be made without this in the future. Considerable interest is being taken by tractor men in the various differential gears that have recently come to the front and have the power to prevent the spinning of a wheel that loses traction. If one of these works out satisfactorily in tractor service it can have the whole tractor market, and the makers of such differentials would probably find it well worth while to make a special bid for this large and growing field.

Automatic steering has been sought on a good many of the small tractors, the idea being to allow the driver to relinquish the wheel in order to attend to his plows. Steering in such case is effected by a small wheel that runs in the furrow, while plowing, and has a link connecting to the steering gear at some convenient point. In the field these devices appear to operate very well indeed, and, even if two men are working together, there is no object in compelling one of them to hold the steering all the time if that is not really necessary. The additional amount of mechanism is small, the cost negligible and the added weight also too small to be of any account, so there is no obvious reason why automatic steering should not be used even more extensively than it is. Of course, it is more readily applicable to a small machine where the amount of force needed for steering is small than to a big machine.



Left—Fig. 1—With a driving wheel center O and drawbar pull P applied at radius r, all the weight of the power plant being on the one axle, the center of gravity would have to be behind the axle at W. Center—Fig. 2—With the weight farther forward and partly supported by a front wheel the pull P throws a reactive pressure on the front wheel. Right—Fig. 3—With the steering wheel behind pull P tends to lift the rear wheel

Temperature Control Will Be Elaborate

Need for Different Temperatures in Different Parts of Automobile Engines Will Lead to Many Automatic Devices is Opinion of Detroit Meeting

C. F. KETTERING, the man who held the rapt attention of the S. A. E. for a whole evening while he lectured on scientific matters on the Noronic last June, started a wonderfully interesting discussion at the opening meeting of the Detroit section of the S. A. E. on Sept. 14. He read no paper, nor did he speak from notes, but simply talked for an hour on the problems of temperature control in automobile engines, citing the difficulties and hinting the methods by which they may possibly be surmounted.

The conclusions reached after the lecture and the discussion were that heavy gasoline would compel temperature control on automobile engines, and that such control would probably extend beyond that of the water temperature alone. Engineers were started along the line of thought required to bring definite results, and a whole field of necessary investigation was opened up.

The conclusions were indefinite, that is to say no participator in the discussion could say just what ought to be the temperatures of different parts of an engine; perhaps the most immediately interesting part of the proceedings were the remarks made regarding the problem of starting from cold, C. F. Kettering suggesting the use of electricity and Howard Marmon the employment of a burner or pilot light to bring the carbureter and cylinders up to proper operating condition. The drawbacks of over heating were given attention as much as those of under heating and it is safe to say that hardly a man of the large roomful present but went away with his mind set on a problem he had so far considered in only a cursory sort of a way.

Heat for Vaporization

Kettering began by pointing out that a certain amount of heat is necessary for vaporizing any liquid fuel, that an engine burning so many gallons of gasoline per hour requires so much heat to be taken from somewhere in order to vaporize that gasoline; a perfectly definite quantity independent of anything else.

Kerosene requires more heat than gasoline, of course, but the amount needed is still constant for a given bulk of fuel. With light gasoline, like we used to have, the heat could be taken from the atmosphere over a wide range of air temperatures. But this is no longer the case. We must get extra heat from somewhere. Electricity, the ideal form of energy for easy control, was out of the question, far too much heat is required to vaporize heavy gasolines. Also we are now wasting about 50 per cent of the total thermal value of fuel in the cooling water and another 40 per cent in the exhaust gas, so we have only 10 per cent left and do not want to use any of this for vaporizing the fuel. We may either take from the waste heat of the water or of the exhaust for that purpose.

Later on in his discourse Kettering mentioned that electrically derived heat might be used for heating up a carbureter previous to staring, that is, before exhaust heat was available.

Ill Effects of Condensation

There are bad effects through not heating the intake gases sufficiently, effects that may cause actual damage to the engine. In a heavy gasoline, such as is being sold to-day, there are still some light fractions, added to bring down the gravity of the whole. In starting, or in running with an intake that is too cold, these light fractions are vaporized by the heat of compression and burnt out of the gas mixture during combustion, leaving the heavy fractions partially unconsumed.

This action causes a condensation or deposit of heavy kerosene which dissolves in the lubricating oil, thinning it and reducing its lubricating properties, and long continued running with this action going on will certainly cause cylinder and bearing wear. (This has been found to be particularly true with tractors running on kerosene, and for such machines it is recommended that all the oil in the engine be thrown away after 10 or 15 hr. running.)

Running on Half Throttle

A similar effect is obtained by running on half throttle, as most cars are driven most of the time. The depression in the intake caused by the throttling causes wet deposits of fuel to be made in the intake passage; these get into the cylinder and the evil effects of the heavy fractions are noticed. The only way to prevent this condensation is so to heat the manifold that it will supply enough heat to the fuel to keep it in gaseous form. The fuel must not only be made into a gas while in the carbureter, but must be kept in gaseous form while passing through the manifold into the engine.

Granting that once the engine was well warmed up it would run on quite heavy fuel, as long as proper heat for vaporization was supplied, Kettering turned to the problem of what constituted a fuel on which a start could be made from cold. He stated that, at normal air temperature, a fuel consisting of 1 qt. of 60 Baumé gasoline mixed in 5 gal. of 46 to 47 Baumé kerosene would enable starting to be performed, the light fraction doing all the work till heat was available to warm the carbureter and manifold. Such a mixture is just about the equivalent of 54 Baumé gasoline.

A method of supplying heat that has been tried and may have some usefulness is to warm the bowl of the carbureter, heating the fuel till its specific gravity is reduced to the desired Baumé. This, however, is not the equivalent of supplying heated air, as the warmed fuel can only hold enough heat to provide a small portion of what is required for total vaporization. Thus we want hot air, but not too hot because by decreasing the density of the air we reduce the weight of air and fuel that the cylinder can draw in, and so cut down the power possibilities of the engine.

Water Heat Insufficient

To get proper vaporization under all circumstances with heavy fuel it is not enough to control the temperature of the water in the cylinder jackets. It will be necessary to control the temperature of the fuel itself and also of the air entering the carbureter, if we are to get ideal results. The kind of thermostat now being employed for water control is very powerful, though small in size it can exert considerable pressures and could be used for operating all sorts of mechanisms, so there ought to be no very great mechanical difficulties in the way.

The use of a mechanism to control water temperature for

internal combustion engines is not new, as long ago as 1885 a device had been patented for use on stationary gas engines which had as its purpose the maintenance of a constant jacket temperature. Other inventors had followed, the designs growing simpler and more effective, so it is rather remarkable that it is only recently that any attention has been given to this matter in the automobile field.

J. G. Vincent, Packard Motor Car Co., opened the discussion by saying that he had 2 years' experience of thermostatic control of cooling water and his work had shown him that there were slight differences in effect, according to where the thermostatic valve was placed. With the thermostat at the bottom of the water system it controls the temperature of the water entering the cylinders, but when placed at the top of the radiator it controls the temperature of the water leaving the engine jacket. While there might seem to be little difference, there is really a good deal.

Under normal operating conditions the amount of difference is small, but in cold weather the engine with the thermostat controlling the outlet from the cylinders where the water goes into the radiator, there is a considerable difference in the time taken to warm up the cylinders to proper working temperature.

Thermostat Operation

With the bottom position for the valve and thermostat it was set to close at 115 deg., and to open at 125, keeping the water at the bottom of the engine jackets at about 120 deg. What will then be the temperature of the water as it leaves the jackets at the top is variable, depending upon the weather.

On the other hand, if the thermostat and valve are at the top, so that the valve controls the outflow from the engine, then it would be set to open at between 160 and 170 deg. Until this temperature is reached no water can escape from the jackets. As the water grows warmer it rises into the cylinder heads and is trapped there till such time as the thermostat opens the valve.

Thus with the thermostat at the top the temperature of the cylinder head cannot be less than the required amount, but when the control is at the bottom the water in the heads may be too cold. Furthermore, with the top position the water cannot get any hotter than the set point (160 to 170 deg.) while it may get too hot if we control the bottom part of the system.

The engine warms up much quicker with the valve at the top, and tests showed a Packard engine would come up to working heat in 1½ min. with zero atmosphere. Vincent called attention to the fact that the valve must be tight if it is to be of any use.

Radiator Shields Alternative

Several Detroit manufacturers are now trying out a device consisting of a number of shutters mounted in front of the radiator which can be closed or opened by the action of a thermostat. Mr. Lewis, the Detroit Motor Appliance Co., interested in this device, called attention to the fact that it nullified the effect upon the water in the radiator of varying wind conditions. He allowed that heating up after starting would be slower when the whole body of water has to be warmed but thought there were advantages in having the radiator kept automatically from becoming too cold. A. P. Brush, who spoke later, also pointed out that one desirable effect of a constantly warm radiator was to heat the air which the carbureter was taking in, and so utilize some of the heat wasted in the water for performing a desired function.

A. Ludlow Clayden, THE AUTOMOBILE, spoke concerning the effect upon the problem of intake gas velocities. In attempting to carburate heavy fuel we have only the atmospheric pressure of 14.7 lb. per square inch to drive the air past the nozzle and so atomize the fuel. As atomization becomes more difficult carbureter makers are cutting down the size of choke tube so as to increase the velocity past the nozzle, and this increases the depression in the manifold and so aggravates the trouble of condensation.

Gas Velocity a Factor

Particularly in using kerosene it is noticeable that we require more heat for the intake manifold at low throttle, when less is available, and less heat at high throttle, because the tendency to recondense after atomization is increased as the depression in the manifold is made greater. It would therefore seem that there might be good reasons for controlling the amount of heat given to the manifold in proportion to the speed of the gas passing the carbureter nozzle.

He added that electricity seemed to be the ideal energy supply for warming up for starting purposes, and asked Mr. Kettering if the amount needed to warm the bowl of the carbureter sufficiently would be too heavy a demand on the battery. This question was afterwards answered to the effect that the current required would be some 30 amp. for about 2 min. duration and therefore not beyond a battery's capability.

F. O. Ball, Ball & Ball Carbureter Co., stated that he had made some inconclusive experiments with integral intake and exhaust manifolds and was continuing these in the endeavor to discover what the intake temperature ought to be.

K. W. Zimmerscheid, General Motors Co., said that we were always likely to forget that gasoline and air must be mixed by weight and not by volume and that when we heated either, so altering its specific gravity, we upset volumetric metering set for different temperatures. He considered 170 deg. the ideal water jacket temperature and thought 140 deg. about the right temperature for an intake manifold. In arranging for heating the air taken in, the fact that we had to start with cold air must not be forgotten. He considered the best temperature for the entering air would be 120 deg. The fuel ought to be kept at a constant temperature. If the carbureter were insulated from the cylinder block by some nonconducting material it would be easy to control its temperature by means of a thermostat, using an individual water jacket for the instrument. Possibly a carbureter maintained at 120 deg. and an intake manifold at 180 deg. would be correct.

It was also desirable to prevent the temperature of the oil from falling too low. There is always risk of getting water in oil through condensation of the products of combustion that get past the rings and pistons. Probably this water passes the pistons in the form of steam, and, if the crankcase is warm, it will not condense, perhaps, but will have a chance to escape through the breather.

Howard Marmon, Nordyke & Marmon Co., said that the starting trouble was one of the worst the industry had had to face. He found himself wondering whether the simplest solution of the difficulty would not be to use a blow torch or pilot burner playing on the manifold and carbureter to warm them up to working temperature. A. P. Brush, Brush Engineering Assn., who followed, mentioned that small quantities of light spirit would always be available, and it would be comparatively simple to use a small tank of good gasoline to start and warm up, switching over to the heavier fuel when the desired temperature had been attained.

Power of Thermostat

D. McCall White, Cadillac Motor Car Co., said that E. E. Sweet of his company began experiments in 1907, and it was his tests that led up to the adoption of the thermostat by the Cadillac company. He gave several tabulations showing the characteristics of the thermostatic unit they employed. The following table shows the amount of expansion at different temperatures:

(*Continued on page* 482)

Truck and Tractor Engines—Part III

Water Pumps and Engine Cooling—Governor Design a Difficult Problem But Essential—Engine Lubrication—Application of Tractor Engines—Liberal Allowances Necessary

By H. L. Horning
Engineer and General Manager Waukesha Motor Co.

¶EDITOR'S NOTE.—This is the concluding installment of the paper Mr. Horning read at the third quarterly meeting of the Midwest section of the Society of Automobile Engineers held in Milwaukee, Wis., Sept. 1. Previous installments illustrated the differences in the demands on engines for trucks and tractors, outlining some of the more serious problems the engineer has to face in meeting them.

COOLING passenger-car engines sometimes is a serious problem. Cooling is the greatest problem in tractor engines. There are so many variables that little reliable information can be given as to water circulation or radiator capacity. Each individual case seems to require its own treatment. A tractor may be sent to Alberta or to Texas, and the extreme conditions determine the radiator capacity as well as the water pump.

The following limits may serve as a rough rule for water pump capacity:

$$G = \frac{B.H.P.}{V} \qquad (5)$$

In which G = gal. per min. water pump discharge through outlet to waterjacket.

V= Variable depending on engine and radiator design. For poorly designed combination V = 3.5. For a very efficient design V = 4.5.

There are some tests being run by a well-known company on the capacity of different type radiators and fan designs for tractor service which will be available soon, and which will constitute the only complete information available.

Manifolds

The only change manifolds require for truck or tractor service is in the intake, which should be smaller than usual, due to the low maximum speeds of engines and to the poor quality of fuel. The following formula for truck or tractor intake manifolds on egines up to 5-in. bore results in gas velocities which give good results for engine speeds encountered in these services and are correct for the poor gasoline and kerosene service:

$$I = 0.3\ B \qquad (6)$$

in which I = core diameter of intake manifold. Exhaust manifolds outlet cores have diameter corresponding approximately with the following formula:

$$Ex = 0.5\ B \qquad (7)$$

Governors for Truck and Tractor Engines

Governors must be installed on trucks primarily to prevent them from racing. Truck users have found governors useful to maintain the maximum speed of the trucks so as to give the driver both hands and feet for driving on straightaway work. It has been found that constant-speed governors help to keep up the maximum speed of the truck or make a truck average more miles in a day.

Governors for tractors are constant-speed type and usually are of the flyball design, which act directly on the butterfly throttle.

By far the most satisfactory arrangement for governors is to build them into the engine and to have them lubricated by the engine lubricating system.

Time will not allow a discussion of governor design other than to say that it has been the most difficult phase of truck and tractor engines, with which the writer has had to contend, and yet the most essential. Experience indicates that the flyball type is the most practical and easily understood by the average user and any form of this should prove satisfactory if built with ample bearings and wearing parts. Experience is such as to indicate that the butterfly is the most difficult form to use while being the easiest to manufacture.

A paper before this Society on governor forms, in the writer's opinion, is the best that has been written.

Lubrication of Truck and Tractor Engines

Generally speaking, the difficulty in lubricating tractor engines efficiently is second only to lubrication of racing engines. They are operating between the speed of maximum torque and maximum economy, a range in which the greatest heating occurs, which is directly responsible for most failures in tractor lubrication. What is true of tractor engines under 50 hp. applies with equal weight to truck engines.

Lubricating systems for both services are no different than found in passenger-car service with the exception that greater care must be taken to insure an abundance of oil at all times and to see that the system is such that if one point fails other parts will contribute oil to prevent sudden failure, but not sufficient for extended service.

To illustrate, one engine is equipped with a lubricating system that is so designed that if one connecting-rod pocket fails to get its oil, the adjacent rods supply enough to spread the development of a knock over 2 days' time so that it can be heard and corrected before full failure. Most oiling systems fail so quickly at one point that there is no chance to catch the failure in time. Truck engine bearings fail for lack of proper oil and from the above cause. Successful lubrication of heavy-duty engines imposes two functions on the oil.

First, to make an oil film between wearing surfaces.

Second, to act as a conveyor of heat. As the duty of an engine increases it is hard to tell which is the most important. The writer thoroughly believes in the great benefit derived from a large quantity of oil washing the heat from the lower part of the cylinders and crankcase into the lower pan, where design should promote dissipation of this collected heat.

The importance of an abundant screen area for very thoroughly straining the oil becomes of great importance in heavy-duty work.

Geared oil pumps have been found to be the most satisfactory and dependable in service; the only points where they fail is in leakage of oil, both internal and external, and being not sufficiently large for the service.

Proper lubricating oil for heavy service seems to be one important insurance for long life.

The following general classification of oils manufactured by leading oil companies seems to fit the requirements and is given here rather than a scientific statement of oil characteristics. Oil companies produce oils graded as follows:

Light.
Medium.
Heavy.
Extra heavy.

Whereas most automobile engines will thrive on light oil, truck engines require medium and tractor engines require medium-heavy and extra-heavy. Truck engines run well in winter on light oil and operate best in summer on medium. Some tractor engines operate in winter, spring and fall on medium and in summer, heavy oil. These are the smaller tractor engines which do not have the piston clearance nor do they get as hot generally as the large engines which operate in winter, early fall and late spring on medium and summers on heavy or even extra-heavy.

In burning gasoline, engines do not usually get as hot as when burning distillate or kerosene. If an engine operates well at any one season on one grade or weight of oil while burning gasoline, it will operate better with a heavier oil burning kerosene. Full force-feed systems can use heavier grades of oils than splash systems.

There is still another reason for heavier grades of oils in tractor service or when burning kerosene which has been mentioned before under crankshaft specifications, namely the dilution of the crankcase oil due to loss of mixture past the rings. Two days' service using the same lubricating oil while burning either gasoline or kerosene will result in heavy dilution of the crankcase oil.

One instance comes to the writer's mind in which, after a day's run, there was a greater quantity of oil and kerosene in the case at the end of the day than in the morning. In gasoline engines the gasoline evaporates under the best conditions of operation, while kerosene remains. Ten days' service with kerosene without complete change of oil will bring the power of an engine down 20 per cent. In hot weather, the drop will be greater. Frequent renewal of oil or boiling off the lighter constituents before mixing with other oil helps considerably.

Fuel

The most serious problem at this time is the matter of fuel for truck and tractor engines.

The problem of burning so-called gasolines now sold is becoming very serious and the further the situation develops the greater necessity there is for starting on one fuel and running on another. This leads to the question of burning straight kerosene.

The writer has produced and put in service engines of the regular truck type for burning kerosene in tractor work, and probably has out 2600 kerosene-burning engines, some having run for 3 years. The following conclusions regarding kerosene burning can be drawn:

(1) In tractor service where the load range is within 50 per cent of full load, kerosene can be used with reasonable satisfaction by the use of properly proportioned combined intake and exhaust manifold, the starting to be made on gasoline.

(2) Under these conditions the loss in volumetric efficiency due to heating the intake charge results usually in a loss of 10 to 20 per cent in the maximum horsepower output, whether gasoline or kerosene is used.

(3) Where speed of engine increases, the necessity for heat in the intake decreases, while when speed decreases necessary heat in intake increases. At full speed and power output, very slight heating of intake will suffice.

(4) Trucks can be made to operate on kerosene by the means mentioned above. One truck has operated one season in a pea harvest on 6.4 gallons per mile on a 2-ton truck equipped with a 3¾ by 5¾ engine. On the same job with conditions as nearly identical as possible and in the same service, the truck made 7.75 gal. per mile on kerosene. On a run of 50 miles the same truck made 10 miles per gallon over city and country roads with gasoline while on kerosene it made 15.25 miles, both figures being for truck running half the distance with pay load and return empty. These figures were made in an attempt to produce the best performance and all figures are given to encourage the hope of progress along this line. The design and applications which were responsible for this performance are being put in commercial shape.

(5) The science and art of burning kerosene as indicated by experience and the results obtained in service are identical with the principles set forth in several papers by Prof. Lucke, and the writer takes pleasure in testifying to the correctness of both the scientific and practical conclusions contained in his papers.

(6) *Our experience is that a kerosene engine does not carbon any more than a gasoline;* in fact, stays cleaner than a gasoline engine if vaporization is only comparatively well done.

(7) Where kerosene is well vaporized so that the mixture reaching the cylinder is in a dry state, a kerosene engine with a correctly designed combustion chamber will not heat as much as a gasoline engine.

(8) Experience as to the function of various elements in burning any or all grades of fuel is expressed as follows:

The carbureter meters and atomizes the fuel.
The manifold must vaporize the mixture.
The combustion chamber burns it.

It will save many inventors much disappointment to know that of all the things mentioned above the carbureter is the most perfect for the work they have to do.

The manifolds are next in efficiency.

The engines in their present form are furthest from being able to perform their functions in attempting to burn kerosene.

The development of kerosene burning in engines of the prevalent types must start with the engine and end with the carbureter.

Application of Tractor Engines

While a definite knowledge of transmission and tractive resistance losses are necessary in order to make a rational design, engines are generally applied based on broad considerations. The average light tractor will show a draw-bar horsepower of 60 per cent of the brake horsepower of the engine. A poor tractor and design will deliver only 50 per cent, while the best never exceeds 70 per cent, and this figure is doubled by good authorities. The above performances are based on the tractor operating on good solid dirt footing.

Plows require a draw-bar pull from 300 lb. apiece to 1200 lb. This is for a 14-in. mold-board plow cutting 14 in. wide and 8 in. deep. An average would be 600 lb. per plow. The average day-in and day-out plowing is done at 2¼ m.p.h., which is practically 200 ft. per min. If, therefore, we solve for horsepower necessary to get

$$\text{Hp.} = \frac{600 \times 200}{33{,}000} = 3.6 \text{ Hp.} \qquad (8)$$

$$\text{or } \frac{3.6 \times 100}{60} = 6 \text{ brake Hp. average.} \qquad (9)$$

For average service it requires 6 brake hp. per plow or 1 hp. for every 100-lb. draw-bar pull at 2¼ m.p.h. Using the figures as given above, it will be easily seen that the maximum requires just twice the average and the minimum, one-half the average. Twelve brake hp. per plow for maximum plowing conditions would therefore be correct. A great many tractors are based on these figures, which are considered conservative. The most efficient tractor in the writer's

experience allows only 6 brake hp. per plow but can handle only 800 lb. draw-bar pull or 4800 lb. for six plows at 1.7 m.p.h. Where this tractor is operated in 1200 lb. soil, it immediately plows very shallow or drops down to four plows.

Allowing a brake M. E. P. of 85 lb. per sq. in. as a working pressure and a piston speed of 1000 ft. per min. as a high working average, and figuring a tractor speed of 200 ft. per min. we then have a ratio of 5-1 for piston speed to tractor speed and our equation for draw-bar pull figured from the bore would be as follows:

$$D.B. = \frac{0.7852\ B^2 \times M.E.P.\ Ps \times E}{100\ Ts} \qquad (10)$$

In which D.B. = Tractor draw-bar pull.
M.E.P. = Average working pressure on piston.
B = Bore of engine in inches.
Ps = Piston speed.
$E = \frac{\text{Tractive Hp.}}{\text{Brake Hp.}}$
Ts = Tractor speed in ft. per min.

This formula points out the desirability of high working pressure in the cylinder, higher piston speeds and the influence of tractor efficiency and design on the size of the engine. It also calls strong attention to the fact that the high tractor speeds mean great cylinder size.

Inserting in equation (10) the various values ascribed above we simply with E = 70 per cent to

$$B = \sqrt{\frac{D.B.}{234}} \qquad (11)$$

and with an efficiency of 60 per cent

$$B^2 = \sqrt{\frac{D.B.}{194}} \qquad (12)$$

We have seen that it requires 1200 lb. maximum draw-bar pull efficiency and design on the size of the engine. It also calls strong attention for each plow. If we desire to know the bore of a four-cylinder engine necessary to pull the plows under the average conditions at 2¼ m.p.h., we substitute the 1200 lb. value in the equation (11) as follows:

$$B = \sqrt{\frac{3600}{234}} = 3.9$$

with an efficiency of 60 per cent

$$B = \sqrt{\frac{3600}{194}} = 4.3$$

The most frequently used engine for a three-plow tractor has a 4.25-in. bore. Tractor engine speeds have been determined mostly by what experience has shown to give endurance. Investigation has proven that the bore seems to have quite an influence on speeds, as well as the development of the art. The following formula expresses the speed of tractor engines in terms of the bore:

$$S = \sqrt{\frac{3{,}000{,}000}{0.04545\ B^3}} \qquad (13)$$

In which S = Revolutions per minute.
3,000,000 = A variable depending on manufacturer or development of the art.
0.04545 = Constant.
B = Bore in inches.

The formula holds good for 3¼-in. bore to the very largest sizes, even 9-in.

It is obvious that the factor 3,000,000 cannot hold for all engines of any manufacture, but it gives merely an average.

Life of Engine Parts

The piston speed of 1000 ft. per min. is higher than the old line manufacturers use, their practice being to limit piston speed to 800 ft. per min. While this most certainly results in longer life it is doubtful if this low figure is necessary with the efficient engines of to-day. The piston speed does not in itself determine the life of the engine parts. The engine endurance is more dependent on the square of the r.p.m., weight of reciprocating parts and above all on the efficiency of cooling and lubrication.

Tractor Applicable to Stationary Work

Engines on tractors are used for stationary work, such as running a grain separator, etc. The following formula is derived from service conditions:

$$D = 17\ C \qquad (14)$$

in which D = Displacement of the engine in cubic inches.
C = Size of cylinder on separator.

This assumes power feeds and wind stacker, or what is known as modern attachments on the separator.

General Conclusions

Within the scope of a paper it would be impossible to go very deeply into the science of internal combustion engineering. What has been written has been merely the attempts to answer in a general way the common daily questions that an engineer is called on to answer.

The writer has come to look on the building of engines from the following standpoints:

1—To generate quickly and to utilize all the heat that is possible to produce power.
2—To eliminate the greater part of the heat so as not to interfere with practical working conditions of the structures.
3—To maintain lubrication, an art not generally understood, the development of which is but beginning, and yet the art that makes engines possible.
4—To produce an engine which will not tear itself to pieces, or, in other words, will endure its own stresses, both dynamic and thermal.
5—To make such liberal allowances in design that engines will operate in spite of their neglected upkeep.
6—To get more out of given displacement by increasing the working mean effective pressure and to improve the details, so higher engine speeds can be used without reducing the life of a motor or satisfactory service.

This constitutes ideal progress and is the only way progress can be made.

—

Temperature Control Will Be Elaborate

(*Continued from page* 479)

Temperature	Expansion
150 deg.	0.101 in.
160 deg.	0.202 in.
170 deg.	0.250 in.
175 deg.	0.250 in.
200 deg.	0.254 in.

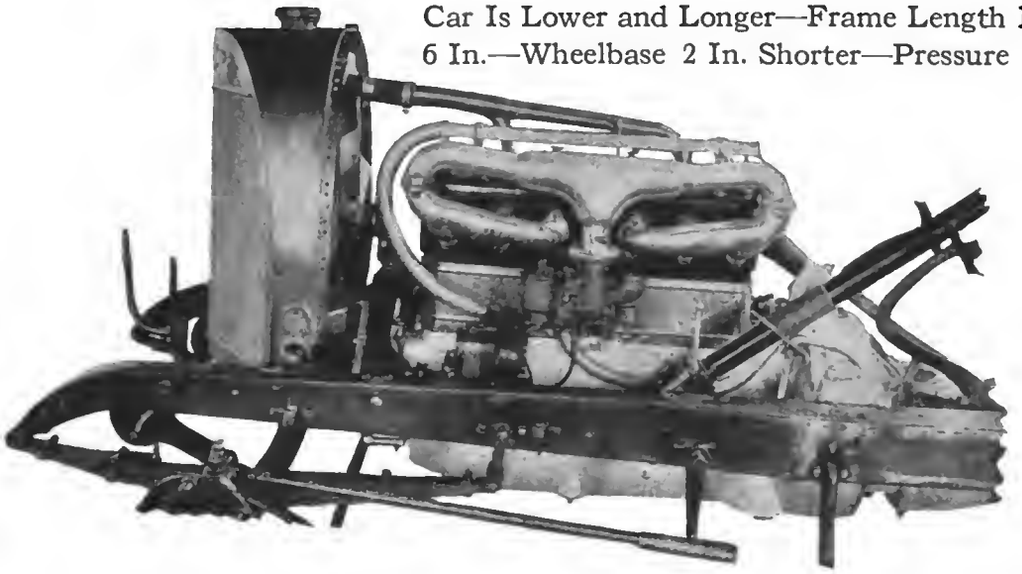
He said that he had tried running at boiling point and found the revolutions increased 150 per minute, while the power went up also, but piston expansion caused a drop again after a short period of running. Regarding the mechanical power of the thermostat unit it was as follows:

Temperature	Pressure Exerted, lb.
70 deg.	Closed
90 deg.	1
110 deg.	2.5
130 deg	3.5
170 deg.	9.5
190 deg.	14.5
190 deg.	21.0

Concerning the effect of the thermostat he tried taking a car from a room at 60 deg. and starting out in weather 8 deg. above. With the thermostat the carbureter was operating properly after 2.9 miles running with the water temperature in the jackets at 110. The same experiment was made without the thermostat and the carbureter was still popping back and misbehaving after 12 miles running.

Aluminum Alloy Pistons in Singer

Car Is Lower and Longer—Frame Length Increased 6 In.—Wheelbase 2 In. Shorter—Pressure Oil Feed



Intake side of the 4 by 5½-in. six-cylinder engine used in the new Singer

ALUMINUM alloy pistons are the most important innovation on the Singer six for 1917. This car, which sells for $3,500, is entering its third year of production with very few changes of a fundamental nature. There are, however, a number of detail improvements which have rendered the car, as a whole, lower, of slightly better characteristics at high speed, and more nearly perfect in suspension and control.

Car Is Longer and Lower

Magnalite has been selected as the material to supplant the cast-iron formerly used in the pistons. The only other engine change is in the oiling system, which heretofore has fed lubricant to the connecting-rod bearings by splash. In the new cars pressure feed, acting at 30 lb. per sq. in., sends the oil positively to the required spots. This has, of course, necessitated a new oil pump.

Structurally, the Singer car is longer and lower, although the wheelbase is shorter. This condition is obtained by an increase in the length of the frame of 6 in. The wheelbase is now 136 in., however, instead of 138 in., giving a greater over-all length on a shorter supporting span. The prime reason for the change in frame length is in a new type of gasoline tank which, instead of being cylindrical, is now of rectangular section. The cylindrical tank was used because it conformed to the turned-over frame-ends which formed the rear tire support. Since a spindle is now being mounted to carry two extra wire wheels, it is not necessary now to curve the frame over, and hence the new form of tank and longer frame.

This increase in frame length has effects which are not confined to the gasoline tank, in that more room has been secured in the body because of the extra supporting surface which is now possible beneath the sills. Not only is the body more roomy in a lengthwise direction, but the rear seat is also wider, having been increased from 45 in. to 47 in. The body is more comfortable also because of deeper upholstery, which is now 10 in., and, instead of tufting, French plating is used in its place. As far as decoration and conveniences go, the body is improved, particularly in the fitting of a mahogany case in the rear cowl behind the front seats.

Throughout the chassis there are several spots which have been improved in detail. The rear springs, for instance, are now flatter under load than they were formerly. In fact, with a fully loaded car springs should be horizontal, and the feature of this which is important to the driver is that the radius of oscillation of the spring is such that the results on the brake linkage are at a minimum; that is, there is no tendency to bind the brakes owing to spring oscillation because of the minimum projected length of the spring variation. The flatter springs, combined with lower bodies, make the entire car 3 in. lower than it was a year ago.

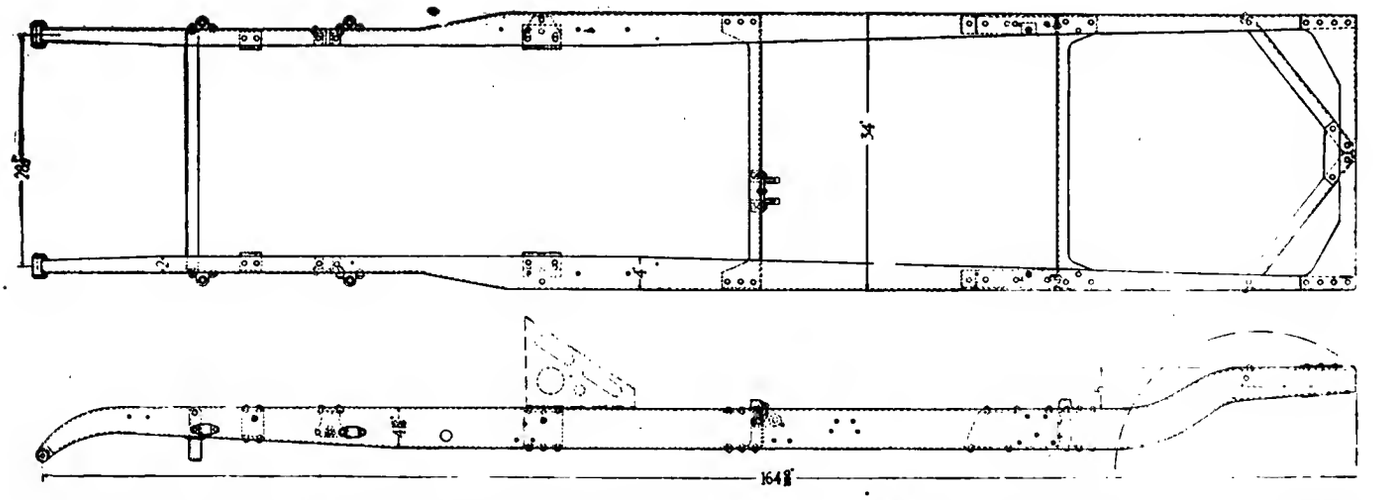
Front Spring Mounting Changed

In the front springs there has been an alteration in mounting. These are parallel to the center line of the car, but are tilted in their own vertical planes so that the forward end of the spring is lower than the rear. This has been done owing to the belief of the engineering department that the shocks are better absorbed in this way. The front spring horn has been made steadier and of greater bearing space to compensate for this change. In addition, the Timken axle, which is used in front, is now the heavy-duty design with full bearing support.

While the torque rod made up of welded Shelby tubing with cross members forming virtual webs is still employed, it is 8 in. shorter. This change has been accomplished by moving the front cross member which carries the support for the forward termination of the torque arm, back a corresponding distance. The result is that owing to the decreased length the torque rod is more rigid. Another change in the rear linkage is in the braking system which used to run continuously from the

Features of Singer Six

Engine	Six-Cylinder
Bore and Stroke	4 by 5½ in.
Formula Hp.	50
Oil Feed	Pressure
Clutch	Dry Plate
Gearset	Four-Speed
Wheelbase	136 in.
Electric System	Westinghouse
Upholstery	10 in.



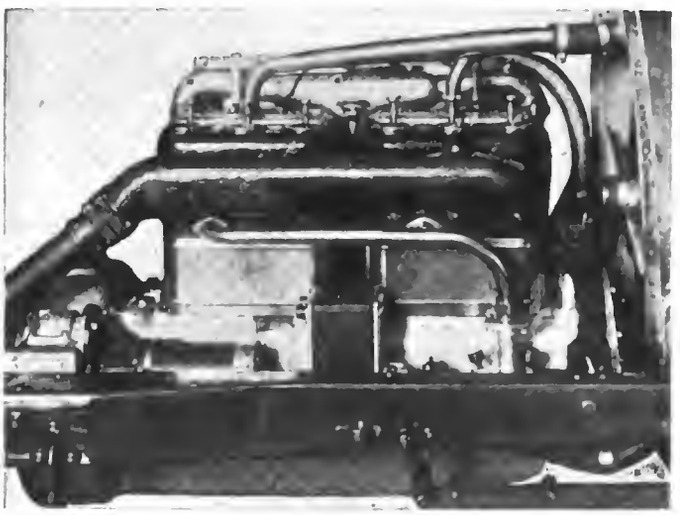
The Singer frame layout is very rigid, the 5-in. channels being well provided with cross members which stiffen it against racking stresses

operating levers back to the brakes. It has now been broken in two, giving a double reduction.

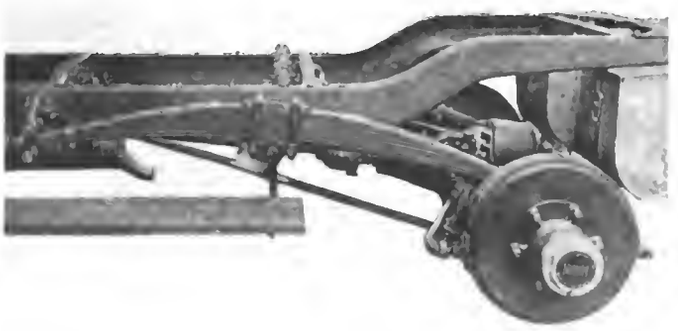
Clutch Easy to Operate

As regards control, the changes are only in detail. There is a longer clutch pedal which has increased the leverage to such an extent that a person standing beside the chassis has no trouble in disengaging the clutch with the hand. The steering gear has been changed and is now a Gemmer.

Fitted to the engine there are three attachments which are innovations for the 1917 model. These are a Rayfield carbureter, a Klaxon horn and a four-bladed cast aluminum fan.



Exhaust side of the engine used in the Singer six chassis



Cantilever rear spring on Singer chassis. This is flatter under load than previous models, making riding easier and also aiding in giving the car a low appearance

The carbureter formerly used was abandoned owing to its difficulty of adjustment, and the simpler Rayfield substituted. As with the other type, this is distinguished by its full hot-water and hot-air vaporizing means.

The Singer power plant is made up of a specially-built Herschell-Spillman engine, a dry plate clutch and a four-speed gearset with direct drive on fourth. While the engine is rated at 50 hp., it has developed in excess of 100 hp. at more than 2000 r. p. m., and with the aluminum alloy pistons there has been an increase in power output due to a higher maximum speed. Probably the most notable point of the power plant is the unique system of manifolding. It is to this that a large part of the power and flexibility is credited. The intake manifold has a sort of ram's horn effect, taking the gases from the carbureter, carrying them upward to the branches of a Y-shaped water-jacketed pipe, from where each branch divides into a loop to the three cylinders. This is clearly shown in the accompanying illustration of the intake side of the engine. While this manifold seems long, it will be noted that throughout a large part of its length it is heated, and, furthermore, it is of large diameter and has no sharp turns. It is stated that a marked gain in volumetric efficiency has been obtained due to this intake system.

Dual Exhaust Manifold

On the exhaust side there is a dual manifold in which each set of three cylinders is taken care of independently, thus avoiding conflicting or overlapping exhaust. The manifold itself is in one piece, but there is a wall between, which separates the flow from each block of three cylinders. The timing is arranged so that the exhaust of two cylinders are never open at the same time.

The engine dimensions are 4 by 5½. The cylinders are T-head, cast in threes, with integral waterjacket spaces closed by caps on the top. The manifolds are separate. The aluminum alloy pistons deliver the power to I-beam connecting-rods of forged steel. Both sets of valves are thoroughly inclosed, giving a clean exterior. The carbureter and magneto are mounted on the left, the latter being a Bosch high-tension instrument with the wire leads carried in conduits to the spark plugs. On the right side is mounted the electric generator and water pump, and also the starting motor. The generator and pump are carried on the same shaft, while the starting motor engages with the flywheel at the rear right of the engine.

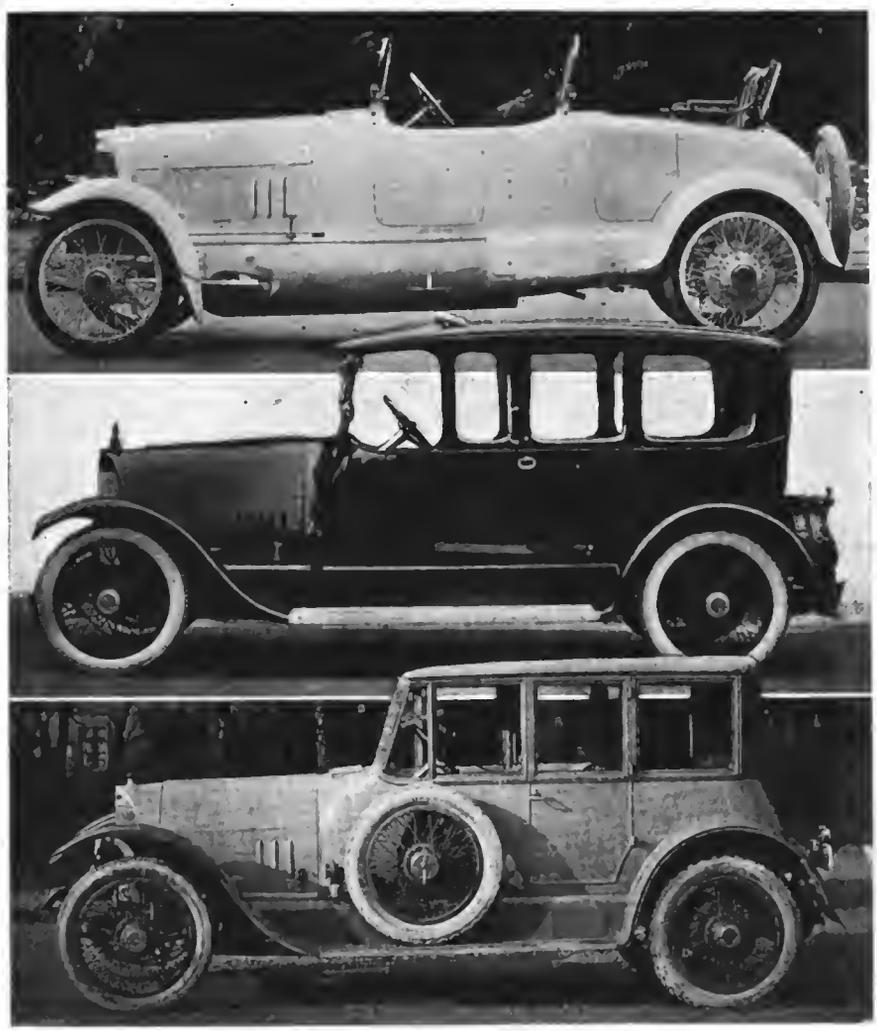
Besides the ignition system, the remainder of the electrical equipment is Westinghouse. There is a two-unit starting and lighting system operated on the single-wire system, and the storage battery is a Willard.

In the new oiling system the gear pump is driven off the

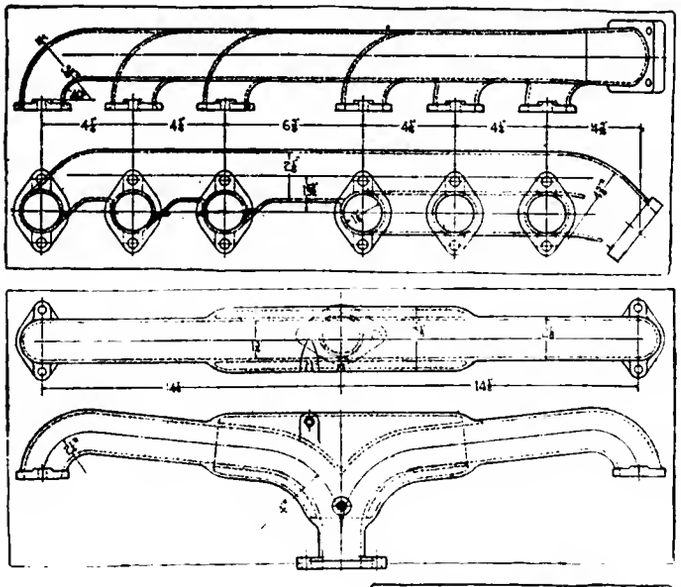
camshaft, and the oil reservoir is in the bottom of the crankcase. The oil is fed under pressure to the main bearings and through the hollow crankshaft to the remaining bearings under pressure. Under ordinary running the oil feed is up to 30 lb. per sq. in., but this will vary according to the work performed by the engine. The oil is recirculated and screened on its course through the lubricating system.

Power is transmitted from the motor to the gearset through a dry plate clutch consisting of steel disks faced with fiber. The clutch is held engaged by a double concentric helical spring, and although this spring is of sufficient strength to hold the car and to guard against slippage on acceleration, the disengagement can be affected by remarkably light pressure on the clutch pedal. This clutch is in a unit with the four-speed gearbox, which is featured by the mounting of the shafting on Timken roller bearings. The shifter mechanism is conventional with the lever mounted on the cover of the gearbox and operating on a ball joint.

Two Spicer universals are used in delivering the car to the rear axle, which is a Timken floating design. The drive is taken through the cantilever rear springs, but the torque is taken care of by a special member assembled and welded together in the triangular form of Shelby steel tubing. The rear axle gears are spiral bevel and provide a ratio on fourth speed or direct of 3½ to 1. The wheels are Houk wire and carry 35 by 5 in. tires, which have been continued owing to the remarkably good mileage experienced with this size.



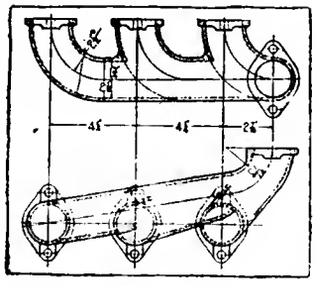
Illustrating some of the body styles mounted on the Singer chassis



Above — Exhaust manifold of Singer six, showing partition which separates the two cylinder sets

Below—Intake manifold, showing waterjackets

Right—Portion of intake manifold which bolts to cylinders



One of the noteworthy features of the Singer construction is in the rigidity of its frame layout. As is conventional practice, the individual members are of channel section with a 5-in. depth of web and 4-in. flanges. The frame is amply provided with cross members, which stiffen it against racking stresses. The cross members are fitted with large gusset plates which give them a capability of withstanding distorting tendencies.

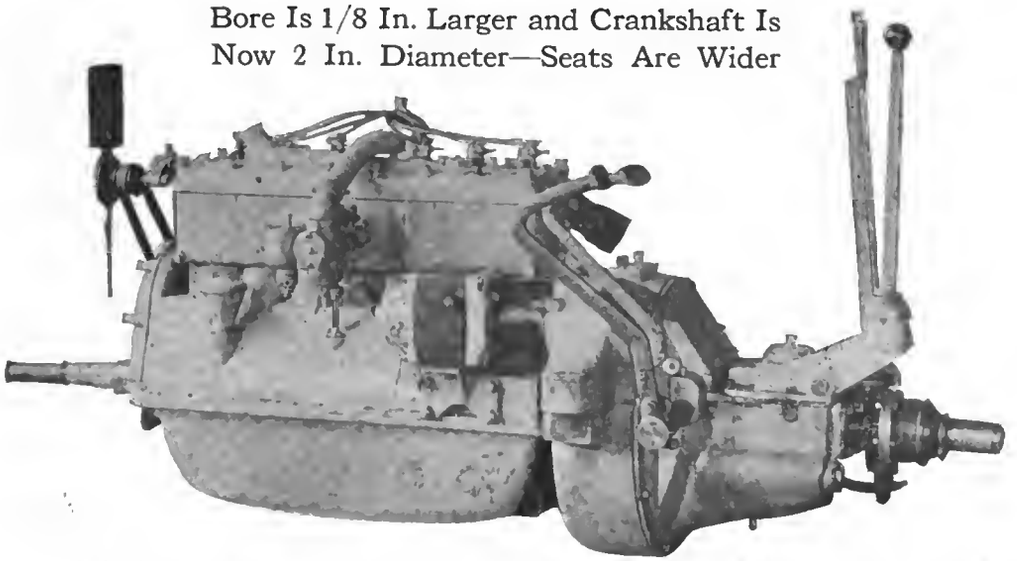
As would naturally be expected with a chassis of this price, the equipment is of the best. The radiator is a V-shape of exceptional size and capacity, and throughout the actual fittings are large and sturdy. The top is a one-man design provided with Jiffy side curtains, and connects with a special built-in ventilating windshield. The car also has a Warner 100-mile speedometer fitted with an electric light, Klaxon horn, 8-day keyless clock, electric trouble lamp with extension cord, tools, jack, power-driven tire pump, etc.

Standard Bodies Made

While the major percentage of bodies for the Singer cars are custom built, the concern is marketing standard roadster, touring and closed bodies. The standard touring design is a seven-passenger type with the Belgian double cowl. The extra seats fold into the backs of the front seats, and above them is located the mahogany cabinet which is an innovation this season. This is made of inlaid wood and is ornamental as well as of practical utility. Any color that is desired will be given the body, so that the purchaser is allowed a very wide latitude in making his selection. The chassis alone sells for $3,000.

New Glide Roomier and More Powerful

Bore Is 1/8 In. Larger and Crankshaft Is Now 2 In. Diameter—Seats Are Wider



Left side of the six-cylinder 3⅛ by 5-in. power plant used in the 1917 Glide, showing the mounting of the carbureter and the starting motor

NO changes of any consequence have been made in the Glide line for 1917. The light 6-40 car is continued with refinements and no additions have been made by the manufacturer, the Bartholomew Co., Peoria, Ill. In general, the changes which have been made in the car are such as to render it more powerful, more roomy and to increase the factor of safety. There have also been a few alterations which would tend toward making the car more nearly silent.

Probably the most notable change is in the engine where the bore has been increased from 3 to 3⅛ in. Another change in the engine is in the crankshaft which has been rendered more rigid by increasing the diameter to 2 in. instead of 1¾ in. Another change in the engine which would tend to make it noiseless is in the use of a Fabroil gear on the end of the camshaft.

While the mechanical changes noted have the most to do with the performance of the car it is also altered to some degree in appearance. One of the improvements is in the rounded cowl which takes away the square effect at the windshield and the latter is especially built to conform with the rounded shape of the cowl and fits exactly to its curvature.

As far as comfort features are concerned a conspicuous feature is the width of the rear seat which is now 47 in. and will accommodate three adults very comfortably. The springs have been lengthened both front and rear giving an easier suspension, the dimensions being now 38 and 54 in. respectively. In general, all the parts and accessory equipment made by specialists have been retained. This includes Westinghouse lighting and starting, Rayfield carbureter, Brown-Lipe three-speed gearset, Spicer universals, etc.

While only one chassis model is marketed the body line is quite complete as the car will be furnished in the regular touring models and with a detachable sedan top if desired. There is also a four-passenger close-coupled roadster in the process of production in which particular attention is stated by the makers to have been paid to the comfort of the occupants of the rear compartment. For instance, by a special arrangement of the footboard in the rear, the passengers have as much room with their feet as those in the front.

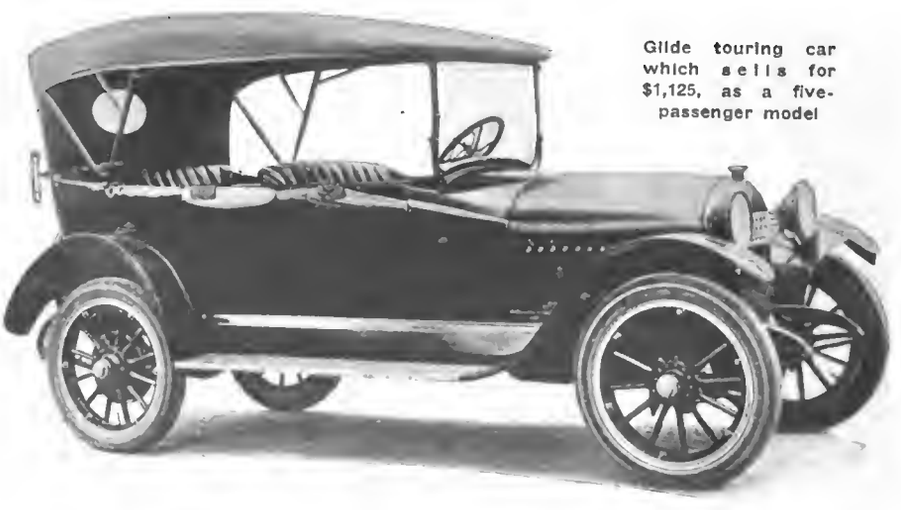
All the improvements in the body can really be summed up in the words, increased roominess. The 47-in. seat is 5 in. wider than in the 1916 car. The front seat is 1½ in. wider than previously. The windshield is 1¼ in. wider and 1½ in. higher besides the alteration in curving it to conform to the shape of the cowl. The top is also new, being a five-bow design with bare top holders and having the rear curtain fitted around the corners of the body to exclude dust. It is fastened to the back of the body by German silver molding.

A unit power plant is employed having block cylinders and three-point suspension. The six cylinders have a bore of 3⅛ and a stroke of 5 in. and are of L-head form with the valves on the right. This is a Rutenber product designed particularly for the Bartholomew company, and is known as model 25.

Three Piston Rings

The pistons are cast iron and are fitted with three separate rings. Two of these are close to the top and the third just beneath the wristpin boss. The wristpin is secured in the boss by a set screw and engages through a bronze bushing with the drop-forged I-beam connecting-rod.

The 2-in. crankshaft is a forging, as is also the camshaft which has a diameter of 1⅛ in. with the cams integral. The shafts are hardened and ground and are carried on plain bearings at the center and front and in an S. K. F. double row self-aligning bearing at the rear. Mushroom type flat



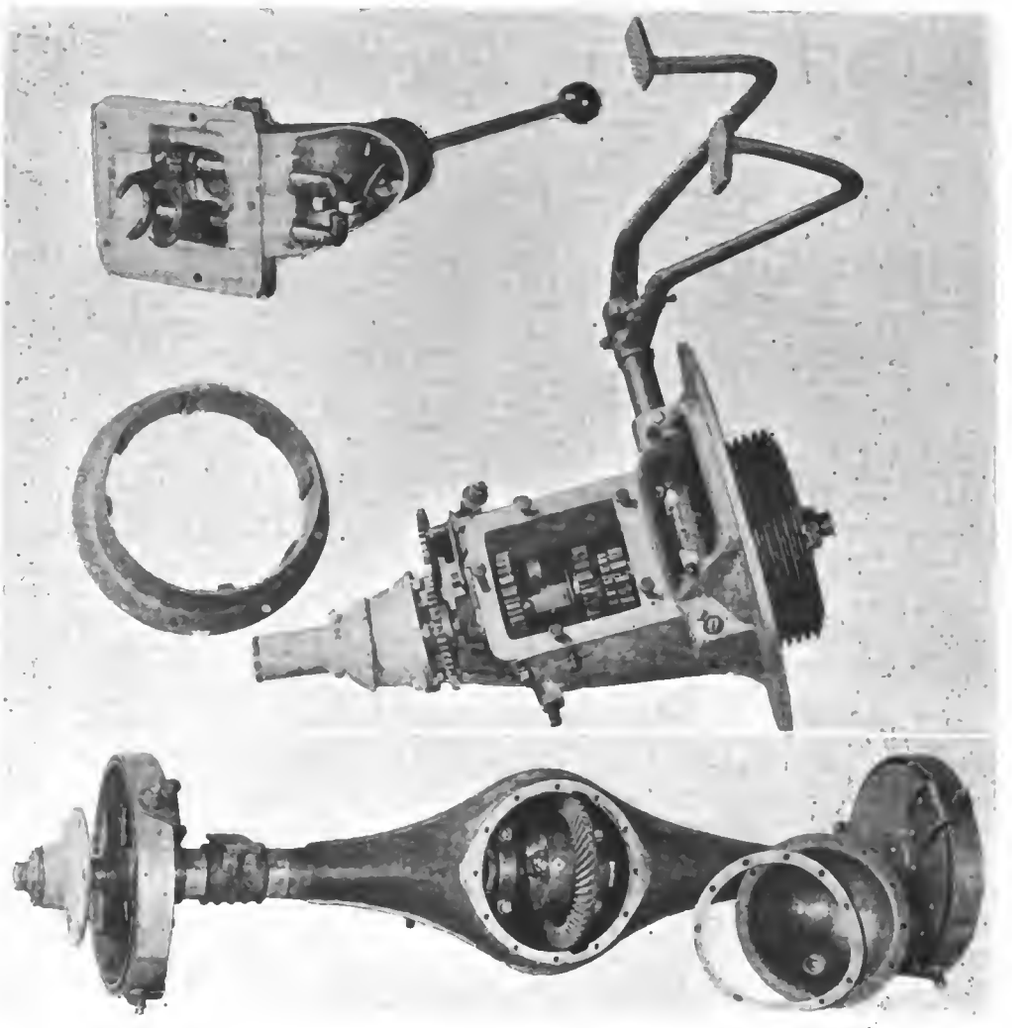
Glide touring car which sells for $1,125, as a five-passenger model

followers take the valve drive. These are offset 1/16 in. to distribute the wear. The valves are made in two parts with alloy steel stems and carbon steel heads. The diameter in the clear is 1 5/16 in. and the lift is 5/16. One of the features of the valve construction is that the brackets, together with the entire lifter mechanism, can be taken from the engine without disturbing the camshaft. This is done by removing the cover plate and stud nuts and then turning the starting crank until the valves are at their lowest level.

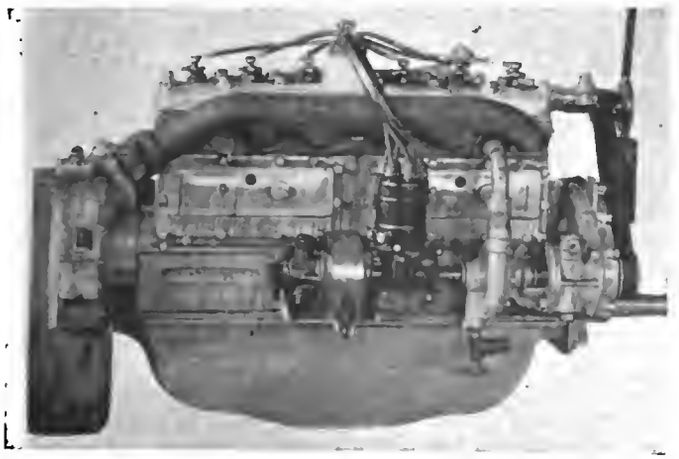
Standard timing is used with the intake valve opening at 15 deg. after top center and closing 50 deg. before bottom center. The exhaust valve opens 45 deg. before bottom center and closes 10 deg. after top center. The compression of the engine is 75 lb. absolute.

Lubrication is by accommodation pressure and splash feed with a 1½ gal. reservoir in the bottom pan. From this the oil is drawn by a plunger pump which is driven by an eccentric off the camshaft. There are direct leads from the pump to the main bearings which thus receive a supply of oil under pressure. The other leads go direct to the crankcase where the oil is led to splash troughs placed beneath each connecting-rod throw. Provision is made for the mounting of an oil pressure gage and this may be regulated by an adjustable relief valve.

Complete Westinghouse equipment is used throughout, even to the fitting of an ammeter and voltage regulator. It is a two-unit layout with a reversible switch which alters the direction of current flow automatically so that the contact points of the breaker box are prevented from pitting. For engagement with the flywheel a Bendix gear is used. The battery is a Willard of 80 amp. hr. capacity. Two sets of bulbs are provided in the headlights and there is also a dash light which can be employed as a portable lamp by means of a 12-ft. extension cord.



Details of the three-speed gearset and floating axle used in the 1917 Glide



Right side of Glide six engine, showing the generator and ignition distributer mounting

Gasoline is fed by means of the Stewart-Warner vacuum system which is mounted beneath the hood and operates in connection with a 16-gal. tank at the rear of the frame. Carbureter is a Rayfield and is provided with an efficient choking device which renders it unnecessary to prime the engine through the petcocks even in the coldest weather.

From the engine the power is taken by a dry multiple disk clutch having twelve steel plates. Six of these are faced with Raybestos. The selective gearbox is Brown-Lipe, mounted in an aluminum case, to cut down weight. From this the drive passes through a Spicer universal joint which is dustproof and self-lubricating. The propeller shaft is hollow, having a tubular section and taking the drive directly to the pinion shaft upon which is mounted the spiral bevel pinion. This transmits the power to the floating axle shafts through the Brown-Lipe differential. Two sets of brakes with 14-in. drums having a face width of 2 in. are bolted to the rear wheels. Wheelbase is 119 in.

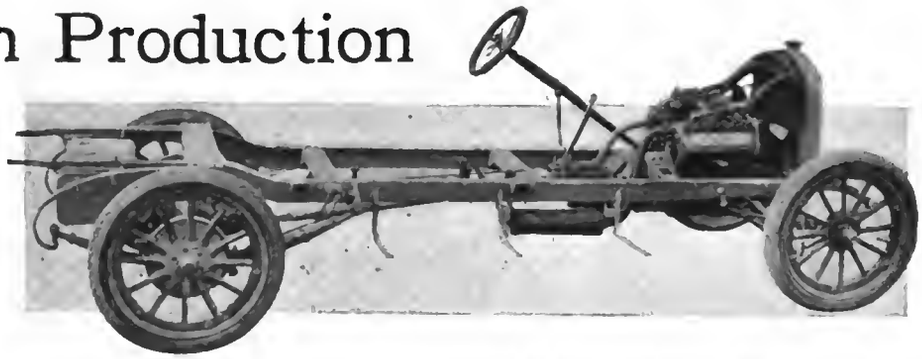
Hotchkiss Drive Used

Hotchkiss drive is used as both the propulsion and torque strains are absorbed in the springs. This is in conformity with the policy to be noted throughout in keeping the car as light as possible. The tire sizes are 34 by 4.

At the price, $1,125, full equipment is included. The price mentioned is for the five-passenger body. A detachable sedan top can be had for $200 additional.

Yale Eight in Production

New Seven-Passenger Car Is Mounted on Chassis Made Up of Standard Units



Chassis of the Yale eight, showing three-quarter elliptic type of rear springs, fuel tank mounting and installation of unit power plant in the frame

THE Yale Eight, which is produced by the Saginaw Motor Car Co., Saginaw, Mich., is characterized by the use of standardized products throughout. For the present it will be supplied only in seven-passenger form at $1,350, though the addition of a Winter top is contemplated. The standard color is ivory white for the body with black fenders and trim. Yale blue and black is an optional finish furnished without extra cost.

The engine used in the new car is built by the Saginaw company and adheres to standard practice in design, having its 3⅛ by 4½-in. L-head cylinders cast in two blocks of four each. Formula horsepower is 31.25. The carbureter is a Rayfield. The Remy ignition unit is acessibly mounted directly at the front of the V. The electric lighting and starting system is a two-unit outfit and the battery is a Willard.

Thermo-Syphon Cooling

Lubrication is primarily by force feed with auxiliary oiling by splash. Cooling is by thermo-syphon. The clutch is a multiple disk type transmitting power through a Muncie three-speed selective gearset in unit with the motor. Hotchkiss drive is a feature.

The chassis has a 126-in. wheelbase and 34 by 4-in. tires are used, with non-skid in the rear. Axles are Timken and steering is Lavine.

Wind Resistance Minimized

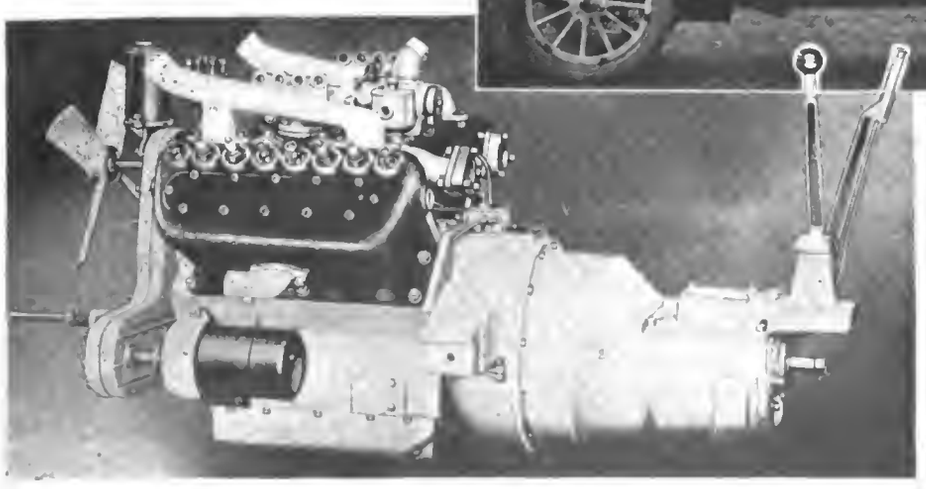
The attempt to reduce wind resistance to the minimum is apparent in the body design. The hood is tapered to blend well with the rather deep cowl and the sides are perfectly smooth. The windshield is smartly raked. There is a cowl at the back of the driver's seat which serves to house the auxiliary seats. All doors are fitted with pockets. The upholstery is leather and the backs of the seats have been moulded to fit the backs of the occupants.

Comfort an Aim

Great care has been taken to insure excellent riding qualities, and to this end the weight has been proportioned over front and rear axles only after long experiment. The spring suspension is normal in front, but in the rear there is modification of the three-quarter elliptic idea, which, however, does not appear unusual. The springs are 56 in. long.

The Saginaw Motor Car Co. has recently purchased the plant of the American Electric Wheel Co., which will be used to facilitate production. The E. B. Sutton Sales Co. has taken over the entire distribution of the Saginaw company. Headquarters have been established at the factory.

The eight-cylinder, seven-passenger Yale touring car which is now going through production. It has a 126-in. wheelbase, three-speed selective gearset and uses 34 by 4-in. tires. Cooling is by thermo-syphon and Hotchkiss drive is a feature. With complete equipment the car sells for $1,350



Yale eight-cylinder unit power plant. It has a bore of 3⅛ in. and a stroke of 4½, the formula horsepower rating being 31.25. The generator mounting is shown, carburetor and ignition units being carried in the V between the cylinder blocks

Burford Truck in 2 and 4-Ton Models

Internal Gear Drive Used on Smaller and Worm Replaces Chain on Larger of New Vehicles

TWO models, a 2-ton and a 4-ton, will compose the line of the Burford Motor Truck Co., Fremont, Ohio, for 1917. The internal-gear drive is used on the smaller chassis and a worm axle on the larger, the former being a continuation of last year's practice and the latter a change from the chain drive employed previously.

Engines Are Similar

The engines used are similar on both models, though different in size and in the fact that the smaller has block cylinders while the larger has pair castings. Dimensions are 3¾ by 5½ in. for the 2-ton and 4½ by 6¾ in. for the larger model.

Lubrication has been cared for particularly, oil being forced to the main crankshaft bearings by a plunger pump, and also supplied to dip troughs for the connecting- rods. Oil pump and strainer gauze are both very easily removable.

On the side of the cylinders remote from the camshaft there is a front end gear which drives the water pump, and the Eisemann magneto is coupled to the water pump shaft by a universal joint. The pulley for the fan belt is set on the same line, just in front of the water pump, keeping the belt high up and so well protected from the destructive action of oil and water.

Difference in Gearsets

On the 2-ton model the flywheel is contained in a bell housing which incloses the leather-faced cone clutch and supports the three-speed gearset, but the 4-ton type has a separate gearbox mounted independently and giving four speeds. This large gearset is of rugged construction, having gears 1½ in. wide with a 5-7 pitch, which makes for great tooth strength. Driveshafts and transmission gears are all chrome-nickel steel.

Strength in frame and springs is obtained by the use of high-quality steel and ample proportions. Radius rods are employed on the 4-ton model, but the smaller truck has Hotchkiss drive, the springs taking both torque and load. There is plenty of load space, the 2-ton being obtainable with either 132-in. or 144-in. wheelbase, and the 4-ton with a wheelbase of 175 in. Throughout both chassis a number of New Departure ball and Bower roller bearings are used.

Brakes Differ

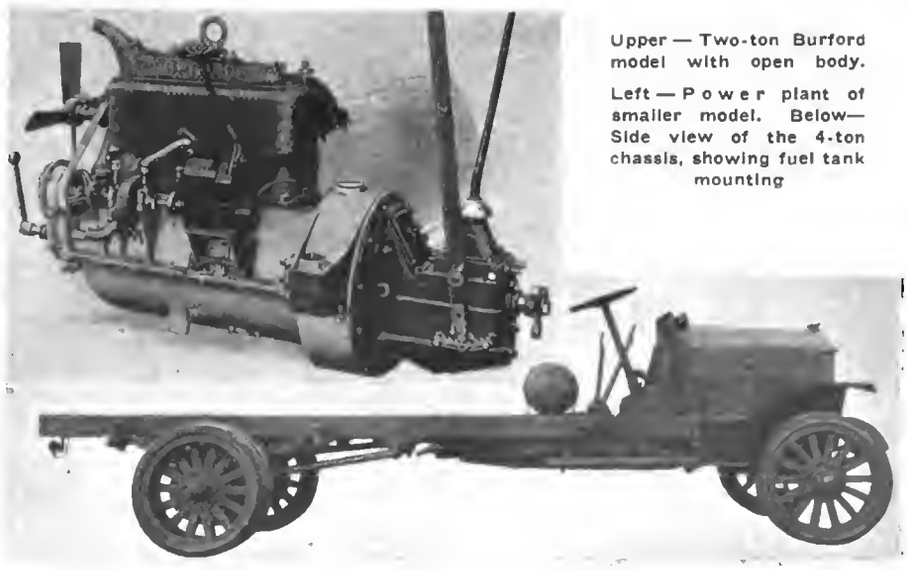
There is a little difference in the brake equipment, the smaller having the conventional expanding brakes in the wheel drums, but the emergency brake acts on a drum attached to the bevel pinion shaft. This axle is made in the Burford plant. The 4-ton has a Sheldon axle, and uses Sheldon double expanding brakes.

Special Bodies Made

Tires are 36 by 3½ on the 2-ton, single in front and dual rear, while the 4-ton has 36 by 5 in., similarly disposed. The smaller chassis lists at $2,250 without body or cab, the latter costing $50 extra, and the 4-ton chassis sells for $3,600. Bodies of any kind can be supplied on special order. A fore-door cab can be supplied at an extra cost of $50.

Both models are electrically lighted, employing Willard storage batteries of the 6-volt, 80 amp.-hr. type. Each model also comes complete with horn, jack and tool kit.

The steering gears are of the conventional worm-and-nut type, with an 18-in. wheel on the 2-tonner and a 22-in. wheel on the 4-tonner. Right drive is adhered to in both models.



Upper — Two-ton Burford model with open body.

Left — Power plant of smaller model. Below — Side view of the 4-ton chassis, showing fuel tank mounting

Colorado To Have 45,000 Cars

Secretary of State Estimates Registration Increase of 50 Per Cent Before End of 1916—Over 200 Manufacturers Represented—Analysis by Makes

By H. G. Hedden

DENVER, COL., Sept. 16—Secretary of State Ramer estimates that automobile and motor truck registration in Colorado will pass the 45,000 mark before the close of the year 1916. During the first 6 months of the year 36,231 cars and trucks were recorded, representing the products of over 200 manufacturers. This is a gain of 14,405 cars or 66 per cent over the 21,826 registered during the same period in 1916. When the 45,000 mark is passed the increase over last year will be over 50 per cent. Mr. Ramer estimates that the 40,000 mark was passed early this month, which registration means one motor vehicle for every 20 of Colorado's 800,000 population. This estimate is based upon partial returns received for July and August, upon the calls from County clerks for more license tags and the continued heavy sales reported by State distributors of cars.

$150,000 in Fees

Receipts from motor vehicle license fees in Colorado for 1916 will total between $150,000 and $175,000. No count has been made thus far, however, and the gain will depend upon the ratio of high-power cars. The license fees are $2.50, $5 and $10, for up to 20 hp., 21 to 40, and above 40, respectively. Inasmuch as the Fords, which pay only $2.50, represent 43 per cent of the total for the first half of this year, as against 34 per cent for the same period last year, it will be seen that the gain in receipts can hardly keep pace with the gain in number of cars registered.

The registration shows the following division of cars, according to class and horsepower:

	Denver	Outside	Total
Gasoline passenger cars up to 25 hp.....	4,912	15,762	20,674
Gasoline passenger cars above 25 hp.....	4,153	8,368	12,521
Gasoline trucks	440	181	621
Electric passenger cars	471	82	553
Electric trucks	67	6	73
Stanley steamers	65	75	140
Dealers' cars, unclassified	270	1,309	1,579
San Miguel County, unclassified.....	...	70	70

This shows a comparative ratio of approximately 24 per cent for Denver and 76 per cent for the outside counties in the low-power class gasoline passenger cars, with 33 per cent for Denver and 67 per cent for the outside territory in the class above 25 hp.

15,727 Fords Registered

An analysis by make of all the registrations available to date in Colorado shows that there are 15,727 Fords on record,

Analysis of Colorado Registrations By Make and Type

GASOLINE PASSENGER CARS

Make	Denver	Outside	Total
*Ford	3,494	12,233	15,727
*Overland	659	2,267	2,926
*Buick	437	1,932	2,369
*Studebaker, E. M. F. and Flanders	477	1,373	1,850
*Maxwell	534	1,173	1,707
Dodge	239	783	1,022
Cadillac	354	492	847
Chalmers	248	406	654
Chevrolet and Monroe	162	404	566
Reo	130	430	560
Metz	148	307	455
Hupmobile	111	244	355
Hudson	143	184	327
Saxon	62	249	311
Oakland	57	227	284
Franklin	120	126	246
Oldsmobile	105	132	237
Grant	56	152	208
Paige	49	156	205
Cartercar	23	155	178
*Packard	99	77	176
*Pierce	116	46	162
*Jeffery and Rambler.	45	110	155
Case	23	114	134
*Velie	38	95	133
Abbott	60	72	132
Mitchell	58	74	132
Haynes	61	60	121
Apperson	50	64	114
*††White	36	66	102
Dort	11	89	100
Inter-State	50	50	100
Regal	22	77	99
Chandler	25	68	93
Stevens-Duryea	60	29	89
Cole	42	42	84
Columbus	71	17	88
Brush	18	63	81
Everitt	42	37	79
Michigan	15	55	70
Kissel	38	31	69
Winton	40	25	65
Jackson	23	39	62
Briscoe	14	45	59
Moon	12	44	56
Peerless	31	20	51
National	23	25	48
Thomas	31	16	47
King	21	24	45
Krit	13	27	40
Dorris	28	11	39
Marion	23	16	39
R. C. H.	17	21	38
Pullman	7	29	36
Scripps-Booth	16	18	34
Detroiter	11	21	32
*Locomobile	18	12	30
Stoddard-Dayton	29	1	30
Pathfinder	13	15	28
Empire	10	16	26
Imperial	4	20	24
Stearns	18	6	24
Elmore	11	9	20
Pope-Hartford	9	11	20
Auburn	0	19	19
Colburn	12	7	19
Pilot	8	10	18
Marmon	10	7	17
Premier	10	7	17
Henderson	10	5	15
American	8	6	14
Crow	5	9	14
Lambert	0	14	14
Cunningham	12	0	12
Hollier	7	5	12
Marathon	6	6	12
Westcott	5	7	12
Allen	0	10	10
Great Smith	0	10	10
Pratt-Elkhart	0	10	10
Smith	10	0	10
Continental	7	1	8
Little	6	2	8
Monarch	8	0	8
Renault	8	0	8
*Alco	5	2	7
Bergdoll	5	1	6
Imp	0	6	6
Moline	0	6	6
Petrel	0	6	6
Sears-Roebuck	0	6	6
Speedwell	0	6	6
Wayne	0	6	6
Welch	0	6	6
Capitol	5	0	5
Gleason	0	5	5
Parry	0	5	5
Warren	0	5	5
Glide	0	4	4
Jones	0	4	4
*Schacht	0	4	4
Stutz	4	0	4
Total	9,161	25,439	34,598

GASOLINE TRUCKS

Make	Denver	Outside	Total
I. H. C.	27	66	93
Chase	27	29	56
Commerce	14	6	20
**G. M. C.	18	12	30
Hercules	6	12	18
Rapid	9	7	16
Federal	12	3	15
Columbia	4	5	9
Denby	5	4	9
Mack	5	4	9
Autocar	5	3	8
Brockway	8	0	8
Garford	7	1	8
Kelly	8	0	8
Wichita	0	7	7
Little Giant	4	2	6
Sampson	6	0	6
Wilcox	6	0	6
Randolph	0	4	4
Total	171	165	335

ELECTRIC VEHICLES

Make	Denver	Outside	Total
*Baker	104	30	134
Fritchle	119	14	133
Detroit	54	32	86
Ohio	55	6	61
*Waverly	39	6	45
Rauch & Lang	29	9	38
Columbia	25	2	27
Hupp-Yeats	11	9	20
Studebaker	18	0	18
†General Vehicle	16	0	16
Babcock	5	3	8
Woods	0	6	6
Flanders	4	0	4
Total	479	117	142

STEAM CARS

Stanley	65	75	140

MISCELLANEOUS

Various makes	169	145	314
Grand total	10,045	25,931	35,893

NOTE:—*Includes trucks. **Includes electric trucks. †Trucks. ††Includes trucks and steam passenger cars.

Overland holding second place with 2926, Buick third with 2369 and Maxwell fourth with 1707. Of the Fords 3494 are registered in Denver and 12,233 in the rest of the State. There are 659 Overlands in Denver and 2267 outside the city. Denver has 437 Buicks as compared with 1932 for the balance of the commonwealth and 534 Maxwells as against 1173 outside.

These four cars held the first four places last year, but Overland is now credited with second position, which was held by Buick last year.

Of the total of 35,893 registrations available when the analysis by make was undertaken this week, 34,598 were gasoline passenger cars, 335 gasoline trucks, 142 electric vehicles, including passenger cars and trucks, 140 steam machines and 314 miscellaneous. The latter being those whose make and type were not apparent from the registration records. The tabulation herewith shows the number of each make registered in Denver and the rest of the State, the number in each county being given in the second table. The county registration is not entirely complete but approximates the correct figures very closely.

Increased Gains Each Year

A study of the registrations in Colorado for the past three years brings out strikingly the tremendous increases made each year.

To the 1913 registration of 13,624 cars, 1914 added 4809 cars, or an increase of 35 per cent, while 1915 showed a gain of 9821 cars, or 53 per cent, over 1914, and this year promises a gain of 15,000 to 18,000 cars, or more than 50 per cent over last year.

The record for the lone carless county is still held by Dolores County, located in the extreme southwestern corner of the State, highly mountainous, thinly settled and with few roads.

REGISTRATION BY COUNTIES

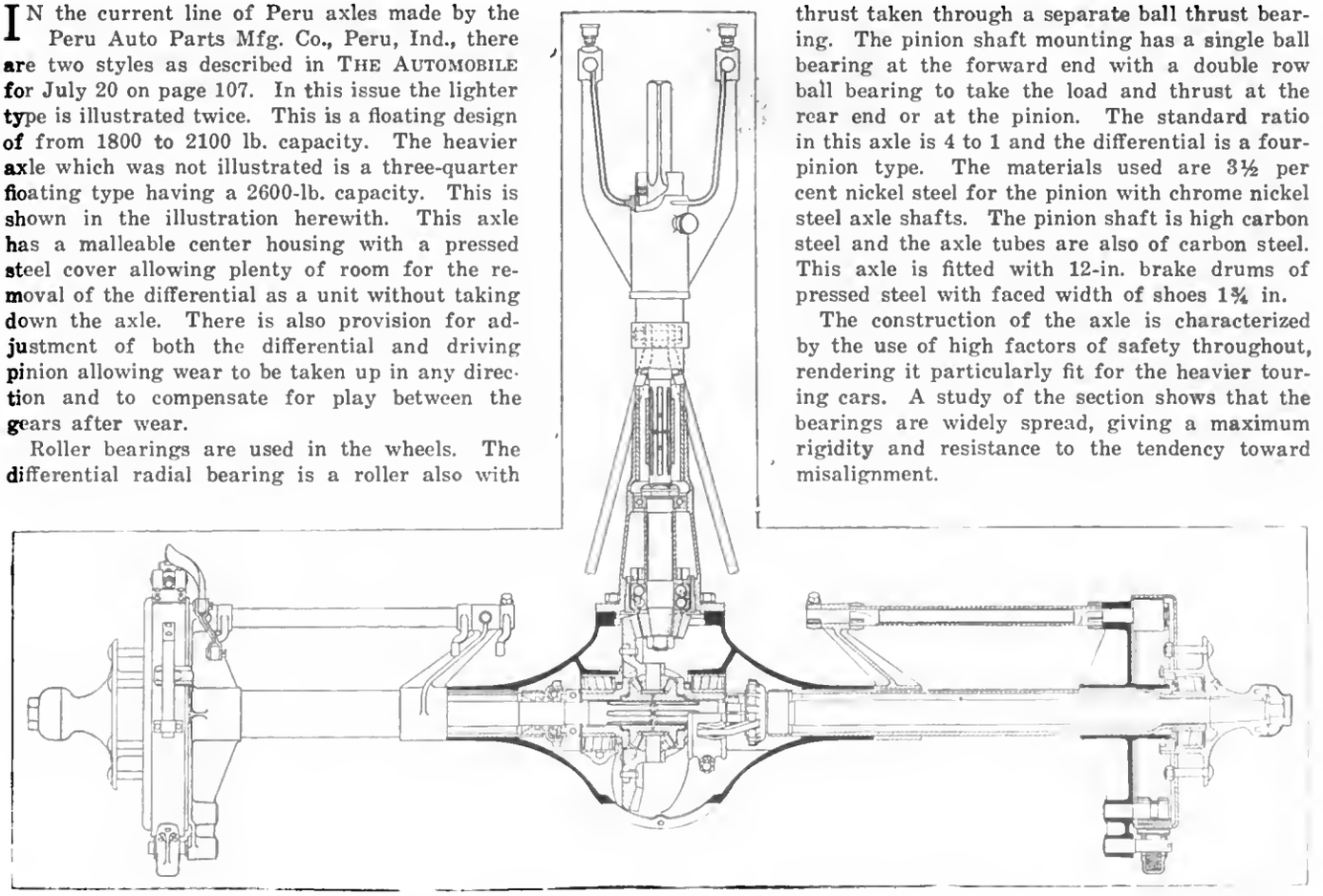
County	Cars	County	Cars
Denver	10,378	Saguache	229
Weld	2,811	Alamosa	222
El Paso	2,680	Crowley	193
Boulder	1,989	Baca	186
Pueblo	1,984	Sedgwick	181
Larimer	1,960	Douglas	179
Otero	913	Conejos	167
Las Animas	862	Routt	154
Prowers	775	Cheyenne	139
Morgan	747	Lake	136
Yuma	736	Kiowa	124
Logan	694	Rio Blanco	109
Fremont	616	Gunnison	107
Mesa	545	Park	105
Jefferson	539	Montezuma	93
Arapahoe	512	Ouray	93
Delta	497	Costilla	92
Rio Grande	490	Eagle	92
Washington	478	Moffat	90
Montrose	451	Jackson	87
Kit Carson	384	Clear Creek	79
Teller	375	San Miguel	70
Lincoln	367	Pitkin	64
Bent	365	Archuleta	57
Garfield	356	Grand	57
Phillips	346	Custer	53
Chaffee	339	Summit	40
Huerfano	318	Gilpin	34
Adams	304	Mineral	26
Elbert	298	San Juan	16
La Plata	244	Hinsdale	8
		Doloros	No report

Peru 2600-Lb. Axle with Malleable Housing

IN the current line of Peru axles made by the Peru Auto Parts Mfg. Co., Peru, Ind., there are two styles as described in THE AUTOMOBILE for July 20 on page 107. In this issue the lighter type is illustrated twice. This is a floating design of from 1800 to 2100 lb. capacity. The heavier axle which was not illustrated is a three-quarter floating type having a 2600-lb. capacity. This is shown in the illustration herewith. This axle has a malleable center housing with a pressed steel cover allowing plenty of room for the removal of the differential as a unit without taking down the axle. There is also provision for adjustment of both the differential and driving pinion allowing wear to be taken up in any direction and to compensate for play between the gears after wear.

Roller bearings are used in the wheels. The differential radial bearing is a roller also with thrust taken through a separate ball thrust bearing. The pinion shaft mounting has a single ball bearing at the forward end with a double row ball bearing to take the load and thrust at the rear end or at the pinion. The standard ratio in this axle is 4 to 1 and the differential is a four-pinion type. The materials used are 3½ per cent nickel steel for the pinion with chrome nickel steel axle shafts. The pinion shaft is high carbon steel and the axle tubes are also of carbon steel. This axle is fitted with 12-in. brake drums of pressed steel with faced width of shoes 1¾ in.

The construction of the axle is characterized by the use of high factors of safety throughout, rendering it particularly fit for the heavier touring cars. A study of the section shows that the bearings are widely spread, giving a maximum rigidity and resistance to the tendency toward misalignment.



Section through the Peru 2600-lb. axle, which is a three-quarter floating type

Glimpses of Owen-Tour Through

Over Fifty Men **Guests**
tion Tour Through **Pictur**

A brief stop at one of the many beautiful points along the Connecticut River in Vermont, where the river winds between the sloping hillsides

The famous horseshoe on Mohawk Trail ascending the mountain between North Adams and Greenfield

Above — Along one of the good stretches of road on the main highway between Boston and Bretton Woods

Right—An example of the roads construction found in Massachusetts

Magnetic Cars on 5-Day New England

of R. M. Owen on Invita-
esque Mounta'n Sections

Owen tourists rolling along roads in New Hampshire which represent the ideal for automobile drivers

Where over fifty Owen tourists spent the night—at Profile House in the White Mountains

Above—Another view in the Vermont section of the Connecticut Valley along the highway to the White Mountains

Left—The eleven Owen-Magnetic cars on the tour on New York highways north of New York City

Liberty Production on Quantity Basis

In Half Year of Company's Existence Scientific Plant Has Been Developed and Sales Approach $5,000,000

AN excellent example of the rapidity of industrial organization and immediate launching into manufacturing activity which is characteristic of the automobile industry, is the progress made in 6 months by the Liberty Motor Car Co., Detroit, Mich. This company, though incorporated only last February, already has a scientifically laid out factory and has been turning out cars in quantity for 2 months. The merchandising side of the business has kept pace with the manufacturing end and sales of the new Liberty six are approaching the $5,000,000 mark, distributing representation having been secured in practically all the leading cities of the country.

The first Liberty car was on the road in April. The factory buildings formerly occupied by the R-C-H Corp. were secured and remodeled to suit the new conditions. New buildings were constructed and old ones rearranged; and equipment to care for modern progressive assembly seemed veritably to be in the plant over night, so industriously did the entire organization work.

By July 4, all was ready; materials having been purchased and delivered, and everything in order. According to a prearranged schedule, cars bearing the Liberty name were being produced long before the end of July, and in presentable quantity.

Ideal Assembly Plant

The buildings are one story and spacious so as to make an ideal assembly plant. Progressive assembly, following a chain system that is slightly modified to meet the needs of the concern, is used. A moderately inclined track has been built down the center of the largest of the group of buildings, this track being about 275 ft. long. At the starting point it is elevated about 1½ ft. above the floor, and at the finish end it slopes down to floor level. The object of this very slight incline is to make it very easy to move the cars along after each operation. A slight push moves the vehicle without effort, and gets away from the necessity of a power conveyor of any sort. Further, the elevating of the track makes it more comfortable for the men, who can work standing at normal height without platforms or falsework. This results in higher speed and, consequently, greater production.

The Assembly Circle

About thirty cars can be accomodated by this assembly track at one time, and the chassis parts are stored on either side of the track. Beginning at the opposite end from the start of the inclined final assembly track, the frames commence their journey through the frame and spring assembly departments and wind up at the chassis paint. Simultaneously in another building, the unit power plants are assembled and prepared for the block test. After passing this examination, the motors go to a position beside the track from which they can advantageously be assembled to the chassis. Thus, beginning at one end, a swing in a complete circle is accomplished, and when discharged from the main line, the completed cars are road-tested and then driven 100 ft. to the long loading platform.

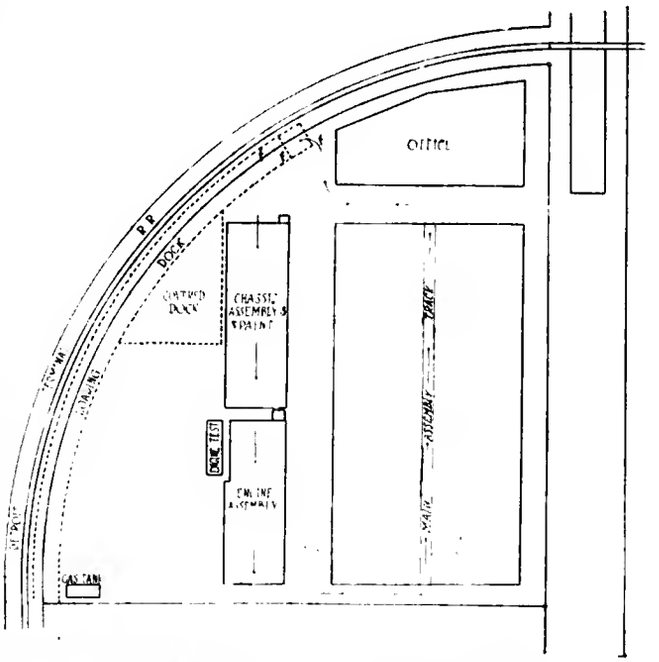
This summary of operations will show that Liberty has laid out its plant scientifically, and in accord with the best experience in building cars rapidly and substantially. It shows that entering into the manufacture of automobiles to-day is no venture for a weak organization, but that brains and experience, backed up by a reasonable amount of money, can succeed even against the great handicap of going into a field of manufacture that is now most keenly competitive.

15.4% of N. Y., N. J. and Pa. Roads Are Bituminous

ROADS treated with bituminous preparations constituted 15.4 per cent of the highways in the three middle Atlantic States, New York, New Jersey and Pennsylvania, in 1914, as compared with 1 per cent in the same States in 1909. This improvement is entirely due to the increase in the use of automobiles and trucks, according to the third 5-yearly study of road mileage, road types and highway finances in these States reported by the Office of Public Roads and Rural Engineering in department bulletin No. 386.

Approximately 9 per cent of the improved road mileage of the three commonwealths is now surfaced with concrete brick or other of the more substantial materials used in road construction as compared with 1 per cent in 1909. In 1904, when the first road study was made neither bituminous nor the more substantial roads were found, untreated macadam and gravel roads predominating. Roads of the unimproved type were reduced from a percentage of 51 to only 39.3 in the 5 years from 1909 to 1914.

On Jan. 1, 1915, the three States mentioned had roads totaling 185,770.84 miles, Pennsylvania having approximately 91,500, New York 79,000 and New Jersey 15,000, these statistics being exclusive of practically all streets in incorporated cities and towns. New Jersey added 17 per cent of surfaced roads in the 5 years from 1909 to 1914, Pennsylvania 7 per cent and New York 3.5 per cent.



Layout of the factory buildings of the Liberty Motor Car Co.

Progressive Assembly System Speeds Up Liberty Production

At the start of the assembly line in the factory of the Liberty Motor Car Co., Detroit, Mich. The chassis run down the track accumulating their component parts as they progress. Note the engine being lifted into place at the right and the overhead runways delivering wheels from the stockroom

A vista down the inclined assembly track, showing the chain of Liberty six chassis gradually growing into complete cars fitted with bodies, tops, etc., at the farther end of the line

Above—Part of the engine testing room at the plant of the Liberty Motor Car Co., showing the type of testing blocks used and the cooling water connections employed for the test runs

Right—A view of the engine assembly department at the Liberty factory, showing how each engine is mounted on a rolling stand, rendering it easy to move it from point to point as needed. Note the gearbox, bell housing and control assemblies in the background waiting to be mounted

The Rostrum

Why Four-Cylinder Pistons Are Larger

EDITOR THE AUTOMOBILE:—Will you kindly tell me why the piston is larger in four-cylinder cars than in six and eight-cylinder cars and why they will develop more power than a four-cylinder?

Harrodsburg, N. Y. H. G. S.

—The reason that the bore of the four-cylinder motor is in general less than that of six and other multi-cylinder engines, is simply because of the fact that more power than is necessary for the car is not desired. Every cylinder assembly acts as a separate engine in supplying power. The same amount of power can be obtained from six smaller cylinders as from four larger ones. Hence, to secure the desired amount of power with four cylinders, it is natural that each of the cylinders should be made larger.

Looking at the matter from another angle, that of piston displacement, it will be remembered that displacement is a direct factor of power. If a displacement of, say, 300 cu. in is desired and if enough power will be secured from this displacement, it would be obtained by using four cylinders of 75 cu. in. displacement or six cylinders each having 50 cu. in. displacement. Naturally, the pistons for the 75 cu. in. cylinder will be larger than those for the 50 cu. in.

Naphthalene Not Recommended in Fuel

Editor THE AUTOMOBILE:—Please advise me as to the use of naphthalin or naphthalene with flakes in gasoline for increasing mileage and as a carbon remover. It has been recommended to use a teaspoonful to every 5 gal. of gasoline and I am told that this substance is put up under many names and sold for that purpose. Please advise me as to its qualities and how it works and if you advise me to use same, giving reasons for your conclusions.

Fall River, Mass. E. J. D.

—The use of naphthalene or, as it is commonly known, camphor, is not recommended in gasoline. As a matter of fact it will deposit as much carbon as it will remove and will result in a sooted engine. A simple experiment which will readily show you the carbon-forming tendencies of camphor may be performed by simply holding a camphor or mothball over an open flame. The carbon will leave the camphor in long string-like formations.

Compression Bad on Three Cylinders

Editor THE AUTOMOBILE:—I have a 1916 model 43 Oldsmobile which has poor compression on all but one cylinder when cold, but does not show so much difference when hot. I have had the head off and ground the valves. I think it is in the gasket joint as the old gasket showed black carbon streaks, especially between cylinders. It hasn't the power it should have and has only run 2200 miles. Would it help any to put in two gaskets and shellac all sides of them, or is there anything else that will make it hold?

2—I am getting about 15 miles per gallon of gas. How many should I get with a new Stromberg carbureter?

3—Will this carbureter increase the power acceleration speed and make starting easy?

4—Is the Fracto a good device for headlights? Will it prevent glare and give good driving light?

Kenosha, Wis. T. A. F.

—Since the old gasket shows carbon streaks it is quite likely that you are right in your surmise that the car is losing power due to leakage. The new gaskets well shellaced may remedy the trouble. Also, go over the intake manifold connections very carefully and be sure that there are no air leaks around these.

2—It is pretty difficult to state what mileage you should get to a gallon of fuel without knowing how fast you drive, what load is carried in the car and other details which have their effect. In all probability, however, 15 miles to a gallon is a good average consumption.

3—In fixing upon a carbureter for their car the Oldsmobile engineers have no doubt taken all the matters which you mention into consideration, and while it is within the realms of possibility that you may secure a gain by changing your carbureter there is no reason why you should not get satisfactory service from the one which is on your car.

4—THE AUTOMOBILE has never had an opportunity to test out this device, but no doubt you could secure a demonstration from its manufacturers.

Redesigning Michigan Radiator

Editor THE AUTOMOBILE:—I desire to make a change in the radiator design of my 1913 Michigan car. I have designed one of the following dimensions and would like to know if it is large enough to cool a four-cylinder motor of 4¼ by 5¼ bore and stroke. The height is 25¾, width 22½ and 3¾ in. through cross section. The design is the same as the 1916 Mercer.

Pittsburgh, Pa. N. H.

—The radiator you mention would be sufficient, provided you have good pump delivery. The cooling of an engine does not depend so much on mere capacity of the radiator as it does on the volume of water that is handled in a unit of time. The purpose of the radiator is to carry a given number of B.T.U. from the engine in a given amount of time. Generally, the thermal units lost through the cooling water are about 35 per cent of the heat taken into the engine with the fuel. Under abnormal conditions, such as climbing long hills, this percentage will increase to as high as 50 and if the cooling chamber is too small it will go above the capacity of the radiator, causing overheating.

The method of determining the amount of heat carried off by the radiator is to first measure the quantity of water in cubic feet passing through the cooling system in 1 min. The temperature of the entering water is then subtracted from the temperature of the water leaving the jackets, giving the range between extreme temperatures. This temprature range is multiplied by the cubic feet of water passing through in a minute to determine the B.T.U. per minute. Knowing the calorific value of the fuel, the theoretical radiator can be readily determined in the manner suggested.

As a matter of fact manufacturers of cars do not determine their radiator size so much by the theoretical calculation as they do from a knowledge of what can be expected from a given size engine, a pre-determined pump and a known radiator size. This is a matter of development and even calculating on this basis errors have been made which have resulted in a necessary increase of radiating surface. Radia-

tors of different forms have different efficiencies and the mere capacity and dimensions of a radiator do not tell anything unless its efficiency is known. You do not mention the form of radiator you are employing, but, assuming it to be of the honeycomb type, it will be sufficiently large if the pump capacity is great enough to keep the radiator filled with rapidly flowing water at low engine speeds.

Even the fan design is of greatest importance in cooling. A fan that is sufficient for one radiator will be bad for another. The reason for this lies largely in the shape of the radiator, which may be such that it does not permit the fan to draw through all sections. A simple test can be made to determine the area of draw of the fan by placing small pieces of paper against the outside of the radiator when the engine is turning over at idling speed, and seeing if the paper remains drawn against the face of the radiator. It very often happens that certain areas of a radiator have a positive back current or eddy passing through them which instead of pulling cold air from the exterior of the car gives a flow of warm air which has been heated from its confinement beneath the hood.

Information on Stearns-Knight Engine

Editor THE AUTOMOBILE:—What are the most difficult features to overcome in the manufacture of a Knight eight engine? What part of the motor would be most likely to give trouble in operation, that is, in ordinary touring service?

2—Kindly illustrate the Stearns-Knight six engine in THE AUTOMOBILE. I wish to know the distance from driveshaft of transmission to front of engine, also width from tip to tip of arms that the engine is hung on, and distance between front and rear arms.

Swan Lake, Miss. H. D.

—In manufacture there is little doubt but that the grinding work is the thing which must be watched closest on a Knight eight-cylinder engine. This must be accurate for all cylinders. As for trouble in operation, there is no reason why any part should be conspicuous in this respect after manufacture has been carefully carried out.

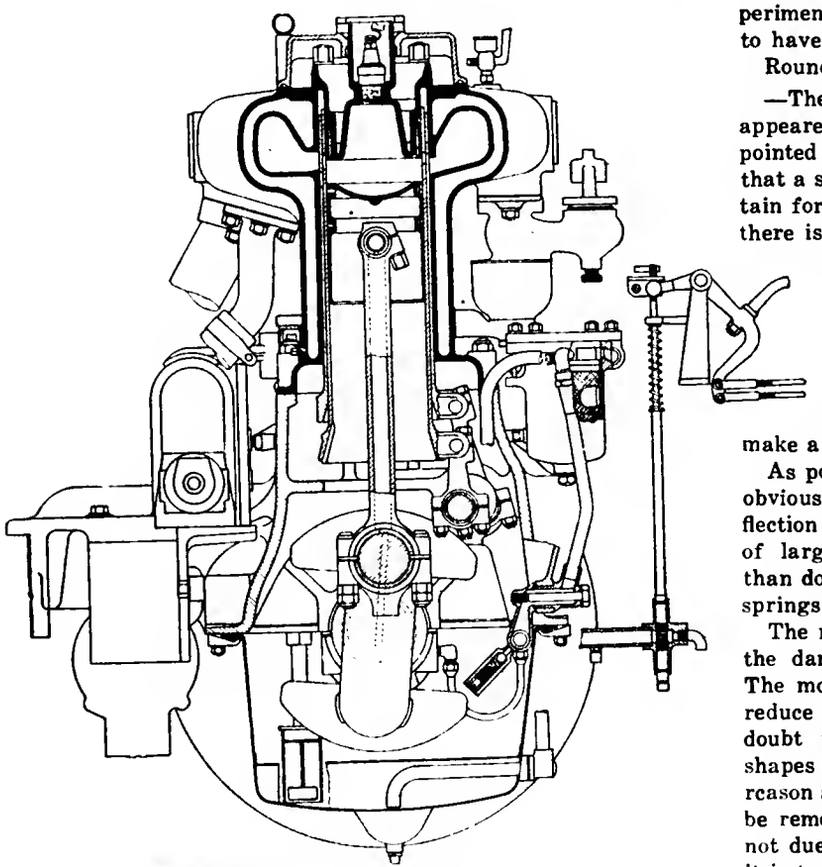


Fig. 1—Transverse section through Stearns-Knight six-cylinder engine

2—The Stearns-Knight engine is shown in section in Fig. 1. The distance from the driveshaft of the gearset to the front of the motor is 39⅜ in. The width of the arms in front is 20¾ in. and at the rear 26⅞ in. The distance between the front and rear arms is $18\frac{13}{16}$ in.

Believes in Full Elliptic Springs

Editor THE AUTOMOBILE:—There has been much speculation as to the most comfortable spring for the automobile, but strange to say, the full elliptic spring is not mentioned. This is probably due to the fact that so few have had the experience of riding in cars fitted with these springs, as the conventional half and three-quarter elliptic are mostly used.

I claim that there is nothing that can approach the full elliptic both front and rear, with the front spring slightly tilted backward, as in the Franklin, to receive road shocks. This may seem a broad assertion, but it is conceded by everyone who has had experience. There may be a few very heavy, high-priced cars fitted with deep cushions and shock absorbers that give comparative ease, but I am speaking of the ordinary size car. This also holds true with respect to pleasure wagons as long ago the elliptic spring was used. Then came the desire for something better and all sorts of springs were tried, but they soon disappeared and the elliptic came back and stayed because the principle was right.

I would like to ask why manufacturers of automobiles do not use them more. Is it the cost, or the difficulty of attachment on a steel chassis, or both? Is it the appearance that is objectionable? There are thousands of cars made to-day that meet every requirement except riding qualities, and we believe it would be a big selling factor if some other leading makers would adopt the elliptic spring. It sold my car after trying a score of others and after using it 5 years and experimenting with different models it would seem a hardship to have to change.

Round Top, N. Y. J. W. F.

—The point you bring up is covered in an article which appeared in THE AUTOMOBILE for Sept. 7, page 393. As pointed out in this article, by A. Ludlow Clayden, the idea that a spring had some special virtue because it was of a certain form has been pretty well exploded. On the other hand, there is no doubt that certain forms of springs have certain advantages but no spring is easy riding simply because of its external shape. It is rather in the development of its individual units that the secret of its success will be found alive. The length of the spring and the number of leaves have a marked effect regardless of the shape, and the ratio of sprung to unsprung weight of the chassis will also make a material difference.

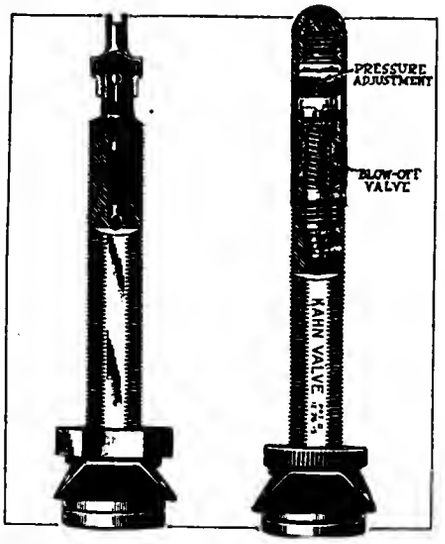
As pointed out, in the article mentioned, a long spring will obviously alter its curvature less for a given amount of deflection than a shorter spring, since the tangent to the circle of large diameter more closely approaches the periphery than does a tangent to a small circle. Fiber stresses on long springs are also less than on shorter ones.

The number of leaves in a spring has a direct effect upon the damping action which reduces the bounce or rebound. The more leaves there are the greater the surface area to reduce the throwing action of the spring by friction. No doubt manufacturers find that the chassis weights and shapes suit certain springs better than others, and for this reason a variation will be found in external shape, but it must be remembered that where easy suspension is obtained it is not due so much to the virtue of the shape of the spring as it is to the scientific way in which the spring design has been worked out.

ACCESSORIES

Armstrong Inner Tubes

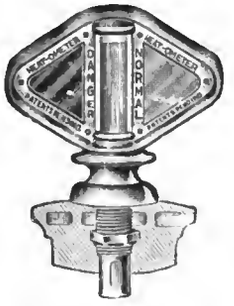
LONGER tube life and greater comfort and convenience for the car owner are the features claimed for Armstrong inner tubes, due to the use of the Kahn automatic valve. As shown in the accompanying illustration, this valve differs from the conventional type in that it is provided with a blow-off valve and a pressure adjustment so that when the desired degree of inflation has been reached no more air enters the tire and the whistling of the blow-off indicates the fact. The valve also differs from the usual type in that the valve stem fits through a hole in the body of the valve instead of having the stem screwed into the body of the valve. The operation of the pressure adjustment is clearly shown in the illustration. The inner tubes themselves are laminated, being made of heavy red rubber. The manufacturer controls the Kahn valve construction and states that the tubes sell at standard prices.—Armstrong Rubber Co., Inc., 118-122 Adams Street, Newark, N. J.



Left—Conventional tire valve. Right—Kahn valve used in Armstrong tubes

Heat-Ometer

This instrument is intended to apprise the driver of an overheated condition of his engine. As shown in the illustration, it is inserted through a hole drilled in the radiator cap and held in position by a lock nut. A diamond-shaped frame holds the glass indicator tube containing a sensitive liquid, which is pink at normal temperatures, but turns a deep purple when a dangerous degree of heat is reached. The frame at each side of the tube is paneled, one side being enameled pink and the other purple, enabling the driver to check the engine temperature by comparison. The standard size sells for $3, and the junior for $2.—Heat-Ometer Co., Inc., 1 Broadway, New York City.

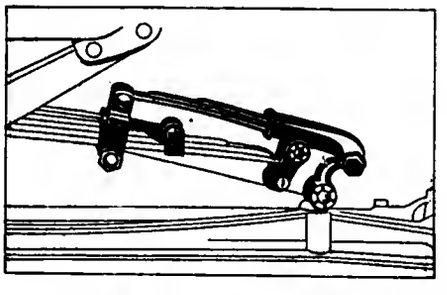


Heat-Ometer, a radiator gage

United Stands and Cranes

The Every-Way engine stand supports the engine while being overhauled, allowing the workmen to reach every portion with ease. The base is composed of two steel Z-bars bolted to the floor. To this two uprights of cast iron are fastened, cored hollow, with vertical slots in which the two steel brace clamping nuts travel. One upright is rigidly bolted to the base, the other being adjustable to take any width of engine, and is locked in a manner similar to the tail stock of a lathe. The supporting arms for the engine are steel angles, with numerous holes bored both in the horizontal and vertical sides. These angles are pivoted in the center to the two uprights. The engine is bolted to the angles by the same supporting brackets that support it in the chassis. The height to the top of the angles from the floor is 30 in.; length of angles, 42 in.; length of base, 52 in.; weight, 185 lb.

A portable, hand operated floor crane, having the high lift and deep overhang required in repair shop work, is also manufactured. A heavy cast iron base, mounted on truck wheels, supports the light steel superstructure carrying the hook, chain and drum. Because of the heavy base and light upper structure, the center of gravity is very low, preventing top-heaviness, and permitting a high lift. The U-shape of the base allows the crane to be placed in any desired position about the car, and is narrow enough to pass between the wheels of a car. Prices, No. 66, 1-ton, 6 ft. 6 in. lift, 33 in. overhang, $64; No. 76, 1-ton, 7 ft. lift, 33 in. overhang, $66; No. 80, 2-ton, 7 ft. 6 in. lift, 36 in. overhang, $82.—United Engine & Mfg. Co., Hanover, Pa.



Duplex cantilever spring for Fords

Hi-Comp Piston Rings

Two eccentric interlocking rings combine to form a single concentric ring. The rings are made from soft gray iron and ground together. It is not necessary to take the rings apart, as they expand sufficiently to fit over the piston. The design of the ring is said to give an equal expansive power on all parts of the cylinder, even though worn out of round. Two rings only are required for each piston. Price, all sizes to 5½ in., $1.65 each.—Continental Piston Ring Co., Memphis, Tenn.

Hi-Comp piston ring composed of two eccentric interlocking rings

Duplex Cantilever Springs

A new type of auxiliary spring for Ford cars has been developed in the Duplex cantilever spring. Upon each end of front and rear springs one of the Duplex springs is fastened, the upper end being secured at about half the distance to the middle of the standard Ford spring; the lower end under the front springs is attached to the present Ford perch and the front spring suspended

Every-Way engine stand, showing mounting of engine

from the Duplex spring, producing a cantilever action. This is said to eliminate side-sway and promote easy riding of the body. The rear Duplex springs attach to the perch in the same manner and add 5 in. to the span of the ordinary Ford spring. A set costs $15. —Duplex Cantilever Spring Co., Chicago, Ill.

Wegman Automatic Decarbonizer

This device supplies moisture to the intake manifold. Water is taken from the waterjacket above the carbureter down through tubing to the intake manifold, where it is carried with the mixture to the cylinders. The amount flowing is regulated by a needle valve used in connection with a sight feed glass on the tubing, and the supply is automatically shut off when the engine stops by a ball check valve. The device may be attached to any make motor by drilling and tapping two ⅛-in. standard pipe tap holes—one in the intake manifold and one in the waterjacket. It is claimed that the water is turned to superheated steam by the explosion temperature, which removes the carbon and increases the power of the engine. Price, $5.—Manufacturers Distributing Co., 400 Publicity Bldg., St. Louis, Mo.

Morton Front Wheel Brakes

Designed to supply a front wheel braking system for most makes of cars, no alterations to the car are required in the installation, and the brakes are said not to interfere with the proper operation of any part of the car. The brakes are of the expanding type, and so connected that the braking effort is applied to all four wheels at once. Quickness in stopping and prevention of side sliding or skidding are the advantages claimed for these brakes.—Morton Brake Co., 45 S. Tenth Street, Minneapolis, Minn.

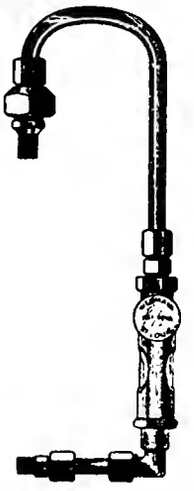
Comet Dash and Trouble Lamp

A combination dash and trouble lamp. On the dash, behind the lamp socket, is an automatic reel carrying 10 ft. of lamp cord. A spring in the rewind reel holds the lamp to the dash as a dash lamp. When used as a trouble lamp, it is freely portable. Price, $5.—Auto Specialty Co., Galesburg, Ill.

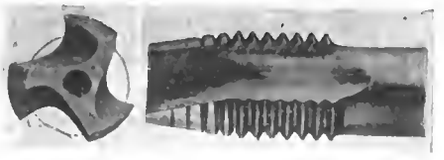
New Greenfield Tap

This tap, styled the "Gun" tap, is so made that it cuts with a shearing action, curling the chips ahead of the cutting edge and preventing clogging. The cutting edges are ground at an angle at the point, permitting the tap to cut freely and make clean, sharp threads. The body of the top has no cutting action, only serving to hold the work true to lead. The taps are made with two or three flutes only, left shallow so that the tap is nearly as strong as the solid stock. It is claimed that chipping is confined to the cutting edge, which may easily be reground. Regrinding may be repeated until only two or three full threads are left, it is said, and will retain its cutting size to that limit.—Greenfield Tap and Die Corp., Greenfield, Mass.

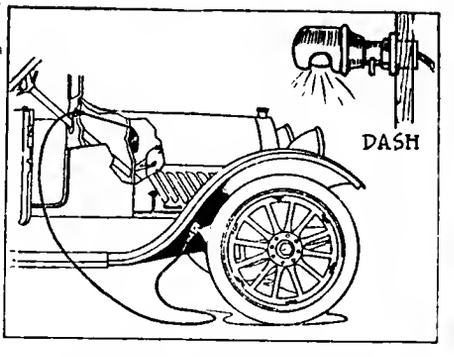
The Morton front-wheel brakes are of the expanding type, and connected with the rear-wheel braking system



Wegman Decarbonizer, which supplies moisture to the intake manifold, draining the water from the waterjacket



The new Greenfield tap



Comet dash and trouble lamp combined

Ventilating Hood Holder

This ventilator is intended to permit the free circulation of air beneath the Ford hood. These holders are substituted for the standard Ford clamps, and allow the hood to be clamped in an elevated position. The forced draft caused by the motion of the car passes over the motor, and escapes at the rear. The running temperature of the engine is lowered, and the performance of the engine is bettered, it is claimed. In cool weather the hood may be locked in the closed position. Price, per set of four, $4.50.—V Air Valve & Mfg. Co., Denver.

M. & E. Metal Shingles

Light, fire and storm-proof metal shingles are made up of copper, tinplate or galvanized iron. Constructed on scientific principles, this shingle can be put on more readily than any other form of metal roofing, it is said. Expansion and contraction are provided for; and the large overlap makes an absolutely tight roof of one-sixth pitch or over. A pleasing appearance, combined with reliability at a moderate cost are the advantages claimed for this type of shingle. Prices, Gothic, 14 by 20 size, 68 shingles per square, $4 painted, $5.75 galvanized.—Merchant & Evans Co., Philadelphia, Pa.

Lally Motor Tread Mill

Power for driving a saw or any machine requiring a power drive may be taken from the rear wheels of a car by the use of this device. It consists of a frame carrying a cross shaft with three pulleys and a jacking device which lifts the car wheels and presses them against the two outer pulleys on the shaft. When the engine is run the shaft is driven and power taken from the middle pulley by a belt. The jacking device is operated by a screw and the tension of the rear tires against the drums may be adjusted.—Lally Commercial Body Co., Everett, Mass.

Ventilating hood holder

The Automobile

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Building vs. Assembling

MANY of the manufacturers who commenced their business as chassis assemblers, using stock parts throughout have recently changed their system, and some of them now make all the principal parts of their car. This has come about in two ways. In some cases the manufacturer has enlarged his factory and equipped to make his own parts in the parent plant, as for example the Hudson extension for the making of the Super-six engine. Others have bought up parts producing plants, as for example the complete absorption of various parts makers into the General Motors organization.

It is interesting to speculate as to the ultimate effect, and the reasons for the observed changes in policy. No doubt several automobile assemblers have been driven to making their own parts by failure of their original supplier to make deliveries on schedule. In other words the condition of the materials market has reacted via the parts maker and has mildly frightened the automobile producer. In other cases the desire for a distinctive design has been the mainspring.

Meanwhile the parts makers have all improved their plants and nearly all have enlarged; they have better facilities than ever before, so when the cost of raw material comes down again, the parts makers will be able to offer very tempting prices indeed. In conditions of enormous demand and high material cost it is less easy for the parts specialist to hold his own against the car builder with a fairly large output, than it is in normal times.

No other industry owes so much to detail specialists as does the automobile industry and it is hard to believe that the parts makers will not be able to retain their position as conditions ease, so any great extension of individual manufacture of complete cars is unlikely. In another 3 or 4 years we ought, however, to be able to see clearly when it does pay to make parts specially for one car and when it does not, a matter which is still debatable.

"Tanks"

THE huge war machines which have just made their appearance as participators in the British advance on the Somme seem, from the cabled reports, to be exactly what so many war story writers of the past have imagined. H. G. Wells pictured just such machines 10 or 12 years ago in one of his novels. and the impregnable motor car has been used by many another author of fiction.

A Matter of Cost

That such machines were possible, that even bigger ones could be built, has been known to automobile engineers for a long time. What has hitherto been lacking was sufficient funds to enable sufficient experiment to be made. No doubt these British crawling forts are the product of many experiments and many failures, and they have been built with no regard whatever to their cost.

Of course we are still ignorant as to the exact size and detail of these machines, probably very little detail will be available till the end of the war. One certain thing. however, is that they must be vastly heavier than the biggest caterpillar tractor ever built in America if their power of crumbling down houses and breaking off trees is as great as the daily press reports state, even though it is reported that the chassis used in their construction are of American manufacture.

There is no fundamental reason why one could not build a land traveling machine as big as an ocean liner if there was any purpose to be served, just as there is no doubt an automobile could be built that would do 200 miles an hour, if the incentive were sufficient. It is. however, not easy to see how monster land machines could serve any useful purpose in peace time although many other war creations have afterwards found their place in the scheme of things and history may repeat itself once more in this connection.

U. S. Troop Trucks

IT is about time that the United States government tried the motor truck as a means of transporting troops. The reflection of the French success on the Marne should be found in this country. Recently two regiments were transported 200 miles in 32 hours, using 132 trucks. This is only a start. Let us try longer distances with more men.

Open Price Value in Co-operation

Price Publicity and Profit-Sharing High Lights of Babson Conference

WELLESLEY HILLS, MASS., Sept. 15—The Third Babson Conference on Co-operation was held here Wednesday, Thursday and to-day. Its object is the promotion of co-operative competition, which includes the open price and profit-sharing.

The open price is the most radical part of the plan, for profit-sharing is quite extensively practised and is generally understood.

The open price means price publicity, and in those associations which are founded on this idea the members freely exchange the prices they make on different articles, the bids they submit on contracts, and even the cost of production.

It is opposed to price maintenance and yet it tends to reduce price cutting. The element of futurity is eliminated. No member tells what his price shall be, but, instead, tells what it has been or is now. This prevents unscrupulous buyers from playing one manufacturer against the other and beating down prices by false statements. But there is nothing to prevent any man making any price he wishes. He can sell below cost if he wants to. The big idea is that if all the prices are known to all there will be less tendency to cut ruinously than if all work in the dark and slash dangerously low to make sure of getting the business.

Open-Price Operation

The open-price plan is operated through associations, which exchange the information through a bureau. There are about twenty associations to-day and the plans vary in detail. In some all the data connected with a sale is given—price, customer's name and cost. In others less is given, running down to the price alone.

The open-price part of the conference was devoted principally to an explanation of plans now in effect. The speakers were: D. B. Doremus, Salt Producers' Association; Ernest H. Gaunt, Optical Manufacturers' Association; W. V. Spaulding, Leather Belting Exchange, and H. S. Wales, Pressed Metal Association.

Cost Finding

Another phase of the work of these associations is that of cost finding. Efforts are made to have manufacturers install systems that will tell them the exact cost of the product, which information will be of assistance in making prices. The speakers stated that cost systems disclosed some startling facts to manufacturers.

In the employees' profit-sharing part of the conference three plans were described:

1. Simple share in company's profits. Described by Everett Morse, president Simplex Wire & Cable Co., Cambridge, Mass.

2. Share in profits and stock interest in business. Plan used by Dennison Mfg. Co.; described by Mr. Dennison.

3. Share in profits under fraternal interest of company without interest in company. Plan of Ford Motor Co. Described by Dean S. S. Marquis, head of educational department of the Ford Motor Co.

—

Times Square Motor Supply Co. Formed with $1,000,000

NEW YORK CITY, Sept. 20—The Times Square Motor Supply Co. has been formed here to take over the business of the Times Square Automobile Co. and all its branches. The new company has $1,000,000 in preferred stock, all of which has been subscribed and 40,000 shares of common of no par value. The stock will be offered on the New York Curb.

All capital will be used in enlarging the business of the company, which plans to establish twenty new stores within 90 days and twenty more before May 1, 1917, making a total of fifty. Accessories will constitute the entire stock, neither new nor used cars being bought or sold.

Officers of the new company are: Morris Froehlich, president; Jesse Froehlich, vice-president; Louis Mansbach, treasurer; and John E. Gores, secretary.

—

Invents Two-Wheeled Armored Car

AUBURN, ILL., Sept. 16—S. J. Clark, this city, has invented a two-wheeled armored motor car, designed for military use, which he has submitted to the war department at Washington. The car is equipped with a small central wheel in front of the two main wheels. The principal object of the car is to protect men from fire while digging trenches, being easily shifted from point to point. It is also designed for patrol duty, operating under almost any kind of conditions, due to its light weight.

—

Crowther Chassis on View

ROCHESTER, N. Y., Sept. 15—A chassis has been assembled by the Crowther Motor Co. which incorporates the Duryea roller drive in which the power is applied to the rim of the wheel. This is now on exhibition at the Powers Hotel in this city. It is stated that the company will be soon ready for production in their Rochester plant.

U. S. Caterpillar Battery

Holt Machine Can Pull Big Guns at 3 M. P. H at a Big Saving

NEW YORK CITY, Sept. 20—Considerable excitement has been manifested in the daily press regarding the so-called Tanks or crawling forts in use by the British army. From the information that has leaked through the ever-vigilant censors it would appear that these are a super-developed caterpillar tractor, very possibly of Holt design as far as the chassis is concerned.

The success with which these heavy tractors seem to have been used on the other side lead to the natural question as to what has been done in this country along the same lines, and it is gratifying to note that while the United States has not as yet done anything on the heavily armored tractor very thorough data has been accumulated on the subject of tractor transport for heavy artillery.

It is understood that at the present time there is under process of organization a tractor battery in which an entire regiment with twenty-four heavy field pieces will be drawn by caterpillars. This organization will be ready, it is believed, in about a year and is to be stationed in the Hawaiian Islands. The battery which is to be known as the ninth heavy field artillery will have no horses at all, the caterpillar tractors taking the place of 1000 of these animals. The place of saddle horses will be taken by motor cycles and the reserve ammunition will be carried by motor trucks. It is very probable that this regiment will be equipped with artillery which will correspond to the famous German 42-cent. gun.

Full data as to costs, etc., have been worked out at the experimental station at Fort Sill, Okla., and it is found that in this heavy work the cost of the motor-drawn battery would be about $40,000 less than a horse-drawn one, and the annual saving of pay, clothing, rations and forage would be about $25,000.

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A. S. A. E. Members Can Join S. A. E.

NEW YORK CITY, Sept. 20—Members of the American Society of Aeronautic Engineers can become members of the Society of Automobile Engineers without payment of initiation fees, provided these memberships are taken out within 90 days. This announcement was made in THE AUTOMOBILE last week, except that the name of the Aeronautical Society was used in error for the A. S. A. E. and it was stated that annual dues need not be paid. This should have referred to initiation fees.

$500 Electric in Boston?

Battery That Will Recharge and Marked Economy Features of New Car

BOSTON, MASS., Sept. 16—Plans are now under way here to build an electric car with a battery that will recharge itself when running on level ground, and which can run 2 or 3 days without getting a boost. It will run very cheaply, will weigh less than 1500 lb. and will sell in the neighborhood of $500. Plans are under way to place the stock on the market, and the men behind it are all big enough so that their names mean something. The man who has devised the machine has a national reputation in the electrical world, and is connected with the biggest company in the country making electrical apparatus.

An experimental car has been thoroughly tried out and it has proved a success.

More complete details regarding the new car will be available as soon as the manufacturing arrangements are under way.

Lane Trucks Out Soon

KALAMAZOO, MICH., Sept. 16.—The new plant of the Lane Motor Truck Co., Kalamazoo, will be turning out manufactured goods within a short time. M. H. Lane reports that the necessary parts for a large number of trucks have been ordered and that the output will be marketed rapidly as soon as the new factory is ready for the work ahead.

Light Four Tractor Tested

MARION, OHIO, Sept. 16—The Huber Mfg. Co. gave a demonstration of its Light Four tractor on the J. B. Guthery farm, located 2½ miles west of Marion, this week. The tractor pulled three 14-in. plows, plowing at the rate of a little better than 1 acre an hour. The furrow was 9 in. deep.

Bound Brook Oil-less Bearing Co. Adds

BOUND BROOK, N. J., Sept. 16 — The Bound Brook Oil-less Bearing Co., is erecting a re-enforced concrete addition, 50 by 100, to its plant No. 2, to take care of the increased business in Nigrum impregnated wood bearings.

Hench & Drongold to Make Automobile and Truck Bodies and Parts

YORK, PA., Sept. 16 — The Hench & Drongold Co., this city, large manufacturer of garden implements, has entered the automobile field as maker of wood work of all kinds for automobiles and trucks, including bodies and parts of both wood and metal. The company will also build special machinery and do machine and forge work. Special equipment has been installed in the company's large new plant, which covers about 6 acres.

Van Dorn Tool Doubles Capacity

CLEVELAND, OHIO, Sept. 15—The new plant of the Van Dorn Electric Tool Co., located on the heights above Cleveland has doubled the output of the company. The new building is three stories and is of steel, brick and concrete. It is located on a spur of the Cleveland Belt Line.

American Chain Salesmen Inspect New Bridgeport Plant

BRIDGEPORT, CONN., Sept. 15—At a convention of American Chain salesmen held recently, a thorough inspection was made by the men of the new plant which is being erected here. This will double the capacity of the Weed concern, as it includes 50,000 sq. ft. of floorspace. The roof is just being closed on one of a group of six buildings and a duplicate of this five-story building will be completed in 30 days.

Continental Begins Another Addition

MUSKEGON, MICH., Sept. 13—The Continental Motor Co. has begun work on the erection of a new automatic screw machine factory building, which will be one story high and of the saw-tooth roof style. When this building is completed the automatic screw machine department, which is now located on the third floor of the L factory building, will be moved into the new plant.

Kelly-Springfield May Move

AKRON, OHIO, Sept. 18—The Kelly-Springfield Tire Co. is considering the removal of its plant from this city to Cumberland, Md. If moved, the plant will be tripled in capacity. The Akron plant will be sold for, it is expected, $750,000, and negotiations are under way for the donation by Cumberland of $750,000 and a 75-acre site. The company now employs 1500 men, but in Cumberland would have 3000. Kelly-Springfield is paying $4 a share and earning about $12.

Maxwell Assembly Plant for Dallas

DALLAS, TEX., Sept. 13—The Maxwell Motor Car Co., Detroit, Mich., has purchased a site for an assembling plant to be the distributing point for five States. The Dallas plant will be the third of its kind to be erected by the company.

Master Calorite Plugs Adopted by P. O.

HARTFORD, CONN., Sept. 16—The postmaster general has awarded to the Hartford Machine Screw Co., manufacturer of master calorite spark plugs, the contract for the Postal Service.

Waukesha Motor To Expand

Increases Capital from $200,000 to $1,000,000—Adds to Plant Facilities

WAUKESHA, WIS., Sept. 16—The Waukesha Motor Co., Waukesha, Wis., manufacturer of motor car, truck and tractor motors, has increased its capital stock from $200,000 to $1,000,000 to provide for extensions to its plant. Work on a new office building is now under way, and plans are being prepared for large extensions of the machine shop, assembly department, and testing shop. The company has been obliged to decline acceptance of numerous large orders for engines because its facilities already are being pushed to the utmost by the orders now being executed.

Harroun Motors Buys Plant

DETROIT, MICH., Sept. 18—The Harroun Motors Corp., in which Ray Harroun is a principal, has bought the Prouty & Glass Carriage Co. plant at Wayne, and will begin the manufacture of a car designed by Harroun, as announced in THE AUTOMOBILE last week. First models were built in the Dodge Power Building. The car will be sold for less than $600.

Bosch Magneto Co. Adds Again

SPRINGFIELD, MASS., Sept. 16—The recent addition to the local works of the Bosch Magneto Co. is to be further augmented by an addition providing more than 60,000 sq. ft. Ground has already been broken for the new building, and it will be rushed to completion.

The addition is to be a single-story building, with saw-tooth roof providing maximum light and ventilation.

When this second addition has been completed there will have been more than 130,000 sq. ft. added to the Bosch works during 1916.

Maxwell Plant for Dallas

DALLAS, TEX., Sept. 16—The Maxwell Motor Car Co. has purchased a site for an assembly plant here, which will be the distributing point for five States. The plant is the third of its kind in the United States.

Brunswick-Balke Tire Plant Contracts Awarded—Plan Dwellings

MUSKEGON, MICH., Sept. 11—Construction work on the automobile tire factory of the Brunswick Balke-Collender Co. will be started soon, the contract for the building having been awarded. The

structure will cost $40,000 to $50,000, and will have 40,000 sq. ft. of floor space. It is to be ready for occupancy within sixty days.

In order to provide for the increase in the number of its employees, the Brunswick company has also contracted for the erection of about thirty double dwellings, to be occupied only by its own workers.

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Loewe Is Brunswick-Balke Mgr.

MUSKEGON, MICH., Sept. 18—F. J. Loewe has been appointed general manager of the Brunswick-Balke-Collender Co., billiard and bowling alley fixture maker, which entered the automobile tire manufacturing field last April. For the benefit of its workmen the company has started construction work on a large number of double houses.

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Russell Resigns from Bessemer

GROVE CITY, PA., Sept. 16—R. F. Russell has resigned as production engineer of the Bessemer Motor Truck Co. to become identified with the Air Reduction Co. in New York. Mr. Russell has been connected with the Bessemer for the past 3 years.

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Taylor Joins Evapco Co.

DETROIT, MICH., Sept. 16—Kirk Taylor has been appointed sales and advertising manager of the Evapco Mfg. Co., this city, succeeding W. O. Seelye. Taylor was formerly assistant manager for the New Era Spring & Specialty Co. The Evapco company hereafter will sell only to jobbers.

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Millar, of Auto Parts Mfg. Co., Dies

MILWAUKEE, WIS., Sept. 16—James D. Millar, secretary and treasurer of the Auto Parts Mfg. Co., Milwaukee, died of apoplexy this week, aged 62 years.

Imperial Brass Co. Expands

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Will Have 150,000 Sq. Ft. After Additions Are Completed—24 Hr. Schedule

CHICAGO, ILL., Sept. 18—The Imperial Brass Mfg. Co., this city, will begin next week the construction of an addition to its factory which will double its floor space. The present building contains 75,000 sq. ft. and the addition will contain an equal area, giving a total of 150,000 sq. ft. The new foundry space will more than double the present foundry space. Like the present plant, the new building will be of heavy mill construction and will be erected on an adjoining site at Harrison Street and Racine Avenue. Bids are now being taken for the building work. Orders have been placed for the new factory equipment.

The company's plant has been running night and day for several months without doing any war business.

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Ford Distributes $850,000

DETROIT, MICH., Sept. 18—The Ford Motor Co. has distributed $850,000 as bonuses among 1399 heads of departments, superintendents, foremen, and other employees, in sums of $100 and up. This is $120,000 greater than the 1915 bonus.

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Tobin with Cutting, Armstrong & Smith

DETROIT, MICH., Sept. 16—F. D. Tobin, assistant district manager of the Willard Storage Battery Co., Detroit, has resigned to become affiliated with the Cutting, Armstrong & Smith Sales Co.

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Iowa Rubber Plant in Bettendrof

DAVENPORT, IOWA, Sept. 16—The Iowa Rubber Tire Co., recently organized, will locate its plant in Bettendrof, a suburb of Davenport. A tract of 10 acres has been purchased, and an option secured upon an adjacent tract of similar size. It was necessary to locate the plant close to the Mississippi River, as 200,000 gallons of water will be consumed daily in the various processes of manufacturing tires. Ground will be broken on Nov. 1. An initial order for $100,000 worth of machinery has been placed. C. H. Roth, who recently resigned as vice-president of the American Tire and Rubber Co., has arrived in Davenport to take active charge of the department of sales of the new concern.

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McQuay-Norris Men Promoted

ST. LOUIS, MO., Sept. 18—The McQuay-Norris Mfg. Co. has made the following promotions in its selling force: Frank J. Stanley of the traveling force is made manager of the Cincinnati branch; Howard W. Sweeney is made manager of the Denver branch.

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Stockbridge Heads N. E. Winton

LONDON, ENGLAND, Aug. 26—Ball and Motor Car Co. of Cleveland has sent Frank W. Stockbridge to Boston to become manager of the New England branch on Commonwealth Avenue. He succeeds F. A. Hinchcliffe, who has taken the agency for the Jordan car.

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Wizard Parts Co. Formed

BAY CITY, MICH., Sept. 15—The Wizard Auto Parts Mfg. Co. was recently organized here to manufacture a new steering device for Ford and other cars, invented by L. J. Weatherwax. It is said that several automobile manufacturers after having investigated the merit of the new invention have made propositions to Mr. Weatherwax for exclusive rights to use the device. Mr. Weatherwax is president of the company; C. J. Scheurmann is vice-president; F. B. Scheurmann, secretary-treasurer.

Selberling Field, Akron, Ohio, as it appeared Labor Day on the occasion of the field and track meet held by the Goodyear Tire and Rubber Co. This athletic carnival is said to be the largest ever held by a private corporation

Hydraulic Pfd. Issue $1,000,000

Pressed Steel Co. Plans to Retire Present Issue of $200,000

CLEVELAND, OHIO, Sept. 16—The Hydraulic Pressed Steel Co., this city, has issued $1,000,000 7 per cent cumulative preferred stock, which has been purchased by Borton & Borton. J. H. Foster, vice-president and general manager of the company, states that the new capital will be used in extending and developing the company's business, it being proposed to retire the present preferred issue of $200,000, which is callable at 102½. A sinking fund will be established Jan. 1, 1917, and each year thereafter $50,000 worth of the new stock will be retired. The stock will be callable at 107½. The company will not be sold.

Total net assets of the company will show an excess of three times the new preferred stock issue, and the net quick assets about one and one-half times. The earnings of the company for the past 2 years have averaged four times the dividend requirements of the new preferred issue. The subscription price has not yet been set.

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General Bearings Corp. to Take Over Standard Roller

PHILADELPHIA, PA., Sept. 16 — The General Bearings Corp. is about to be organized here to take over the business of the Standard Roller Bearing Co., this city, which has been in the hands of receivers for 3 years. No information as to the personnel of the new company is ready for publication, but it was stated that the capital stock will be about $5,000,000.

The receivers, R. S. Woodward, Jr., and S. Laurence Bodine, are preparing their report to be submitted to the United States District Court in this city for approval. In the meantime an application has been made for the renewal of the present license which was granted by the Hess-Bright Corp., holder of the Conrad patents for ball bearings, and which is about to expire. The renewal is being asked for as a matter of protection to the new company and will be considered by the court.

The plans for reorganization, it was said, will allow the present stockholders to participate by paying an assessment of $7.50 on each share of common stock and $15 on each share of preferred.

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$40,000 Co. to Make Visible-Measure Gasoline Dispenser

LOUISVILLE, KY., Sept. 16—The Visible Measure Gasoline Dispenser Co. has been incorporated here to manufacture, sell, install, rent and lease the Visible Measure Gasoline Dispenser. The capital stock of the company is $40,000, divided into 4000 shares of $10 each, and the limit of indebtedness which may be incurred is $10,000.

Incorporators and their holdings are: J. Henry Brady, 3000 shares; William A. Earl and William A. Pell, 10 shares each.

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Materials Market Holds Steady

NEW YORK CITY, Sept. 20—Tin and cottonseed oil showed the greatest changes in the materials market quotations during the past week. Both were up, cotton seed oil by 58 cents per barrel and tin by 50 cents a 100 lb. Lead also increased so that it has now attained a level of 7 cents per pound. Lard oil left the dollar mark and ascended to $1.08. No drops in prices are to be noted in the quotations.

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Calmont Resigns from Jackson

JACKSON, MICH., Sept. 11—G. C. Calmont, has resigned as advertising manager of the Jackson Automobile Co.

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Ryan Heads Gibson Branches

INDIANAPOLIS, IND., Sept. 20—The Gibson Co., Indiana Overland distributors, has appointed P. J. Ryan as supervisor of its six branches.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.60	.61	.61	.61	.61	.61	+ .01
Antimony, lb.	.11½	.11½	.11½	.11½	.11½	.11½	...
Beams & Channels, 100 lb.	2.76	2.76	2.76	2.76	2.76	2.76	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28	.28	.28	.28	.28	.28	...
Copper, Lake, lb.	.28	.28	.28	.28	.28	.28	...
Cottonseed Oil, bbl.	9.75	10.10	10.04	10.20	10.25	10.28	+ .58
Fish Oil, Menhaden, Brown, gal.	.58	.58	.58	.58	.58	.58	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.00	1.00	1.00	1.00	1.00	1.08	+ .08
Lead, 100 lb.	6.70	6.80	6.80	6.90	6.90	7.00	+ .30
Linseed Oil, gal.	.69	.69	.69	.69	.69	.69½	+ .00½
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.30	2.30	2.30	2.30	2.30	2.30	...
Rapeseed Oil, refined, gal.	.90	.90	.90	.90	.90	.90	...
Rubber, Fine Up-River Para, lb.	.72	.72	.72	.72	.72	.72	...
Rubber, Ceylon, First Latex, lb.	.58½	.58½	.58½	.60	.60½	.61½	+ .04½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	38.50	38.37½	38.50	38.50	38.50	38.50	+ .50
Tire Scrap, lb.	.05⅜	.05⅜	.05⅜	.05¼	.05¾	.05¾	+ .00⅜

Fuller Ouput Worth $700,000

Parts Manufacturing Concern Has Record Year—New Plant Is Planned

KALAMAZOO, MICH., Sept. 12—This has been the biggest year in the history of the Fuller & Sons Mfg. Co. The value of the output of automobile parts for the fiscal year 1916 as given by the officials is $700,000, as compared with $225,000 in 1915 and $75,000 in 1914. The working force, which was about fifty men in 1915, ran up to 225, and even 250 at times, during the present year. By 1918 the concern expects to have a new plant of more than twice the size of its present premises.

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Ellis-Smith Replaces Rub-On

BUFFALO, N. Y., Sept. 16—The Ellis-Smith Mfg. Co., Inc., is the new name of the Rub-On Mfg. Co., Inc. The change became effective Sept. 1. The management and sales policy of the company remain the same.

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Portage Rubber Raises Dividend to 10 Per Cent

BARBERTON, OHIO, Sept. 16—Directors of the Portage Rubber Co., this city, have placed the stock on a 10 per cent yearly basis by declaring a quarterly dividend for a time of 2½ per cent of the common, payable to stock of record Nov. 3.

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Dividends Declared

Gray & Davis, Inc., quarterly dividend of 1¾ per cent on preferred, payable Oct. 1.

Springfield Body Corp., quarterly dividend of 2 per cent on preferred, payable Oct. 1, to stock of record Sept. 21.

Wilson & Co., Inc., quarterly dividend of 1¾ per cent on preferred, payable Oct. 2, to stock of record Sept. 20.

Stutz Motor Car Co., 2½ per cent on common, 1½ per cent on second preferred, and 1¾ per cent on third preferred, payable Oct. 2 to stock of record Sept. 15.

Billings & Spencer Co., Hartford, Conn., quarterly of 2 per cent, and an extra dividend of 3 per cent payable on Oct. 2.

Allis-Chalmers Mfg. Co., quarterly of 1½ per cent on preferred, payable Oct. 16 to stock of record Sept. 30.

Texas Co., quarterly of 2½ per cent, payable Sept. 30 to stock of record Sept. 15.

Saxon Motor Car Corp., quarterly of 1¾ per cent, payable Oct. 2 to stock of record Sept. 29.

G. M. C. Common Up $120 in Week

Market Strong in Many Issues —Chevrolet Increase $18 and Firestone $25

NEW YORK CITY, Sept. 19—General Motors common still remains the feature of the market with a net increase of $120 per share during the last week. This makes a rise of $155 in 3 weeks and is not only a new high mark for the issue itself but sets a record for the New York Stock Exchange, with one exception which is the sale of Northern Pacific at $1,000 per share during the panic of 1901.

Firestone came back during the week. It was off $30 a week ago, but its increase of $25 brings it back to $1,015 bid and $1,030 asked. Another rubber stock to show an advance was Miller which is now up to $265, an increase of $27 a share during the week. The other tire and rubber stocks remained quite firm with little fluctuation as compared with the more active stocks. Chevrolet, which was quite steady last week, took another forward move and increased $18 a share so that the closing price yesterday was $213.

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Scripps-Booth Elects Directors

NEW YORK CITY, Sept. 18—The board of directors of the Scripps-Booth Corp., which was recently formed to acquire and operate the Scripps-Booth Co. and the Sterling Motor Co., of Detroit, is made up of the following: C. H. Booth, president; W. H. Little, N. J. Miller, W. L. Scripps, F. J. Sesenbrenner, Alfred P. Sloan, Jr., and T. P. Warner.

Up to the present time the production of Scripps-Booth cars has reached approximately 6000, about one-third of which has been sold in foreign markets.

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Saxon and Stutz Stock on 'Change

NEW YORK CITY, Sept. 16—Stocks of the Saxon Motor Car Co., Detroit, Mich., and the Stutz Motor Car Co., Indianapolis, Ind., have been listed on the New York Stock Exchange, and will be traded in in a few days, or as soon as the permanent certificates are ready. The new stock of the General Motors Co. is being actively traded in on the Broad Street curb "when, as and if issued." Since Monday last the stock has advanced some 35 points.

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Grant Earns $78,000 in August

CLEVELAND, OHIO, Sept. 16—Net earnings of the Grant Motor Co. in August amounted to $78,000. This is at the rate of 40 per cent on the common stock after paying the dividend on the preferred.

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Gasoline 1 Cent Lower in Ohio

COLUMBUS, OHIO, Sept. 16—The price of gasoline in Columbus and central Ohio territory has been reduced from 22 to 21 cents per gallon. It is expected that the price will be still farther reduced in the near future.

Ky. Crops to Boost Car Sales

Corn Yield Expected to Equal 1915 Record—Tobacco and Hay Do Well

LOUISVILLE, KY., Sept. 16—Kentucky automobile manufacturers, distributers, dealers and factory representatives are elated over the latest report of the United States Department of Agriculture, forecasting for the State a corn crop of more than 114,000,000 bushels, which is equal to the crop of 1915, the largest ever raised in the State; a tobacco crop of 472,000,000 lb., which is 115,000,000 lb. larger than the crop of last year, and is a new high record, and a hay crop of 1,240,000 tons, an increase of 15,000 tons over 1915, and also a new high record. Crops falling short of 1915 include wheat, with an estimated production of 8,190,000 bushels as compared with 9,900,000 bushels in 1915; oats with a yield of 4,540,000 bushels, a decrease of 920,000 bushels from 1915, and apples, with a yield of 2,470,000 barrels as compared with 4,170,000 barrels in 1915. The large crops of corn, tobacco and hay more than offset the decreases in the other crops and the sharply advanced prices for all farm products give the crops of the State a substantially higher value than the crops of 1915.

This means prosperity in the Blue Grass State, and there is no question but what big corn, tobacco and hay crops

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co.	..	..	65½	58	+3
J. I. Case T. M. Co. pfd.	78	84	81¾	84	—1¾
Chalmers Motor Co. com.	109	111	158	164	+13
Chalmers Motor Co. pfd.	96	99	97	100	+2
*Chandler Motor Car Co.	..	..	105	†106	—3
Chevrolet Motor Co.	..	..	208	213	+18
Fisher Body Corp.	..	..	40¼	41	..
Fisk Rubber Co. com.	..	..	97	106	—2
Fisk Rubber Co. 1st pfd.	..	..	110	114	+3
Fisk Rubber Co. 2d pfd.	..	..	101	110	+1
Firestone Tire & Rubber Co. com.	525	535	1015	1030	+25
Firestone Tire & Rubber Co. pfd.	111	..	110	112	..
*General Motors Co. com.	286	290	680	740	+120
*General Motors Co. pfd.	114	115	126¼	127	+ ¾
*B. F. Goodrich Co. com.	65½	67	72⅛	72½	+ ⅛
*B. F. Goodrich Co. pfd.	108	110	113½	113⅞	+ ⅜
Goodyear Tire & Rubber Co. com.	295	300	248	252	+1
Goodyear Tire & Rubber Co. pfd.	108½	109½	108	109	+ ¾
Grant Motor Car Corp.	..	..	7	8	..
Hupp Motor Car Corp. com.	..	..	6¼	6¾	+ ¼
Hupp Motor Car Corp. pfd.	..	..	80	100	..
International Motor Co. com.	29	31	6	10	..
International Motor Co. pfd.	61	65	15	20	..
*Kelly-Springfield Tire Co. com.	210	213	82⅜	82¾	— ⅞
*Kelly-Springfield Tire Co. 1st pfd.	88	90	98	100	—1
*Lee Rubber & Tire Corp.	..	..	46	48	—1½
*Maxwell Motor Co. com.	45½	47	91½	91¾	+9⅞
*Maxwell Motor Co. 1st pfd.	89	90	85⅝	86⅝	+2⅛
*Maxwell Motor Co. 2d pfd.	37	38½	55	56	+2½
Miller Rubber Co. com.	190	195	250	265	+27
Miller Rubber Co. pfd.	107	109	104	106	..
Packard Motor Car Co. com.	120	130	164	173	—1
Packard Motor Car Co. pfd.	93	94	97	101	..
Paige-Detroit Motor Car Co.	..	..	30	34	—23
Peerless Truck & Motor Corp.	..	..	26	27	+2½
Portage Rubber Co. com.	55	59	160	164	+8
Portage Rubber Co. pfd.	93	94	160	165	+10
Regal Motor Car Co. pfd.	..	..	17	22	+3
Reo Motor Truck Co.	..	17½	43½	44	— ½
Reo Motor Car Co.	33	34	43½	44	— ½
Saxon Motor Car Corp.	..	..	75	82	+3
Springfield Body Corp. com.	..	..	84	89	..
Springfield Body Corp. pfd.	..	..	120	130	..
Standard Motor Construction Co.	..	..	6	7	..
Stewart-Warner Speed. Corp. com.	66½	67½	113	114	—1
Stewart-Warner Speed. Corp. pfd.	105	107	..	..	..
*Studebaker Corp. com.	128½	130	129¾	130¼	+5⅞
*Studebaker Corp. pfd.	106	107	109	111	..
Swinehart Tire & Rubber Co.	86	90	99	101	+7
United Motors Corp.	..	..	66	67	+4⅝
*U. S. Rubber Co. com.	51½	53	59½	59⅝	+1½
*U. S. Rubber Co. pfd.	104	106	114	115	+2¾
White Motor Co.	110	..	55	55½	+2
*Willys-Overland Co. com.	192	194	47⅜	47½	— ⅝
*Willys Overland Co. pfd.	105½	108	104¼	105	+1

*At close Sept. 18, 1916—Listed New York Stock Exchange. †Ex.-Div.
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co.	..	..	39	41½	+2¼
Chalmers Motor Co. com.	110	115	165	173	..
Chalmers Motor Co. pfd.	97¼	99	..	102	..
Continental Motor Co. com.	..	295	38¼	40	+3¼
Continental Motor Co. pfd.	85	90	9½	10½	..
Ford Motor Co. of Canada	..	1535	320	..	+15
General Motors Co. com.	285	295	725	..	+80
General Motors Co. pfd.	114	118	126	129	..
Maxwell Motor Co. com.	44	46	87½	90½	+4
Maxwell Motor Co. 1st pfd.	88	90	86	89	+1½
Maxwell Motor Co. 2d pfd.	36	39	53	57	+2
Packard Motor Car Co. com.	120	130	163	168½	—2
Packard Motor Car Co. pfd.	100	..	..	102	..
Paige-Detroit Motor Car Co.	..	450	31	34	—18
W. K. Prudden Co.	20½	22	41½	..	—2½
Reo Motor Car Co.	33¼	34¾	43¾	45	— ¾
Reo Motor Truck Co.	16⅞	17⅝	42½	44	—2⅛
Studebaker Corp. com.	120	125	128½	131½	+6½
Studebaker Corp. pfd.	105	109	105	..	..
C. M. Hall Lamp Co.	..	..	25½	..	+ ½

INACTIVE STOCKS

Atlas Drop Forge Co.	..	31	35	..	..
Kelsey Wheel Co.	205	..	55	60	..
Regal Motor Car Co. pfd.	..	21	18	..	..

will result in a greater demand for cars. Farmers and people out in the rural districts are buying more machines than ever before.

It is pointed out by local automobile men that in a crop year marked by extreme fickleness of weather, from which the country as a whole has suffered severe losses in the principal crops, Kentucky has been conspicuously fortunate.

Skinner a Manufacturers' Representative

NEW YORK CITY, Sept. 16 — Kenneth Skinner has resigned as secretary of the Micro Piston Ring Co., this city, having sold his interest in the concern. Mr. Skinner has gone into business as a manufacturers' representative under the firm name Auto Appliance Co., 1960 Broadway, where he represents the G. H. Dyer Co., Cambridge, Mass., and the Asbestos & Rubber Works of New Jersey, Camden, N. J. The Auto Appliance Co. is also planning other connections.

Electric Charging Station in Melbourne

MELBOURNE, AUSTRALIA, Aug. 26.—The municipal electric supply department in this city will open a charging station for electric vehicles at its power house on Spencer Street. This station will be open day and night. The cost of current for charging will be 2 cents per unit between the hours of 10 p. m. and 8 a. m., and during other hours will be 3½ cents per unit. A charge of $2.43 per vehicle per week will be made for accommodation.

The absence of electric vehicles from the streets of Melbourne is largely due to the lack of charging stations, and the establishment of the above station will do much to create a demand for American electric vehicles of all kinds.

Barley Cars Painted to Suit Buyer

STREATOR, ILL., Sept. 16—The Barley Automobile Mfg. Co., Streator, has decided to paint all of the cars manufactured in the future in accordance with the wishes of the buyers. A lengthy list of color combinations has been prepared which is submitted to patrons.

Cleveland Dealers to Protect Buyers

CLEVELAND, OHIO, Sept. 16—Cleveland dealers have formed an association for the protection of automobile buyers, offering a uniform service policy. This policy will insure to the purchaser the service to which he is entitled, a strict fulfillment of the manufacturer's guarantee, inspection and adjustment.

Ceylon Import Duty Increased

COLOMBO, CEYLON, Aug. 20—The duty on automobiles, excluding trucks, imported into this country has been increased to 33 1/3 per cent ad valorem, the increase being effective Aug. 2. The former rate on automobiles was 5½ per cent ad valorem.

May Revive Hoosier 500-Mile

Proposed Increase of Purse to $50,000 May Mean Longer Distance

INDIANAPOLIS, IND., Sept. 16—It is expected that the Indianapolis Speedway will ask a sanction for a race of 500 miles with a purse of $50,000 to be held next Decoration Day. The original speedway contest was for this distance, but it was reduced to 300 because of the seeming unpopularity of the longer event.

Some time ago the speedway managers agreed not to offer more than $100 per mile and since a purse of $50,000 is being considered by the Indianapolis management, it necessarily follows that the distance must be increased if the $100 per mile agreement is to be kept.

22 Entries for Astor Cup

NEW YORK CITY, Sept. 19—Twenty-two entries have been received so far for the Astor Cup Race which will be held on the Sheepshead Bay track on Sept. 30. The entries are:

Car	Driver	Car	Driver
Crawford	Moore	Sunbeam	Christaens
Crawford	Klein	Sunbeam	Chevrolet
Crawford	Chandler	Deusenberg	Milton
Kleinart	Unnamed	Deusenberg	D'Alene
Delage	Franchi	Mercer	Pullen
Delage	Devigne	Mercer	Ruckstell
Dans L'Argent	Muller	Deusenberg	Buzane
Deusenberg	Devlin	Blue Bird	Unnamed
Peugeot	Resta	K. W. P. Sp.	Packard
Hudson	Vail	Olson	Unnamed
Adams Sp.	Adams	Olson	Unnamed

In addition the management expects further entries which will bring the list up to thirty-two.

Speedway Men Meet Sept. 29

NEW YORK CITY, Sept. 18—Representatives of speedways in Tacoma, Indianapolis, Chicago, New York, Cincinnati, Providence, Des Moines, Omaha, Kansas City and Sioux City will meet in this city Sept. 29 to fix the speedway racing dates for 1917. Some of these tracks are represented by three or four men, which brings the gathering up to twenty-five or thirty.

Returned Soldiers to Build Roads

TORONTO, ONT., Sept. 16—The Dominion Military Hospitals Commissions, which met in Toronto, to-day, under the presidency of Senator Lougheed, adopted resolutions advocating the building of a national highway by the Federal Government and the promulgation of a comprehensive land settlement policy for returned soldiers. The first resolution set forth: That as a considerable number of the men who have enlisted and are at present overseas or about to proceed thither, are unskilled laborers for whom it may be difficult to provide employment immediately on their return, the commission advocates the building of a national highway by the Federal Government. It would respectfully submit to the government that such an undertaking would be a work of the greatest value. Among the advantages would be:

1. Temporary employment would be provided for thousands of men who would not otherwise find work.
2. No public would provide so large an amount of employment at so small a capital outlay.
3. The highway would be of immense value as a means for the transit of agricultural and other produce.
4. It would be the means of attracting numbers of tourists, entailing the spending of money within the borders of Canada.
5. It would solve the problem of demobilization, as it would allow of a gradual disbanding of the troops from coast to coast.
6. It would be a most practical memorial to Canada's part in the great war.

Bearings on British Embargo List

LONDON, ENGLAND, Aug. 26—Ball and roller bearings and steel balls and rollers for bearings have been added to the British list of goods the exportation of which is prohibited to all destinations.

Spark plugs have also been included in the embargo list but these are prohibited from being exported to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain and Portugal.

Illinois Dealers Must Use Number Plates on Demonstrators

BLOOMINGTON, ILL., Sept. 16—Illinois automobile dealers must attach a license plate to every car used for demonstrating purposes, or which are otherwise engaged for commercial purposes. This announcement was made by Ben Cochrane, State examiner for chauffeurs who is now going over the State, issuing licenses to all drivers. In some cities, the dealers have purchased one license and utilized but the single plate. The courts have ruled that one license is sufficient but each car must carry a number. The duplicate plates will be furnished by the Secretary of State for their exact cost. Each dealer is being notified of the requirements of the law, and the authorities in each city have been directed to see that all dealers respect it.

400,000 Cars in Iowa?

DES MOINES, IOWA, Sept. 16—Iowa will have 400,000 automobiles, or one for every six persons in the State, according to the prophecy of W. D. Wilwerscheid of St. Paul, Minn., who manufactures automobile number plates. The registration for this year is already 190,000, and the total is expected to exceed 200,000 before the end of the present year.

84,000 See Show at Milwaukee

State Fair Included 202 Gasoline Cars, 2 Electrics and 14 Trucks

MILWAUKEE, WIS., Sept. 16—More people saw the second annual motor show of the Milwaukee Automobile Dealers, Inc., at State Fair park this week than visited the Milwaukee Auditorium show last January. Nearly 84,000 people paid 10 cents to see the Wisconsin State Fair automobile show of 1916. In all, nearly 100,000 people were admitted to the concrete automobile building. The official attendance at the fair for the week was 172,500, indicating that approximately one-half of the total number of visitors to the fair paid to see the show, and more than two-thirds of the persons who entered the big fair park actually saw it.

A total of 202 passenger cars; two electric cars; fourteen motor trucks, and thirty-one accessory exhibits were crowded into Automobile Hall this year.

Dealers of note from many parts of the country came to Milwaukee this week to inspect the exposition and get a line on the reasons for the great success achieved by the Milwaukee dealers' association in conducting a show at a State fair. Since the motor car became a factor, it has been exhibited at State and county fairs, generally under canvas, or in an open shed, not far from cattle and sheep, or in some corner of the fair grounds not needed for something else. It was the same at the Wisconsin State fair until 1915, when the M. A. D. leased a great concrete, shed-like "Machinery Hall," spent several thousand dollars in walling in the four sides with steel and glass, and leased out space to its members and other tradesmen on the same basis as it did for the annual show held in the Auditorium.

When the fair was over and the show closed its doors, there was enough left from the small admission charge so that every member of the association could receive a percentage return on his expense. Not only that, but every exhibitor was more than satisfied that his expenditure was well worth while on the basis of sales actually made and agencies actually placed.

Although not scheduled to open until Monday, Sept. 11, at 10:30 a. m., the show was ready for inspection at 2 o'clock Sunday afternoon. This year's fair was a 7-day event, instead of running only 5 days, as in former years.

$3,200 for Roads

On Wednesday, which was State and Good Roads day, the M. A. D., as previously pledged, turned over the entire receipts of the show to the Good Roads Association of Wisconsin, to further highway improvement propaganda. It is said that more than $3,200 was realized in this manner.

The booster tour took care of practically all the advance work of the association. It called the attention of from 750,000 to 1,000,000 people to the State fair automobile show.

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30,000 Automobiles at Iowa Fair

DES MOINES, IOWA, Sept. 16—Over 30,000 automobiles, valued at about $200,000,000, passed through the gates of the Iowa State Fair during the 10 days of that recent event. Over 5000 cars entered the grounds daily on several of the big days of the fair, and ten men were working at top speed to take care of the car entrances during the rush hours. The fair this year, with a total attendance of over 300,000, was the greatest in the history of the State.

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Car Show Building at Brockton

BROCKTON, MASS., Sept. 18—A $25,000 automobile exhibition hall is to be erected on the Brockton Fair Grounds. It will have display space for 108 cars, and will be completed the latter part of September. It will be 200 by 125 ft., with only two rows of posts, and will be electrically lighted.

Automobile Hall, in which the Milwaukee dealers held their exhibit at the State Fair

Giant's Despair Climb Oct. 7

A. A. A. Sanctions Revival of Classic—Eleven Events Based on Car Prices

WILKES-BARRE, PA., Sept. 18—The Giant's Despair Hill Climb will be held Oct. 7, according to the A. A. A. sanction.

The events are based upon the selling price of the cars entered, and are: 1, under $800; 2, under $1,200; 3, under $1,600; 4, under $2,000; 5, under $3,000; and 6, under $6,000; 7, Class E, nonstock, open to Class C cars with less than 230 in. displacement; 8, Class C, nonstock, division 6C, 231 to 300 in.; 9, Class C, free-for-all; 10, members of the Wilkes-Barre Auto Club, cars costing under $1,600; and 11, cars owned by members of the Wilkes-Barre Club, costing more than $1,600.

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Omaha to Have Closed Car Salon in October

OMAHA, NEB., Sept. 20—A distinctly new departure is the closed automobile salon, first to be held in the country at Omaha during the latter part of October, and intended to become an annual event, the same as the regular automobile show, usually held in February, with which it will not conflict. It will be held in the main aisle of the main Brandeis Stores building, and will include the display of some forty closed cars.

If possible the salon will be kept open during the evening. It is planned to continue it for 3 days. Arrangements are in charge of a committee of three, headed by Clarke G. Powell.

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N. Y. C. Sets Aside Parking Space, Due to Strike

NEW YORK CITY, Sept. 16—Special parking space has been provided in downtown New York for the large numbers of automobiles now being used by business men in reaching their offices, owing to the lack of transportation facilities caused by the traction strike. The following spaces have been set aside to meet these temporary conditions:

State Street, around park curb.
Battery Place, up to park curb.
Wall Street, Pearl to South Street, one line in center of street.
Burling Slip, Water to South Street, one line in center of street.
West Street, Rector to Cortlandt Street, two lines along outer edge of marginal way.
West Street, Christopher to Gansevoort, two lines along outer edge of marginal way.
Twelfth Avenue, Twenty-fourth to Thirtieth Street, two lines along outer edge of marginal way.
Fifty-seventh Street, Eighth to Eleventh Avenue, two lines in center of street.
Fourteenth Street, Fourth Avenue to Broadway, inside police stanchions on south side of street.
Fourth Avenue, Sixteenth to Seventeenth Street, vehicles to be backed up to west side of park curb.
Fourth Avenue, north of Fourteenth Street, vehicles to be backed up on west side to railing around monument.

Blevins and Davis in Merger

$500,000 Deal Combines Studebaker Dealers—New Co. Has Six States

CLEVELAND, OHIO, Sept. 16—The Blevins Auto Sales Co., Toledo and Cincinnati, and the A. R. Davis Motor Co., Cleveland, both Studebaker dealers, have been merged into a new $500,000 company headed by Harry W. Blevins. The company has contracted for $12,000,000 of Studebaker cars and will have the distribution of Studebakers in Ohio and portions of five adjoining States. The company starts with three buildings, in Cleveland, Cincinnati and Toledo. Associated with Blevins, who is president of the new company, are Vice-President A. R. Davis, Cleveland; Treasurer J. O. Hahn and Secretary H. G. Rossiter, Toledo. Davis was at one time branch manager for the Studebaker corporation and up to this time Hahn has been Cleveland branch manager.

Harry Newman Resigns

CHICAGO, ILL., Sept. 19—Harry Newman, president of Harry Newman, Inc., Chalmers dealers in Chicago, Milwaukee and Springfield has resigned to take a factory position. S. E. Comstock has been made general manager of the Chicago branch. Joseph B. Diebler will control the Milwaukee branch and J. D. Sullivan, Springfield.

Theft Insurance Rates Raised

BLOOMINGTON, ILL., Sept. 16—Increased rates for insurance against automobile theft have been decided upon by the Western Automobile Underwriters. The lower-priced cars, which are in greater danger of theft, due to difficulty in identification, have been raised from $2.75 to $5. On cars valued at $700 to $1,200 the rate has been increased from $2.25 to $3.50. The rate on cars valued at $1,200 to $2,100, has been raised from $2 to $3, while on the higher-priced cars, the advance has been from $1.75 to $2.

Capital-to-Capital Car in Detroit

DETROIT, MICH., Sept. 16—The capital-to-capital touring Hupmobile reached this city to-day to pay its respects to the originator of the tour, President J. Walter Drake of the Hupp concern. The party left Lansing, the capital of Michigan, and the sixteenth visited so far by the car, early in the day, and was met just outside of Detroit by a large party of good-roads enthusiasts, who formed a guard of honor, and, escorted by a band, brought the touring car through the downtown streets of the automobile metropolis and out to the Hupp factory. Detroit marks the end of the first division of the long hike. It means that the car has now traveled 3050 miles of the 20,000-mile trip it has undertaken with the intention of visiting every State capital in the interest of good roads. The car left Washington, D. C., the starting point, on Aug. 28.

Locomobile Holds Fourth Sale

NEW YORK CITY, Sept. 18—The Locomobile Company of America is holding its fourth semi-annual exchange car show and sale this week at its New York branch. The branch salesroom on West Sixty-first Street is devoted entirely to exchanged and rebuilt Locomobiles.

Ohio to Drive Out Motor Leagues

COLUMBUS, OHIO, Sept. 16—State Insurance Superintendent Frank Taggart declared he would start at once the task of driving out of Ohio all of the motorists' leagues and organizations which sell with their membership psuedo insurance policies which provide, besides membership in the organization, monetary compensation in case of accidents, free legal advice, free legal defense and many other attractive features.

Judge Taggart ruled these organizations are doing an insurance business without complying with the insurance laws of the State, and as such are illegal and their agents are subject to prosecution.

Arrested as Tire Swindlers

AKRON, OHIO, Sept. 16—Carl F. Geyer, manager of the Double Service Tire & Rubber Co., here, and manager of two other tire concerns, and Ralph C. Harper, assistant manager, were placed under arrest here by Federal authorities on a charge of using the mails to defraud.

Geyer and Harper are charged with doing a fraudulent mail order business, and Federal authorities said they had sold hundreds of defective tires, representing them as standard quality.

The arrests are the result of a year or more of investigation here by Federal officers and automobile clubs of Northern Ohio.

Geyer and Harper also are alleged to have been receiving tires for repair without returning them. They sold stock in the company for 25 cents and guaranteed buyers 80 per cent dividends, according to Federal officers.

Velie Represented in Australia

MOLINE, ILL., Sept. 16—The Velie Motor Vehicle Co., this city, has closed with Andrew Robertson, representing Clutterbuck Bros., Sydney, Australia, for representation of the Velie line in that country.

J. W. Packard a Packard Dealer

Buys Buffalo Branch of New York Co.—Will Also Handle Liberty

BUFFALO, N. Y., Sept. 18—J. W. Packard, who founded the Packard Motor Car Co., Detroit, Mich., and who gave his name to the car, has re-entered the automobile industry. He has purchased the Buffalo interests of the Packard Motor Car Co. of New York, and will conduct the Buffalo branch as an agency, handling the Packard and the Liberty. Mr. Packard is president of the new business, which is called the Packard Buffalo Motor Co., Inc. B. C. Day, former manager of the branch, is vice-president, and the other directors are: W. D. Packard, capitalist, a brother of the president; E. C. Sutton, president of the Wheat's Ice Cream Co., and L. R. Davidson of the Davidson Ore Mining Co.

The first Packard car was built in Warren, Ohio, by J. W. Packard, in 1899. While the business was still in its infancy Mr. Packard sold his interest to the group which now controls it, and has not been actively connected with the industry since.

The Packard Motor Car Co. of New York has opened a branch in White Plains.

Iowa Denby Dealers Meet

DES MOINES, IOWA, Sept. 16—Iowa dealers for the Denby Motor Truck were assembled here during State fair week, and at their convention listened to talks by Garvin Denby, president of the company, and W. J. Aitken, sales manager, who came from Chicago for the event. President Denby predicted a big business ahead in Iowa for the motor truck men, both among farmers and merchants.

Abler Opens Office in N. Y.

NEW YORK CITY, Sept. 18—M. M. Abler, manufacturers' representative, with branches in Amsterdam, Holland, Birmingham, England, and Soerabaya, Java, has opened a New York office at 32 Union Square East. The concern is now representing Studebaker cars, Goodyear tires, the Automobile Supply Mfg. Co., Brooklyn, N. Y., and intends other connections.

Bearings of Pa. Branch in Chicago

PHILADELPHIA, PA., Sept. 16—The Bearings Co. of Pennsylvania, this city, will open a branch in Chicago. Louis C. Smith, formerly associated with the Class Journal Co. in Chicago, will be manager.

Factory Miscellany

Standard Tire Plant Progresses—The new unit of the plant of the Standard Tire & Rubber Co., Willoughby, Ohio, is almost completed. It contains a power plant sufficient to turn out 1500 to 1800 tires per day. Equipment has been ordered. The company is now bringing out a black tread tire guaranteed to run 3500 miles.

Atterbury Rebuilds—Atterbury Motor Car Co., Hertel Avenue, Buffalo, N. Y., is rebuilding its factory recently destroyed by fire. The estimated cost of the new factory is $50,000.

Tire Plant for Belleville—Maple Leaf Tires, Ltd., has secured a factory site of 22 acres in Belleville, Ont., and has commenced building operations. The company will employ 100 hands at the start. The main building will be nearly 300 ft. long and of concrete and steel construction. It is intended to rush it toward completion before cold weather sets in. Fifty men are now at work preparing for the foundation.

Overland Service Plant in Brooklyn—The Willys-Overland Co. has leased a site 150 by 130 at St. Marks and Underhill Avenues, Brooklyn, N. Y., on which it will erect a service plant. The rental for a period of years is $100,000.

Hudson Service Plant in N. Y.—The Hudson Motor Car Co. of New York, Inc., has let the contract for a service station, 203 by 239, four stories, between West Sixty-eighth and West Sixty-ninth Streets and the North River.

Tom Thumb Tractor Grows—The Tom Thumb Tractor Co., University and Thirtieth Avenues, S. E., Minneapolis, Minn., plans increasing its facilities to twenty-five tractors per day by April 1, 1917. The plant now makes ten tractors per week and employs about thirty men. This number may be increased to 200.

Harrow Spring Adds—The Harrow Spring Co., Kalamazoo, Mich., is to build a large addition to its plant.

Christensen to Expand—The Christensen Engineering Co., Milwaukee, Wis., which has increased its capital stock from $300,000 to $1,000,000, will immediately increase its output of the Christensen air-starting mechanism. The starter is generally used on fire department cars, aeroplanes and motor trucks, many having been shipped to Europe in the last 18 months for war purposes. The factory at 841 Thirtieth Street will be enlarged and from 75 to 100 men added to the payroll.

Boone County Tire Buys Site—The Boone County Tire and Rubber Co. has been organized and will shortly commence the manufacture of tires at Belvidere, Ill. Ten lots have been purchased in a suburb of that city and plans have been prepared for the necessary buildings. When in operation, the plant will turn out 200 tires per day and will employ from 150 to 200 persons. It is hoped to have the buildings erected and machinery installed by Jan. 1.

Parker Rust Proof to Build—The Parker Rust Proof Co., Detroit, Mich., which will manufacture a rust-proof liquid used on motor cars, has purchased a site on Conant Road, in Hamtramck, for a factory, work on which has already been started. It is stated that 700 men will be employed in the plant.

Big Four Tire Plant—The Big Four Tire and Rubber Co., Cleveland, Ohio, has purchased as temporary quarters the plant of the Ohio Rubber Co. on the Lake Shore and Big Four tracks at Berea for about $12,000. There are 18,000 sq. ft. of floor space in the plant, which occupies a tract of 5½ acres. The company is moving its machinery into the building and expects to begin manufacturing in about 60 days. The company is to manufacture a patented combination rubber, fabric and steel tire.

United Smelting's New Mills—The United Smelting & Aluminum Co., Inc., New Haven, Conn., has opened its new rolling mills in that city. Work is furnished in aluminum sheets, coils, circles, etc., to any specifications.

Miller Has Factory Paper—The Miller Rubber Co., Akron, Ohio, is issuing a factory paper entitled "Miller Talk," every one of the 3000 employees being asked to contribute.

Firestone Opens in Kansas City—The new branch building of the Firestone Tire and Rubber Company in Kansas City, Mo., was opened Sept. 14, and a dealers' convention was held during the day, which was attended by 500 dealers from various points in the branch territory.

The new building is eight stories high, and contains shop, storage and shopping facilities.

The dealers spent part of the morning inspecting the new quarters and meeting the various Firestone executives from the home office in Akron. The day's events included a group photograph, luncheon, motor parade, business session, in which sales and distribution problems were discussed, and ended with a banquet in the evening.

The Automobile Calendar

ASSOCIATIONS

Sept. 25—Indianapolis, Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.

Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.

Oct. 2-7 — Kansas City, Mo., Dealers' Show, American Royal Live Stock Show; Kansas City M. C. Dealers' Assn.

Oct. 13—Flint, Mich., Fall Meeting National Assn. of Automobile Accessory Johbers.

Dec. 2-9—Electricians' Countrywide Celebration.

CONTESTS

Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.

Sept. 30—Astor Cup Race, 250 miles, Sheepshead Bay Speedway, Sheepshead Bay, N. Y.

Oct. 7—Philadelphia Speedway Race.

Oct. 7—Omaha Speedway Race.

Oct. 14 — Chicago Speedway Race.

Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.

Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.

Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

April, 1917—Los Angeles to Salt Lake City Road Race.

SHOWS

Sept. 25-30—Salem, Ore., State Fair, Joseph M. Rieg, manager.

Oct. 6-11—St. Louis, Mo., Open Week, Dealers' Assn.

Oct. 9—Kansas City, Mo., Fourth Annual Trade and Booster Tours, Kansas City Motor Car Dealers' Assn.

Oct. 14 - 31 — Dallas, Texas, Show, State Fair.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 13 - 20 — Montreal, Que., Show, Montreal Automobile Trade Assn.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Jan. 27-Feb. 3, 1917 — Chicago, Ill, Show, Coliseum, National Automobile Chamber of Commerce.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers, and Dealers' Assn.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

March 3-10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

TRACTOR

Oct. 14-29—Dallas, Tex., Demonstration, Texas State Fair.

The Week in the Industry

Picard & Stern Ford Dealers—A. J. Picard and E. Joseph Stern have opened a Ford agency at 1659 Broadway, New York City. Picard is the principal in A. J. Picard & Co., an accessory jobber and dealer and distributer of the Genemotor electric system for Fords. Stern is associated with Picard in the Picard company.

To Handle Scripps-Booth—Michigan distribution of the Scripps-Booth four and eight-cylinder cars has been secured by the newly-formed Oldsmobile Distributing Company, Detroit. Recently W. H. Collins and F. J. Muellerschoen bought out the Oldsmobile branch here, and the taking on of the Scripps-Booth adds another car to the line.

Howard Denneen's N. E. Sales Mgr.—S. B. Howard, formerly eastern and foreign representative of the General Motors Company, has been appointed New England sales manager of the Denneen Motor Company, Cleveland, Ohio.

E. P. Strang, formerly with the Kirk-Latty Mfg. Co., Cleveland, has been appointed middle western sales manager of the Denneen company.

Fisk Rubber Builds Service Station—The Fisk Rubber Company opened a new branch office and service station in Galesburg, Ill., leasing a new building, corner of Simmons and South Kellogg Streets. The Galesburg branch is one of a series being established throughout Illinois. The building has a frontage of 60 ft. and a depth of 80 ft. A vulcanizing department and repair shop will be inaugurated.

Earle and Boggs Open N. Y. Office—L. H. Earle and G. A. Boggs, who resigned from the Continental Motors Company last July, have incorporated as Earle & Boggs, to act as manufacturers' representatives for materials. Offices have been taken at 1790 Broadway, New York City, and accounts opened with the Pierce Governor Company and the Blood Brothers Machine Company.

King from Branch to Factory—Changes have been made at the New England branch of the B. F. Goodrich Co. at Boston by the promotion of officials to the factory. Edward King, for several years office manager, has been brought to Akron to join the administration forces. O. E. Hoeger, for some years office manager at St. Louis, has been moved to the Boston branch. C. E. Littlefield, who had charge of advertising and publicity at Boston, has been promoted to a position at Akron under E. C. Tibbetts. Mr. King was presented with a gold watch by his associates before leaving for Akron.

Storey Takes Maxwell in Canada—F. H. Storey, formerly an official of the Maxwell factory, at Detroit, Mich., has arrived in Winnipeg, Man., to take over the interests of the Maxwell Company of Canada, from Fort William to the Pacific Coast.

One of the first steps Mr. Storey will take will be the complete reorganization of the Maxwell service department in Winnipeg. Also there will be new showrooms of the type used by the Maxwell American firm during the New York-Chicago and Boston automobile shows last year, opened at 700 to 708 Portage Avenue.

Cleveland Retail News—The Jordon Motor Car Agency has been formed to handle the Jordon in Cleveland, Ohio, and space has been taken temporarily at 2052 Euclid Avenue. C. C. Neighbors, formerly of the Neighbors Motor Car Company, will be the manager, while V. E. Watkins will be sales manager. Their territory will consist of Cleveland and northeastern Ohio.

The Carris-Franklin Company, 1829 East Thirteenth Street, will handle the Franklin in Cleveland and adjacent territory. C. S. Carris has been associated with the Franklin organization for thirteen years. The employees of the service department of the agency all came from the Franklin factory.

The local sales office of the Standard Tire & Rubber Co., at Cleveland, has been moved from 5017 to 6521 Euclid Avenue. The executive offices remain in the Hippodrome Building.

J. Preston Penfield has been chosen president of the Luxurious Light Car Co., 1849 Euclid Avenue, Cleveland, to succeed J. M. Smith, who has gone to the Cole Sales Co. of Indiana.

E. D. Endsley has been appointed sales manager of the Alter Motor Car Company, distributer of Scripps-Booth and Liberty in Cleveland.

Gets H. A. L. in Ohio—A. W. Woodruff has organized the Woodruff Motors Co. and has opened offices and salesrooms at 2019 Euclid Avenue, having been appointed distributer of the H. A. L. for northern Ohio.

Edison Opens in Los Angeles—The Edison Storage Battery Supply Co. has opened its Los Angeles office on the fourth floor of the San Fernando Building, Fourth and Main Streets.

James F. Rogan, who has been acting as local distributer, will become resident manager.

H. A. L. California Distributers—The Eugene Schuler Co., San Francisco, Cal., has been appointed distributer for H. A. L. cars for the State.

Pearl Motor Car Co., Los Angeles, will have charge of the territory of southern California.

Mountain Trade News—The Colorado Motor Co., Denver, is the name of a new Reo distributing agency for Colorado, with headquarters at 1535 Cheyenne Place. The manager is George J. Hawley, formerly manager of the Reo-Saxon Auto Sales Co., Colorado Springs.

The William Thorney Auto Co., Denver, Apperson distributer for Colorado and Wyoming, has secured the Regal distributing agency for the same territory.

The Carter Motor Car Co., Denver, formerly the Overland Auto Co., which was Overland distributer for Colorado and Wyoming several years up to the recent opening of the Willys-Overland branch here, now has the King and Saxon distributing agency.

The Motor Bank, Denver, is the name of a bank just opened at 1245 Broadway, chiefly for the purpose of helping dealers finance their business when stocking up with cars.

The Roberts Auto Co., Denver, Marmon distributer for Colorado and Wyoming, is having a $20,000 building erected at 1231-1239 Broadway, on a $30,000 site. The building will be two stories high and 50 by 150 ft.

Heiser Brothers Co., Denver, Velie distributer for Colorado and Wyoming, has moved from 1236 Broadway into a new $38,000 building of its own at 700 Broadway. The new structure is 50 by 125 ft., one story and basement.

The Premier Motor Car Co. of Denver, is the name of a new $25,000 incorporation to distribute the Premier in Colorado, Wyoming and New Mexico. O. H. Woods is president and treasurer, and Charles H. Davis, formerly salesman for the Norton-Buick Co., is manager. The salesroom will be located in the Fisk Building.

The Cadillac Motor Co., Denver, Cadillac distributer for Colorado and Wyoming, is erecting a $40,000 fireproof building of steel, concrete and brick, on the corner of Broadway and East Fourteenth Avenue. It will be 50 by 133 ft., three stories and basement.

The Automobile

Vol. XXXV
No. 13

NEW YORK, SEPTEMBER 28, 1916

Ten cents a copy
Three dollars a year

Cowl Board and Speedometer Combined—for Ford Cars

Here's a new Stewart Product for Ford Cars—a Cowl Board, beautifully finished in black enamel, with a Stewart Speedometer mounted in the center.

It adds a finish and a touch of distinction to the Ford dash.

And it holds the Speedometer in a position where it is easy to read.

And the price complete is only a trifle more than the single cost of the Speedometer.

Already selling fast in all parts of the country.

Get in among the leaders.

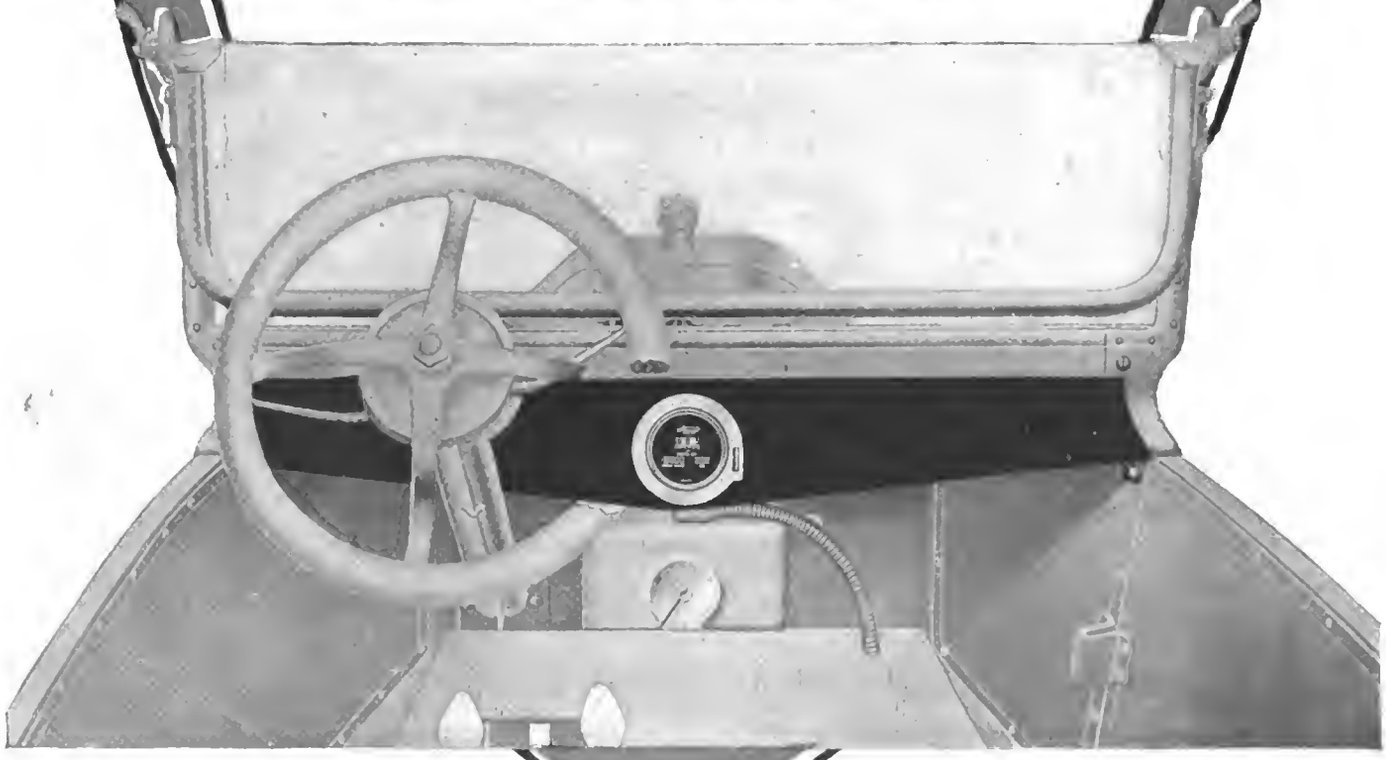
Speedometer for Fords, $10
Cowl Board, $1.25 Price Complete, $11.25

"It will pay you to see that the car you buy is equipped with Stewart Products"

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Stewart

Speedometer and Cowl Board for Fords



The Automobile

VOL. XXXV NEW YORK—THURSDAY, SEPTEMBER 28, 1916—CHICAGO NO. 13

Spicer Mfg. Co. Reorganized

$7,000,000 Corporation to Take Over Business—Name and Management Unchanged

PLAINFIELD, N. J., Sept. 26—The business of the Spicer Mfg. Co., probably the largest maker of universal joints in the world, has been purchased by a syndicate of bankers headed by Merrill Lynch & Co., New York, and Cassatt & Co., Philadelphia. The purchasing syndicate is now offering $1,500,000 first preferred 8 per cent stock at $100 per share. There will also be $500,000 second preferred and $5,000,000 common stock. The first preferred 8 per cent stock has the privilege of conversion into common stock at any time.

Officials Continue in Office

C. W. Spicer and the other officials who have been responsible for the remarkable success of this company will continue to occupy their present positions, in fact, the management will not be changed in any way.

Owing to the fact that Spicer universals are used by a number of the big quantity producers of automobiles, the demand in the past 2 years has increased enormously and the factory at South Plainfield has been expanded in order to take care of its customers. At the present moment a large extension is in process and it is said that the number of universals made during 1917 will not be less than 700,000. Of these, of course, a large proportion are sent out in pairs welded to driveshafts as complete units. Practically all the needs of the automobile industry are taken care of by nine different sizes of universals, this covering both passenger car and truck, so the business is a very straightforward one as a manufacturing proposition.

The reputation of the Spicer joint has been obtained mainly by the use of high grade material and careful workmanship of the wearing parts. A proper selection of the steel and accurate heat treatment are features of the business to which C. W. Spicer has given very particular attention.

—

Tainsh Mitchell Sales Manager

RACINE, WIS., Sept. 26—John Tainsh, formerly assistant sales manager of the Mitchell Motors Company, Inc., this city, has been appointed general sales manager, which position was left vacant by the election of O. C. Friend as president and general manager. George W. Hipple retains the office of general merchandising counsel, and there are three assistant sales managers, Frank W. Pelton, for 3 years in charge of advertising, adding to his duties those of assistant sales manager in charge of western sales; William Liniger, formerly Eastern field representative, becomes assistant sales manager of Eastern sales, and F. W. Archer sales manager in charge of distribution. Federico Sarda, at present abroad in the interests of the company, continues as foreign sales manager.

—

Plath to Handle Harroun Sales

DETROIT, MICH., Sept. 25—John J. Plath, who was sales manager of the Maxwell Motor Co., has resigned to join the recently organized Harroun Motors Corp., where he will have charge of the sales department.

No successor has been named yet by the Maxwell company to take Mr. Plath's place, who, previous to his promotion as sales manager of the company, was manager of the Maxwell branch in New York.

—

Roamer Price Increased $50

STREATOR, ILL., Sept. 26—The Barley Motor Co., this city, has increased the price of the Roamer car $50, making the new price $1,850.

$100,000,000 G. M. Corporation

New Organization To Take Over G. M. C.—1916 Profits 168.61% on Common

HIGH LIGHTS OF G. M. C. 1916 REPORT

Net Profits	$27,740,596
Gain over 1915	12,814,274
Gross sales	156,900,296
Gain over 1915	62,475,455
Cars built	132,088
Gain over 1915	56,020

NEW YORK CITY, Sept. 27—A new $100,000,000 company, to be styled the General Motors Corp., will on Nov. 1 take the place of the present General Motors Co. Holders of more than 65 per cent of the stock of the General Motors Co. have signified their consent to the readjustment and the plan will become effective Nov. 1, 1916.

The formation of the new company will have no effect whatever on the plan of operation of the various General Motors subsidiary companies, nor will there be any changes in personnel or management. Although it had been rumored that with the formation of the new company, the Chevrolet Motor Co. would be taken in, officials of this company state that mention of the Chevrolet company did not enter into the discussion.

Announcement of the readjustment plan follows publication of the General Motors Co.'s annual statement, as of July 1, 1916, which shows that the net profits for the fiscal year were $27,740,596, after deducting preferred dividends. This represents 168.61 per cent on the $16,511,783 common stock outstanding and compares with $14,926,322 net profit for the year 1915, an increase of $12,814,274.

Plan Formally Ratified

At a meeting of the stockholders of the General Motors Co. held yesterday in

(*Continued on page* 551)

N. A. C. C. Forms Traffic Board

Committees of Traffic Managers and R. R. Men to Handle Freight Car Shortage

NEW YORK CITY, Sept. 26—A committee of four traffic managers, consisting of: H. R. Moule (Chalmers), Chairman; H. Higginbottom (Dodge), H. M. Newlin (Maxwell), and C. W. Eggers (Willys-Overland), has been formed to co-operate and confer closely with the Traffic Department of the National Automobile Chamber of Commerce on the question of freight car supply, and the department will put into effect any action that may be helpful.

A committee of five railroad operating men has also been appointed, consisting of: C. H. Bieber (Michigan Central), Chairman; H. J. Merrick (New York Central), C. B. Strohm (Santa Fe), J. W. Roberts (Pennsylvania Lines) and E. E. Betts (Chicago & Northwestern), to give the handling of automobile equipment special thought and co-operate with the chamber in proper supervision of the cars.

The N. A. C. C. has notified its members that car balances of the American Railway Assn. show a net shortage of 14,281 freight cars. This is the lowest supply ever reported at this time of the year when there is usually quite a surplus of cars. A year ago this surplus was 264,243 cars, notwithstanding which a serious car shortage was experienced during the months immediately following.

Members are told this condition indicates that each freight car must be made to perform maximum service and it is urgently recommended that incoming freight at the factories be unloaded promptly and not be permitted to accumulate; also that shipments of automobiles to dealers should be unloaded immediately upon arrival, inasmuch as such shipments are in the special automobile cars, which will be the first to feel the shortage of equipment.

—

N. A. C. C. Committees Named

NEW YORK CITY, Sept. 23—Following is the personnel of the various committees of the National Automobile Chamber of Commerce for the coming year:

Patents—Chairman, C. C. Hanch, Studebaker Corp.; William H. Van Dervoort, Moline Automobile Co.; Windsor T. White, White Co.; W. C. Leland, Cadillac Motor Car Co.; Howard E. Coffin, Hudson Motor Car Co.

Traffic—Chairman, William E. Metzger, Argo Electric; R. E. Olds, Reo Motor Car Co.; A. I. Philp, Dodge Bros.

Show—Chairman, George Pope; W. C. Leland, Cadillac Motor Car Co.

Legislative—Chairman, H. H. Rice; Waverley Co.; J. Walter Drake, Hupp Motor Car Co.; J. I. Farley, Auburn Automobile Co.

Electric Vehicle—Chairman, H. H. Rice, Waverley Co.; Fred R. White, Baker-R & L Co.; W. C. Anderson, Anderson Electric Car Co.

Commercial Vehicle—Chairman, Windsor T. White, White Co.; Alvan Macauley, Packard Motor Car Co.; H. Kerr Thomas, Pierce-Arrow Motor Car Co.; P. D. Wagoner, General Vehicle Co.; M. L. Pulcher, Federal Motor Truck Co.

Good Roads—Chairman, Roy D. Chapin, Hudson Motor Car Co.; W. E. Metzger, Argo Electric; C. C. Hanch, Studebaker Corp.

Hand Book—Chairman, Carl H. Pelton, Maxwell Motor Co.; A. I. Philp, Dodge Bros.; A. L. Riker, Locomobile.

Membership—Chairman, Wilfred C. Leland, Cadillac Motor Car Co.; Hugh Chalmers, Chalmers Motor Car Co.; C. W. Churchill, Winton Co.

—

Torbensen Axle Elects Officers

CLEVELAND, OHIO, Sept. 23—At a meeting of the stockholders of the Torbensen Axle Co., this city, V. V. Torbensen was elected president; W. J. Baxter, vice-president; J. O. Eaton, treasurer; and A. H. Ide, secretary. These officers, with S. H. Tolles, constitute the board of directors.

Besides the officials named, W. F. Rockwell has been appointed works manager; R. A. Bruce, sales manager; and C. I. Ochs, purchasing agent.

—

151,067 Overlands in Year

TOLEDO, OHIO, Sept. 23—The Willys-Overland Co. shipped 151,067 automobiles during the 12 months ending Sept. 19, of which 59,378 were small light cars. This is nearly double the record of the preceding 12 months when 80,750 cars were shipped. More unfilled orders for immediate shipment are on hand at present than there were a year ago.

—

Rosenberg is M & S Engineer

DETROIT, MICH., Sept. 22—R. H. Rosenberg, formerly with the Universal Machine Co., Bowling Green, Ohio, has resigned to become chief engineer with the M & S Gear Co., this city.

—

$5,000,000 Firestone Stock Sold

CLEVELAND, OHIO, Sept. 25—H. S. Firestone, president of the Firestone Tire & Rubber Co., closed negotiations, Sept. 22 for the sale of $5,000,000 new preferred stock issue of the company to the Cleveland Trust Co. The stock will be offered to the public soon.

This transaction is unusual in rubber financing as it is the first large issue to be sold carrying as low a dividend rate as 6 per cent. Previous issues have been on a 7 per cent basis.

The stock is callable at 110 and the redemption price will be at the same figure. Beginning in 1921 the company agrees to redeem the stock to the extent of 5½ per cent of the largest amount at any time outstanding. The present issue, $1,000,000 has been called for redemption at 110 as of Nov. 1. The new stock will be issued as of that date or earlier.

Goodyear Adds to Agents

No Exclusive Territory Given—Dealers Must Make Money and Give Service

AKRON, OHIO, Sept. 26—The Goodyear Tire and Rubber Co. will put into effect Oct. 1 a new plan for retailing its tires. The number of dealers will be reduced about 66 per cent, and those that remain will be required to be of high business calibre. All price lists will be withdrawn Oct. 1 and the new plan will be instituted at once.

Dealers under the new system must be a service station as well. They must carry an adequate stock of tires, tubes and accessories and must be in position to give to the public the service to which Goodyear considers the public entitled.

No Price Changes

There will be no change of consequence in price. Tires will be sold as heretofore on the consumers' list, and the dealer's price will be based upon what has become to be known as the pink list. No requirements as to price maintenance will be made. The only thing the company will insist upon is that the dealer so conduct his business that he is a worthy representative.

It is estimated that there are now in the United States 25,000 or 30,000 Goodyear dealers, and it is also estimated that under the new plan there will be only about 10,000. If the present volume of factory production continues it is obvious that the dealers under the new plan will do in the aggregate 200 per cent more business than they are doing now.

Plan Tried Out

The plan has been operating partially in Chicago, Kansas City, St. Louis, Boston and New York for several weeks. It was begun for the first time about three months ago. The present lists have not yet been withdrawn in these cities, but the placing of service dealers has been begun.

While the Goodyear move is radical among large tire producers, it is not entirely new with Goodyear for its cord tire has been handled on this basis. Because the cord tire was a new type and a comparatively expensive article, it was required that the dealer maintain a certain stock and be equipped to take care of his trade.

The new contracts with dealers will not give exclusive territory, although one of the company's executives states that in towns of a reasonably small population there might not be more than a

(*Continued on page* 551)

Kent Motors Car at $985

Four-Cylinder Touring and Roadster Models Planned—Buy N. J. Plant Site

NEW YORK CITY, Sept. 23—The Kent Motors Corp. has been formed here to manufacture a four-cylinder touring and roadster model at $985. A plant site has been purchased in Newark, N. J., and it is stated that a plant to produce 5000 cars a year will be started at once. Production of cars will be started about Jan. 1. The company will absorb the Kent Motors Corp. of New York, which heretofore has been a dealer, handling at various times the Pullman, the Abbott-Detroit and the Elcar; distribution of the Elcar will be continued for the time. F. H. Clarke, president of the old company, is president of the new one, and associated with him as directors are: Wallace A. Hood; Major A. White, president New York Plate Glass Co., president of the City of New York Insurance Co., and vice-president of Madison Trust Co.; Thomas L. Raymond, Mayor of Newark, N. J.; P. P. Dean, chief supervising engineer; L. A. D. Percival, president Amalgamated Paint Co., New York; R. J. Cosgrove, formerly of the Ford Motor Co.; Lloyd H. Foster, factory superintendent, formerly of the Hupp Motor Car Co. and Briscoe Motor Co.; and Alexander U. Conquest, formerly assistant engineer, Daimler Motor Works, England.

The car will have a Continental 3¾ by 5-in. engine equipped with Bosch magneto and Bosch lighting and starting and Zenith carbureter. Other specifications are: Borg & Beck clutch; Grant-Lees gearset; Timken axles; Gemmer steering gear. The wheelbase will be 116 in. on 32 by 4 tires and rear springs will be three-quarter elliptic. Equipment includes top, slanting windshield, Stewart speedometer, 8-day clock and the usual tools.

—

Canadian Ford Copies Selling Plan

WINNIPEG, MAN., Sept. 24—The Ford Co. of Canada has decided to adopt the selling plan recently started by the American company. In Centre Winnipeg, Michael Ert, Limited, will act as Ford selling agents and will immediately construct a new service station and garage in order to be in position to supply first class service. North Winnipeg will be controlled by the Universal Motor Co., a newly formed organization having behind it representatives of the brewing firm of Drewry's, Ltd., on part of whose property the new garage and service station will be erected.

West Winnipeg will be under the control of Dayton and Studely, former members of the factory branch sales staff. This firm is also erecting a new service station and show rooms.

A garage and service station will also be opened in the South Winnipeg district, but the name of the firm securing the agency has not yet been announced. Any of the agents can sell in the other man's territory, but the service stations will only be expected to cover the districts as outlined. The entire sales staff of the factory branch has been closed and most of the members of the staff have secured positions with the new selling organizations.

Dealers Give Bonds

A bond has to be given by all of these dealers protecting the interest of other agents in regard to any price cutting, retail sale prices of the Ford as advertised having to be maintained in every instance.

—

Automobile Securities Corp. Formed

NEW YORK CITY, Sept. 23—The Automobile Securities Corp. has been incorporated here with $100,000 capital to deal in automobiles, accessories, etc. The incorporators are: C. R. Allison, P. Lacroix and W. L. Glover, New York.

—

Crow-Elkhart Motor Co. Now

INDIANAPOLIS, IND., Sept. 25—The Crow Motor Car Co., Elkhart, Ind., was granted permission by court order last week to change its name to the Crow-Elkhart Motor Co. The name of the car manufactured by the company recently was changed to the Crow-Elkhart.

—

Sweet Leaves M. & A. M. for U. M.

NEW YORK CITY, Sept. 25—William E. Sweet, for 10 years general manager of the Motor & Accessory Manufacturers, the national organization of the accessory industry, has resigned to become assistant to the president of the United Motors Corp., New York. This organization is a holding company recently formed and its subsidiaries are Delco, Hyatt, New Departure, Remy, Klaxon and Perlman. Mr. Sweet assumes his new position on Oct. 15, and will have offices at 33 West Forty-second Street, this city. He will have the management of the corporation under the direction of the president and board of directors. Mr. Sweet was directly responsible for the organization and development of the accessory association and his new position should give him good opportunity for development work. A. P. Sloane, Jr., of the Hyatt company is president of the corporation, E. A. Deeds, of Delco, vice-president, and Dewitt Page of New Departure, secretary-treasurer.

Another Record for Hudson

Makes Transcontinental 'Frisco-N. Y. Round Trip in 10 Days, 21 Hr., 3 Min.

SAN FRANCISCO, CAL., Sept. 24—The Hudson Super-six which arrived in New York, Sept. 18 after shattering the record for the trip from San Francisco to New York by 15 hr. has returned to San Francisco, the elapsed time for the round trip being 10 days, 21 hr. and 3 min. The elapsed time between New York and San Francisco was 5 days, 17 hr. and 32 min. as against 5 days, 3 hr. and 31 min. for the journey eastward.

Remaining in New York only long enough to replenish gasoline and lubricating oil and give the drivers a chance for some rest, the car was started back to San Francisco on Sept. 18 at 10.50 p. m. It was checked out of New York by Jas. A. Hemstreet of the American Automobile Assn. who checked it in on its eastward journey.

Drivers the Same

The same drivers had the car in charge in its second transcontinental dash, Ralph Mulford, A. H. Patterson and C. H. Vincent alternating at the wheel.

The total distance traversed was a trifle less than 7000 miles (6952), and the average daily mileage was about 700.

On the return journey heavy rains were encountered which caused the drivers to go through the Sierra Nevada mountains, thus increasing the distance. But for this, the time, according to the drivers, would have been about 15 hr. less. The last stretch to the Pacific Coast required 35 hr., whereas the same distance was covered in the eastward journey in 20 hr.

—

Chandler Export Office Moves

NEW YORK CITY, Sept. 23—W. S. M. Mead, vice-president of the Chandler Motor Car Co. in charge of exports, has removed his offices from the salesrooms of the Brady-Murray Motors Co., New York distributors, to larger quarters at 1790 Broadway. C. S. Levitt, formerly traffic manager of Gaston, Williams & Wigmore, has joined the Chandler export staff to look after its rapidly increasing foreign shipments.

—

3½-Ton Acme on the Way

CADILLAC, MICH., Sept. 19—The Cadillac Auto Truck Co., will shortly bring out a new model. This will be a 3½-ton truck, the largest yet made by this concern. Full particulars are not yet available.

BRAZIL

Largest Country in South America Is Not Greatest Automobile Market—Poor Roads Big Handicap—State of Sao Paulo, with Its Coffee Industry, Is Best Field for U. S. A. Automobiles, Trucks and Tractors

Part I

By David Beecroft

¶EDITOR'S NOTE:—This is the first of a series of articles embodying the close observations of automobile and general trade conditions in Brazil made by Mr. Beecroft, Directing Editor of THE AUTOMOBILE, during a 10-weeks' trip through Argentina, Uruguay and Southern Brazil as a delegate of the United States Government and member of the Argentine Return Visit Committee. Future articles will further analyze the possibilities of selling cars, trucks and tractors in the United States of Brazil.

BRAZIL does not offer the great automobile market possibilities to-day that Argentina does. Last year we exported over seventeen times as many cars to the Argentine Republic as to Brazil. This is an unexpected condition, in that Brazil is much larger in area than Argentina—Brazil is as large as all U. S. A., leaving out Alaska, whereas Argentina is equal in area to that part of our country east of the Mississippi River. But go further: Brazil has a population of 25,000,000 and Argentina has only 8,000,000. Automobile buying capacity cannot be gaged by area or population.

Will Be Great Market

Brazil will one day be a great buyer of U. S. A. cars; it may be a greater buyer than Argentina, but for the present the reverse holds good. Last year we exported 4444 automobiles to Argentina and only 253 to Brazil. These figures do not represent the correct purchasing ratio between the two countries. The Argentine figures are partly due to war prices for grain and beef, the two great products of Argentina. Our automobiles have been selling to Argentine farmers, who might not have taken to them so readily had it not been for the unexpected cash that flowed from Europe.

Brazil was not so fortunate. She is not the great grain-producing nation that Argentina is. She is not so great a cattle-raising nation. Her goods were not so much in demand. These are not the only reasons that have made Brazil such a poor buyer. There are several others that cannot be answered in a word, or in one article.

The U. S. A. automobile and truck and accessory maker are more interested in Argentina than Brazil for varied reasons. It is debatable if the population of Brazil is as potential a buying population as Argentina's. Argentina is much more white in population than Brazil. There is much African blood through all parts of Brazil, with the possible exception of one or two States along the Atlantic south of Rio de Janeiro. The Atlantic seaboard and southern Brazilian States are the only ones that greatly interest our manufacturers, although there are some ports in the Amazon valley that are absorbing numbers of our cars. The valley of the great Amazon is the largest area in the world that has not come under the sway of man as it should. It is very backward. It is an exceedingly difficult area to handle due to the climatic conditions, in places it lies directly under the equator. The population is very largely colored. It is generally conceded as a poor place for white men.

There is another difficulty, namely, the wide river beds of the Amazon and its many tributaries, which are often overflowed for miles on either side, rendering cultivation very difficult. Because of this situation it is to the southern part of Brazil that our makers must to-day turn their attention.

In this southern section there is no better place than the State of Sao Paulo, the great coffee land of South America, and as fine a part of South America as can be found. Sao Paulo is a white State, with white labor on the coffee plantations. The people in the hustling City of Sao Paulo are white. They are as honest people as you can find. They have a complete grasp of modern business methods. Their fair city and productive state bristle with twentieth-century ideas. You can find no better territory south of the equator. It is a place of greatest interest to our entire automobile and farm-tractor industry.

Before going into details of the automobile selling market in Brazil it is better to gain a clearer conception of the state in general. The map on the opposite page will assist.

Brazil as a Country

The country is known as The United States of Brazil. Brazilians are as proud of the title as we of ours, The United States of America. They do not like our title, because South America is as much America as North America. They say we should style ourselves The United States of North America. A person from any country in South America is as much an American as one from North America.

In area Brazil is as large as we are, but in population only one-third. The country is divided into twenty-one States—just as we are divided into forty-eight. We have our federal capital in the District of Columbia, and in Brazil the federal district is called Rio de Janeiro, and in it is located the federal capital, the City of Rio de Janeiro. As with us each State in Brazil has its State capital and there are the two legislative houses, the House of Representatives and the Senate. The map shows the division into the different States and the capital of each State is given.

The Atlantic seaboard from Natal to Rio Grande do Sul gives every indication of progress. The network of rail-

The United States of Brazil

THE United States of Brazil, a federation of twenty-one states each with its own government, occupies the largest part of the continent of South America. In area Brazil compares with the United States of America, the Dominion of Canada, the continent of Europe and the continent of Australia. Each occupies approximately 3,000,000 square miles. In population Brazil ranks much higher than Australia or Canada but not so high as Europe or U. S. A. Brazil has 25,000,000, Canada has approximately 8,000,000 and Australia has 5,000,000.

Each of the twenty-one states comprising the United States of Brazil has a house of representatives and a senate, both being elective bodies. The map shows the names of all twenty-one states and the capital city of each is marked. There are scores of smaller cities in each state but they are not indicated.

The part of Brazil in which U. S. A. automobile, truck, accessory and tractor makers are most interested is that section along the Atlantic coast from the mouth of the Amazon river to Uruguay. The line of ports shows that settlement started from the coast. All of these ports have very modern docks with electric or hydraulic cranes for loading and unloading. We have no docks in U. S. A. that in general can compare with them.

From these ports railroads pierce the interior, those radiating from the great coffee port of Santos being the most extensive. These railroads are generally held by Europeans, England being by far the largest controlling interest. Brazil does not compare with Argentina in railroad mileage, but good progress is being made in pushing her roads.

This section of Brazil covered by railroads is the greatest buying center for automobiles. The northern part of Brazil is accessible by the great Amazon river and its large tributaries. The Amazon is navigable for steamboat lines from New York for over 2000 miles; in fact, you can take a steamer in New York and sail entirely across Brazil on the Amazon. You can reach Peru this way. Then several of the Amazon tributary rivers on the south are navigable for much of their length.

roads is a good indication of the relative importance of the different sections. The State of Sao Paulo has most railroads; it is the coffee land. The great State of Minas Geraes has many railroads to serve its valuable mining interests, the State being the greatest mineral area of Brazil.

All along the coast you will observe that railroads radiate from the ports, but as yet the line of ports has not been linked together by railroads. Thus as yet you cannot travel from the Port of Bahia to Rio by train. Connecting railroad lines are under construction, but it may be several years before all connections are completed. The same is true between Bahia and Pernambuco. Both of these are large cities, Bahia with 300,000 population and Pernambuco with 200,000 people. Their population would warrant them being connected, but the percentage of African blood exerts a curtailing influence.

Few Long-Distance 'Phones

There are many other things in connection with Brazil that surprise you. Thus you cannot talk by long distance telephone from Rio to Sao Paulo, 310 miles, the two greatest cities in the country. Both cities have excellent telephone systems and both have lines radiating out from them for miles, but as the two cities are in separate States it will require federal legislation to let them be connected up. Business is much hampered because of this. Rio is not only the political capital, but the business capital of the country and should be in long-distance telephone communication with the other great cities. There are good telegraph lines and the rates are reasonable.

In contrast with this in the State of Sao Paulo, which is as large as all our six New England States with New Jersey thrown in, you can talk from the capital city of Sao Paulo to the city of Santos, the port of Sao Paulo, 50 miles distant; and you can also talk to Ribeirão Preto, a city of 25,000 in the northern part of the State. This city is conspicuous as the birthplace of Santos Dumont, the Brazilian national hero in the aviation world. It is also the greatest center of the coffee growing industry, and was recently placed on the motor map of Brazil by the Ford agent in Sao Paulo establishing a branch in it. Other cities in the State of Sao Paulo are served by long-distance telephones, as well as by a very complete telegraph system.

Lack of Good Roads

In the question of good roads you are equally surprised when considering parts of Brazil. The country is hopelessly without roads, but like in U. S. A. the feeling is strong that the automobile will build roads. Brazil is further back than Argentina in road building and much further back than the little country of Uruguay, which is the aggressive center in road building in South America.

It is impossible to drive a motor car from Rio de Janeiro to the summer capital of Petropolis, a distance of little over 50 miles. The City of Rio is surrounded by mountains, and to build roads over these would be very expensive. Good railroads have been built, and as usual roads have suffered where railroads have gone through. This is specially true where the government owns the railroad, as is the case with some lines in Brazil. It is almost impossible to conceive of a city of nearly 1,000,000, people and one of the finest located cities in the world, and a city literally filled to overflowing with expensive European automobiles, and yet not having a road on which you can drive to the summer capital where the government spends the summer months among the mountains, where the diplomatic heads live and where many of the great business men reside. You must take the trip by train. It cannot be made by automobile.

Being hemmed in by mountains naturally restricts the sale of cars in Rio, and it also has had a very restricting influence on the sale of motor trucks. Although you cannot drive out of the city to other cities there are many fine drives around the city, and in the mountains; in fact, there is one drive of nearly 60 miles through the adjacent mountains which is perhaps the finest scenic motor drive in the Western Hemisphere. The roads are excellent. We would be proud to have them in the White Mountains of New Hampshire or among the Rockies in Colorado. They are graded with the finest engineering precision. The surface is smooth and you are led near to the summits of high mountains, 2500 ft., with curves and straightaways that challenge the art of any road builder in Colorado or New Hampshire. These roads are of recent creation and stand a monument to the road-building influence of the automobile. They are being extended every year and it will not be long before you can drive from the Brazilian capital to other great cities in the country just as we can go to-day from New York to Chicago or St. Louis or Kansas City. It will not be to-morrow, or next year, or 5 years, but it is coming. We cannot tell how fast. The influence of the car will have a big bearing on the time required.

Sao Paulo Roads Best

All parts of Brazil are not so poorly served by roads as the vicinity of the federal capital. In this respect the City of Sao Paulo occupies a much superior position. The entire State of Sao Paulo is still backward in roads compared with practically any State in U. S. A. It is only in the last few months that the new road has been completed between Sao Paulo and its port of Santos. Early this year motor trucks were driven over the new road for the first time. Even at present that part of the road at the Santos end is very bad in wet weather, whereas the remainder is best described as a modern stone road. It is now possible to go by car in a few hours from one city to the other.

The road is rather unusual in that you have to climb 2700 ft. in going from Santos to Sao Paulo. Santos is at ocean level and Sao Paulo on a high plateau. You do not ascend this plateau gradually as you reach the mile-high point at Denver, Colorado, but the ascent is exceedingly abrupt. It is so abrupt that the railroad has resorted to a cable system to draw the cars up in groups of three, lowering three at the same time. The railroad has in making this 2700-ft. ascent divided the rise into five short divisions and adopted the cable system for each division. The entire rise is made in 7 miles. The railroad is one of the great railway engineering jobs of the world, and as it raises through the fog or clouds that hang on the face of the plateau its roadbed is a succession of tunnels through the rock alternating with steel viaducts over narrow gorges.

Rolling Coffee Lands

With the exception of this precipitous rise the entire State of Sao Paulo is a rolling country with soil in the best coffee sections as red as you ever saw soil in New Jersey or Georgia. This red soil is ideal for coffee culture; in fact, is considered the best in the world. The coffee grows on the hill tops. It revels in elevation. The valleys are used for other crops.

While the entire State of Sao Paulo is given over to coffee cultivation, do not gain the impression that in traveling across the State the eye falls on nothing but coffee bushes. This is literally true in many sections such as Ribeirao Preto, but after running through such a region you may go for 10 or 15 miles through a section not cultivated and you will not spy a single coffee bush. Coffee is the be-all and end-all of agriculture in the State, but rice, sugar cane and other products are cultivated. Coffee is the great crop, just as corn in Illinois or wheat in Kansas. The government of the State has for 40 years kept a keen eye on the coffee situation and much legislation has been passed to protect the coffee industry. Several years ago when everybody in Sao Paulo was planting coffee trees the government saw the dangers of over-

production, a situation which finally overtook the State and caused a disastrous coffee panic, and legislated, prohibiting the planting of more coffee trees, and went further, empowering the government to buy large quantities of coffee in order to keep it out of the market and so hold prices so as to return necessary profits to the coffee planters. This act on the part of the citizens of the State of Sao Paulo is but one example of their business acumen.

Coffee Owners Are Wealthy

From an automobile manufacturing viewpoint the State of Sao Paulo and the coffee industry are of premier importance. It is here that it is easiest to sell motor cars, motor trucks and farm tractors; and while Rio, the federal and business capital, is practically dead as a market, the State of Sao Paulo is the best market for U. S. A. automobiles in Brazil.

The owners of coffee plantations are wealthy enough not only to own cars, but motor trucks and farm tractors. Coffee culture is generally carried on in large areas. It is not a small-farm system as we know in Iowa, Kansas or any other State in the Mississippi valley. The industry is the one in South America that is not in the hands of foreigners in the sense that the nitrate industry of Chile, and the mining industry of Bolivia and Peru are so largely controlled by European or American industries. Railroads in South America are almost invariably controlled by foreign capital; so are telephone systems, telegraph systems, water works for cities, and many other public utilities. But coffee in Sao Paulo is an exception.

It is largely controlled by a group known as Paulistas, a hardy, adventurous white race that sprang from predecessors who traveled much through all the heart of South America in search of minerals. They bear a slight comparison with the Forty-Niners who worked their way across our prairies to the gold lands of the West. These Paulistas are an intensely business race, free from African blood, and are imbued with high ideals of government, agriculture and general business. The coffee industry could not be in better hands.

By government measures favorable to immigration they were able to induce enough whites from Europe to cultivate the coffee plantations, so that negro labor is scarcely known. On the other hand, the coffee plantation is one of the most cosmopolitan places to be found south of the equator. As many as sixteen different European and Asiatic nations have been represented in the laborers on a single plantation in the coffee-growing section.

Coffee in Brazilian Hands

While practically all of the coffee interests are controlled by Sao Paulo citizens, there are some of the largest plantations controlled by German and English interests, but their numbers are few. The industry is not in their hands.

The coffee industry is estimated in sacks of coffee. The average crop is 15,000,000 sacks. A sack weighs 132 lb. Upward of 1,000,000 tons of coffee are produced in the State of Sao Paulo each year. The State has well over 700,000,000 coffee bushes. There are over 16,000 large plantations, all of which are in the market for cars, trucks and tractors. Much educational work will have to be done. A few of them own cars and trucks, but the great majority have yet to be convinced that cars and trucks as well as tractors will all be investments rather than expenses.

Our U. S. A. cars are already selling in the City of Sao Paulo and also in the coffee country. The Ford dealer in Sao Paulo has sold over 800 cars, nearly all of which have gone into the coffee area. He has 110 sub-dealers in the State. Of these ten are regular dealers with salesrooms and who carry stocks of parts and accessories. The other 100 are generally salesmen who may keep their demonstrating car in a garage, or they may be the agent for National cash registers, Remington typewriters, Fairbanks-Morse scales or Singer sewing machines.

Many of our other makes of cars are represented in Sao Paulo, the city being the natural center for the State, just as Boston distributes to all of New England. Hupmobile has had strong connections for several years, and the dealer claims to have sold over 200 cars. The Hup first sold entirely in the coffee lands, but of late it has been introduced into the City of Sao Paulo and is now selling to the best families in the city. It is another example of how U. S. A. cars started selling first in the country and then started city invasion.

Overland has had representation for several years, but sales have not been so large as warranted, due to local agency difficulties. Cadillac has been represented, but has not been aggressively pushed.

Studebaker got established nearly a year ago. Arrangements were being made in June for Chevrolet representation. A dealer interested in Maxwell had ordered sample cars through a New York exporting house, but received coupés, runabouts and other closed models instead of five-passenger touring cars. There was little possibility of selling the closed types. The dealer was much displeased, but placed the blame entirely on the New York house. Dodge has just arranged for representation, as have one or two other makes.

The Jeffery Quad truck was demonstrated in the coffee lands for several weeks early last spring by George Gaidzik, export representative. He placed an agency for the cars and trucks.

Tires Are Well Handled

Practically all of our large tire concerns are represented, but not so well as in Buenos Aires or Rio. Firestone has representation in one of the largest garages in the city; U. S. has its agency with a supply house, and Fisk closed contracts in June with the Overland dealer, who also handles a line of accessories. Goodrich, Goodyear and a few other U. S. A. lines are handled by the Ford agent for Ford sizes. Michelin and Perelli are strongly entrenched. Michelin carries a large stock in Santos, so that a dealer can get all sizes and in any quantities within two days. Michelin pays the import duty on them.

As in all parts of Brazil there is plenty of gasoline through the entire State of Sao Paulo. You can buy gasoline in small villages as far as 14 miles from railroad lines. The gasoline is handled in 5-gal. cans, the same as in Argentina, and the price runs as high as 50 to 70 cents a gallon in our money. This holds back the sale of motor trucks quite seriously and is also a consideration in the purchase of a small U. S. A. car.

To-day there is not much pleasure driving in a motor car through the coffee lands due to the lack of roads. There are plenty of private roads through the plantations, but unfortunately you have to open gates when entering and leaving a plantation. Often these gates are padlocked and you must walk to the home of the plantation owner and receive permission to go through his private roads. You cannot drive from the city of Sao Paulo to Ribeirao Preto, the heart of the coffee country, without opening upward of 100 gates. Last June the automobile dealers in the city of Sao Paulo had a motor "raid" or test from their city to Ribeirao Preto. You go any way you may select, but have to be checked at all of the important towns and cities passed through on the trip. The rules permitted you to make the trip any time during the month of June and you could try as often as you liked. The distance is 350 miles. A Ford averaged 20 miles per hour for the distance and, as with the other cars, had to open the gates. Its time was 17 hr. and 20 min. A Mercedes made it in 15 hr. and 3 min.; a Zust in 15 hr. 13 min.; and a Gregoire in 17 hr. and 20 min. The Hupmobile and Benz made the best performances, making the trip in approximately 12 hr.

(*To be continued*)

What Happens to a Neglected Storage Battery

An Autopsy on Cells Which Have Met an Untimely End—Symptoms of Trouble and How To Meet Them

By J. Edward Schipper

Fig. 1 — Judicious use of the hydrometer will ward off many minor battery evils

BATTERY TROUBLES AND REPAIRS

Symptom	Cause	Repair
Liquid low in one cell.	Cracked or broken jar.	New jar.
Electrolyte gravity won't rise—A.	Crystallized sulphated.	Recharge at slow rate of 3 amps.
Electrolyte gravity won't rise—B.	Lack of acid.	Go to service station if possible—if sure battery is otherwise O.K. add acid in outside container to bring up gravity, replace when cool.
Overheating.	Liquid low or charged too rapidly.	Refill with water and inspect regularly or alter generator regulation.
Electrolyte leaking at top.	Solution too high.	Draw out quantity with syringe.
Battery box disintegrated.	Acid eaten.	Do not fill so full.
Battery capacity low.	Undercharging.	Increase the generator output—have battery charged on outside current.
Buckled plates.	Overheating.	Charge at lower rate—keep liquid in cell—keep temperature below 110 deg.
Battery exhausts quickly while idle.	Short circuits.	Go over wiring and renew insulation.
Frozen battery.	Discharged in cold weather.	Damage may be irreparable—may try reforming charge for crystallization.
Rotting insulation.	Impure water — too much acid.	Use distilled water only or melted artificial ice.
Battery won't take charge.	Connectors loose—see crystallized plates.	Resolder connectors and plate holders.
Terminals corroded.	Acid leak through vents.	Clean with ammonia or washing soda.
Jars break rapidly.	Battery not fastened down.	See that proper cleats and bolts are fitted.
Separators punctured.	Overheating.	Renew separator and keep battery filled.
Lights rise and fall.	Battery low.	Recharge outside or by long run at 20 m.p.h.
Battery won't operate after storage.	Not maintained during storage.	Should have been kept charged — probably cannot be repaired owing to disintegration.
Lamps dim although electrolyte at high level.	Specific gravity too low.	Bring specific gravity up to 1.275 by charging—see that generator gives 20 per cent more current than lamp consumption.
Electrolyte down to 1.100.	Overdischarge.	Give reforming charge at 3 amps. until up to maximum density.
One cell dead.	Insulation destroyed.	Watch overheating and overcharging—keep electrolyte up.
Battery dead from usage.	Using without restoring.	Charge for 24 hr. at rate marked on battery or until electrolyte reaches 1.275.
Large sediment deposit.	Active material dropping.	Take battery to service station at once, as material has become loosened.

ALL three important forms of energy, mechanical, electrical and chemical, are used in the modern automobile. The mechanical has been with us so long that even the schoolboy is quite familiar with its principles. The electrical has been used in other lines to such an extent that it is not altogether a mystery. The chemical form, which is used in only one place, the storage battery, seems to be buried deep in uncertainty. Like most unknown quantities it is avoided and it is this condition that makes the average owner a contributor to an annual sum of $50,000,000 a year which may be called the Neglected Battery Fund.

The worst feature of this enormous loss and wastage is that it is due not so much to willful neglect as to lack of knowledge of what ought to be done and lack of information on what happens if the neglect occurs. Every man who owns an automobile knows that if he does not put air in his tires they will disintegrate much more rapidly than if the pressure were kept up to normal. Still a certain percentage will neglect the air in the tires, anyway. This same percentage will neglect the care of the battery even after they know what this carelessness is doing. The majority, however, realizing the results of not maintaining a proper state of affairs, take pains to see that conditions are such as to keep the cost level as low as possible.

Mechanical Neglect Rare

Neglect of the mechanical features of the car rarely occurs. Everyone knows that if oil is not put into the motor the cylinders will score and the life of the engine will not be anywhere near as long as it would be if it were kept properly lubricated. Wear is compensated for by adjustment. When a part is slightly out of order it is repaired at once before the damage goes further and affects parts which would otherwise remain in good condition.

All these principles apply to the chemical side of the car, in other words, the battery, as well as they do to the cylinder parts, or the tires. Neglect will cause certain well defined conditions to exist just the same as it will cause rim cutting in tires, scoring in cylinders and other definite conditions in the mechanical side of the car.

The point is that the owner will put oil in the motor because he knows exactly what will happen if he does not. He will put air in the tires because the condition which will result from not having the proper pressure is as clear to him as the fact that he will go hungry if he does not secure food. The automobilist of to-day is taking care of his car as he takes care of his own physical well being. He knows that good food will preserve his health. He knows that good oil will preserve his motor, but he does not know, taking motorists as a body, just exactly what will happen to his storage battery, the chemical element of the car, if he neglects it.

Storage battery books can be secured in any quantity and so can standardized directions on exactly how to take care of the battery; what the average owner does not know, however, is what is happening when this neglect occurs and it is purposed to show some of the actual conditions which have been found in batteries brought into service stations for repair long before the normal time for the end of the battery's life had arrived.

Primarily, the action of a battery is simple. It is simply a device which breathes in acid and discharges electricity or, conversely, breathes in electricity and discharges acid. The acid is the liquid which surrounds the lungs or plates of the battery. When the battery is charged the lungs are full of electricity and the acid surrounds them. When the battery is discharged the electricity is expelled from the lungs over the wires while the acid enters them. This is the fundamental process which takes place.

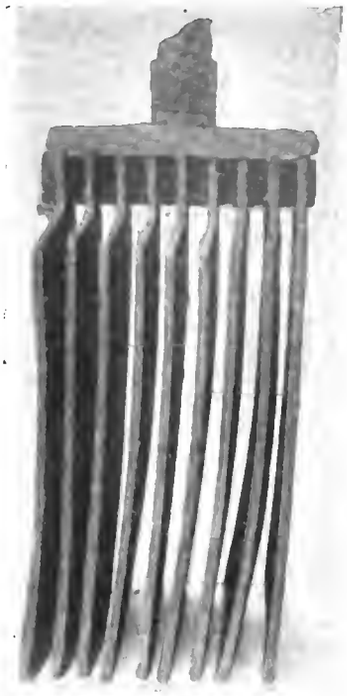


Fig. 2—An example of corroded terminal and warped plates

Any departure from normal conditions in the battery shortens its life just as any departure from normal conditions in life affects the health and period of existence of a man. A man must do a normal amount of work, take a normal amount of food and have a normal amount of sleep to remain in the best physical condition. A battery likewise must take a certain amount of food and must do a certain amount of work and have a certain amount of rest to attain its full period of life. The electrical system on the car is designed to maintain a proper balance between the feeding and exercise of the battery. If it is not doing so, this departure from normal is cutting into the life of the battery and making its owner one of the contributors to the annual $50,000,000 Neglected Battery Fund.

The first lesson that every battery owner receives is to keep water in it and to be sure that the liquid is covering the plates to the extent of at least ½ in. The Willard company alone has spent $250,000 a year in educating the public to do this and other necessary work. The campaign has had its effect so that now batteries which perish through the lack of added water have dropped from 90 per cent down to around 30 per cent. But even 30 per cent is so large that it is still found necessary by this concern to keep pounding away with its campaign. The percentage of people who know what they are avoiding by keeping the water in the battery is very small and it is interesting to point out what occurs from this neglect.

Only Covered Plates Active

Remembering that it is necessary for the plate or lung of the battery to breathe in acid before it can discharge electricity it will be seen that only those parts of the plates which are covered with the acid solution can bear any share of the burden of producing current. All of the plate above the level of the liquid is dead and useless. It is not receiving any food and it is not doing any work. If the arm of a man was shut off from the blood supply and was never used it would wither up and die. The unfed and unworked portion of the battery plate does the same thing. The material in it dries up. This is true both of the negative and positive plates in a battery. The negative plate, which contains a pure gray sponge lead, will crystallize above the point where it was submerged in liquid. This crystallized condition is commonly known as sulphation. The positive plate with its brown lead peroxide also suffers from the same cause and in much the same way when it is kept uncovered.

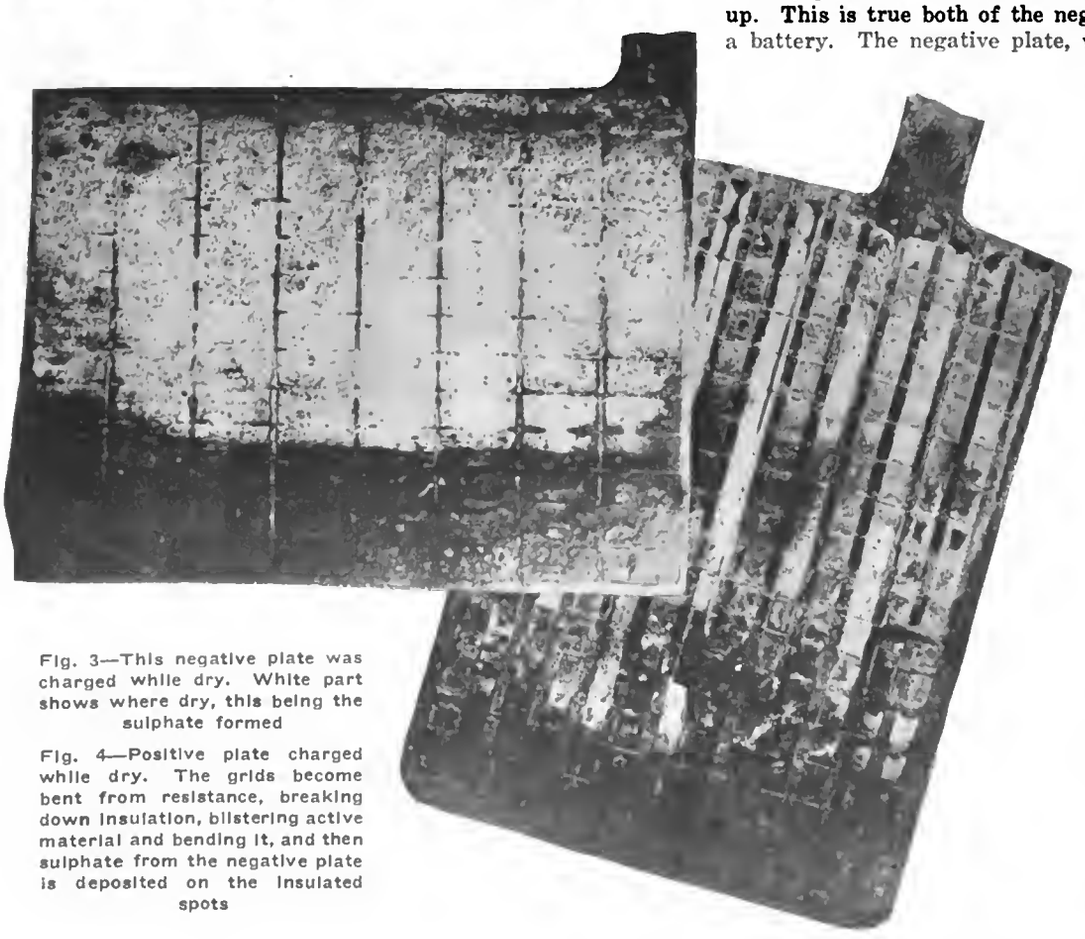
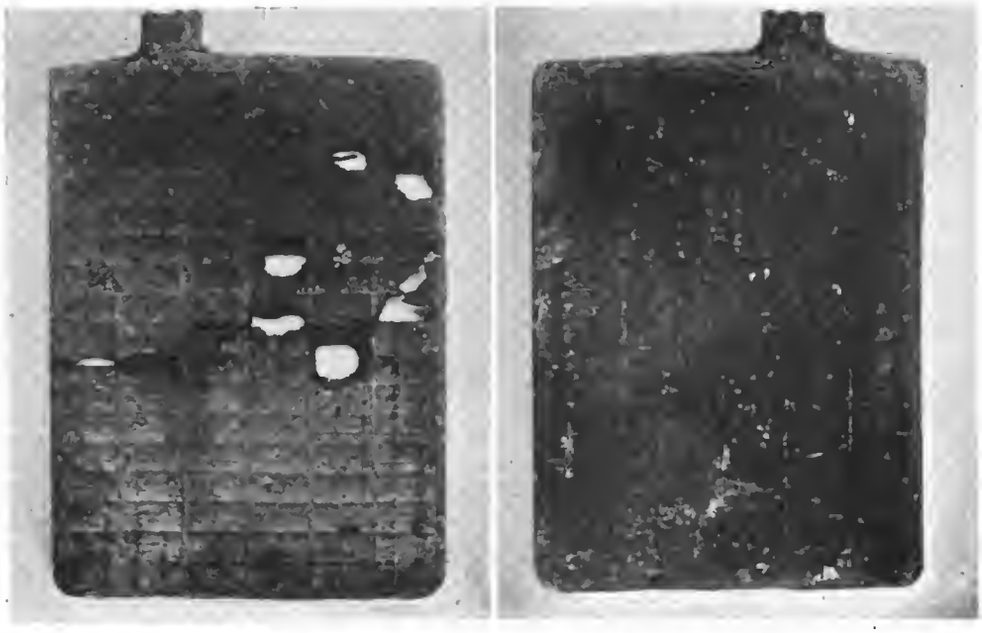


Fig. 3—This negative plate was charged while dry. White part shows where dry, this being the sulphate formed

Fig. 4—Positive plate charged while dry. The grids become bent from resistance, breaking down insulation, blistering active material and bending it, and then sulphate from the negative plate is deposited on the insulated spots

It is quite clear that a battery which has only half the area of the plate covered by the acid solution or electrolyte can only possibly have half the capacity. Yet the electrical system on the car is designed for a battery of the entire capacity, and is pumping an electrical current into the cells of the battery at a fixed rate. This condition when the battery is not filled with electrolyte or flushed, as it is called, results in what battery men know as charging while dry. Owing to the rapid rate at which the small avail-



Left—Fig. 5—Positive plate crystallized. The material is burned through due to charging at a very high rate
Right—Fig. 6—Positive plate in good condition, which has been formed or charged

able plate area receives the current, what electrolyte is left rapidly boils away. The dry part of the plate, which is carrying the current, becomes warm due to the resistance of the grids. In the case of the negative plate sulphate soon forms, turning the active material into the hard, white crystalline structure which is shown clearly in Fig. 3, while with the positive plate the active material is first blistered due to the heat and this soon causes the plate to warp or buckle, breaking down the insulation or wood separator between the negative and positive plate thereby short-circuiting the two and rendering them useless. The battery, in other words, gradually becomes burned up through charging while dry.

If the owner could visualize what is occurring in his battery simply because he has neglected to put in distilled water once a week in Summer and once every two weeks in Winter, he would soon mend his ways. The negative plate shown in Fig. 3 and the positive plate in Fig. 4 are taken directly from a battery which has suffered from this neglect. It is quite useless for the owner to attempt to tell the man at the battery service station that his cells have been receiving attention because the tell-tale line showing the height at which the electrolyte stood is seared indelibly on the plates.

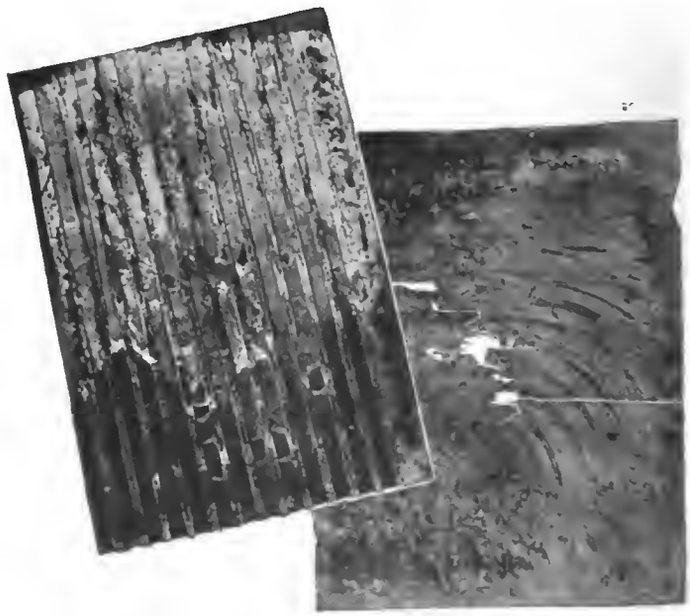
Owner Adds Water Only

Owing to the fact that the battery is of a rather complex chemical nature and that it is thoroughly sealed to prevent damage and leakage, the addition of water is the only actual administration that the owner can, as a general rule, give his battery. But if this is carried out it will generally prevent a great many troubles which can result indirectly, as well as directly, from a temporary period of neglect. It is necessary to use pure water such as distilled or melted artificial ice, in order that the pores of the active material in the plates are not clogged with impurities.

The effect of temporary neglect is partial crystallization or sulphation, as it is generally known, which the generator is not always capable of bringing back and which may require the use of what is known as a reforming charge or a slow charge over a long period which will have the effect of restoring the active material toward its original condition, although it is very seldom that it can be brought altogether back.

When sulphuric acid is poured into water the action is accompanied by heat. A rise in temperature of the solution will take place. A simple experiment will demonstrate this to you very clearly. Never pour the water into the acid but the acid into the water. If the water is poured into the acid the heat is generated so rapidly that it may result in an explosion which might cause serious damage.

When the battery is receiving its charge, the acid is leaving the plates and entering the water. This naturally causes a rise in temperature of the electrolyte. The resistance of the grids and other parts of the storage battery also causes a rise in temperature and the electrolyte of a battery receiving a charge will be seen to be gasing or bubbling. This rise in temperature must be very carefully watched or it will do damage to the battery. A battery should never be allowed to go above 110 deg. in temperature. If it gets up to 120 deg. it may de-



Left—Fig. 7—Separator, showing acid line. This separator has not broken down but shows charging while dry. The grooved side faces toward the positive plate
Right—Fig. 8—A separator broken down by the heat. It has been practically burned away

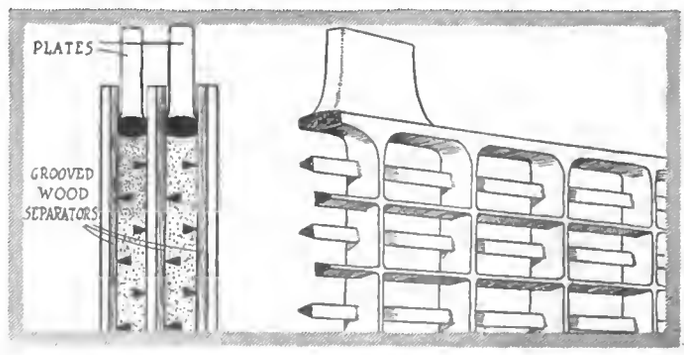


Fig. 9—Showing staggered grid and method of separation

teriorate rapidly. The more rapid the charge the more rapid is the feeding of acid into the water, and hence the quicker the temperature rise. It is therefore very important to know that the battery is not being charged too rapidly lest it cause trouble.

Fever from High Charge Rate

When a man's pulse becomes too rapid it is generally accompanied by a feverish condition. Even a slight rise in his temperature indicates to a physician that a process of destruction is going on in his body. The heart is pumping blood too rapidly and the influx of heat is affecting the body cells. In the same way the electrical anatomy of the car may be out of adjustment and electrical energy may be flowing too rapidly towards the storage battery. In other words, charging is occurring at too rapid a rate. It is being overfed and the result is that the temperature rise is too great and beyond the physical strength of the lead grids with the active material which is pasted into them. This causes the plates to warp and bend against the insulation. If it continues for any length of time this insulation is broken down and a short-circuit between adjacent plates puts an end to the activities of this part of the battery.

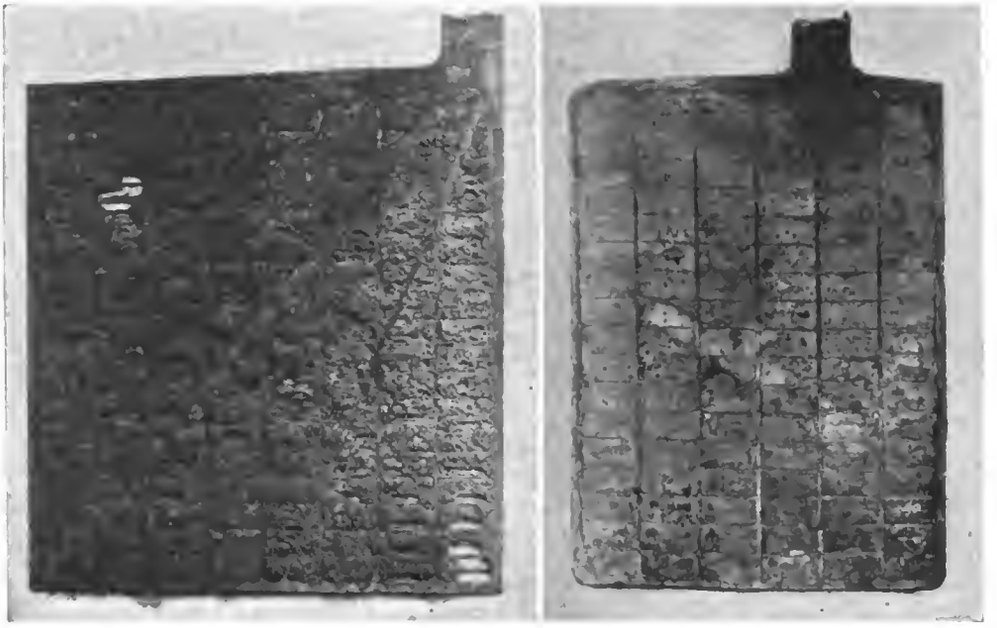


Fig. 10—Left—Negative plate sulphated right through from overheating caused by charging at too high a rate
Fig. 11—Right—Charged negative plate in good condition

This high temperature which occurs from charging at too high a rate also has its effect on the active material. It gradually becomes burned through and hard. Look at Fig. 5 which shows a positive plate that is crystallized, the material in it having been burned through due to this high rate of charging. Compare it with Fig. 6 which shows a positive plate in its normal condition. The color of a normal positive plate is a reddish chocolate brown. Deviations from this color show that some circumstances which should not have existed, have had their effect on the active material. A negative plate which has been sulphated clear through or crystallized completely from over-heating is shown in Fig. 10. This is also due to charging at too high a rate. The negative plate in good condition is a slate gray or lead color, as shown in Fig. 11.

Fig. 12—Left—Frozen positive plate. The material is loosened and falls out, due to standing idle while discharged
Fig. 13—Right—In a positive plate under the same circumstances the material becomes hard. Gray sulphate at top left corner is caused by broken-down insulation

Shorts from Broken Separators

Every time one of the wooden separators or insulators is broken down it puts the negative and positive plates on either side of it out of business. These plates must be insulated from one another in order that the current produced by their relationship may flow through the electrolyte, over the exterior line and back again to the battery. When they are in contact, due to the breaking down of an insulator, they are short-circuited upon each other and subtract their value from the strength of the battery.

It is readily possible for the battery service men to judge from the condition of the separators how the battery has been treated. Fig. 7 shows one of these separators in which the acid line is apparent, showing that the battery has been charged while dry. The separator is not broken down in this instance but it would have become so if the conditions indicated had been maintained for any length of time. The grooved side of the separator is shown. This goes toward the positive plate, the other side is flat and is toward the negative.

Separators which have been completely broken down are illustrated in Fig. 8. These have been disintegrated through

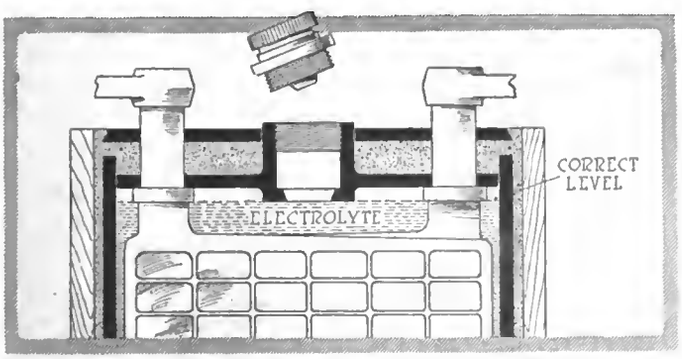


Fig. 14—Section of cell, showing correct level of electrolyte

heat and through contact with plates which have buckled due to the high temperature. It is quite frequent that the separator will break down just in one particular spot, allowing the two plates to come in contact with one another at this point. In disassembling the battery where this state of affairs has occurred, there will generally be a spot of the gray sulphate from the negative plate on the chocolate-brown surface of the positive.

The greatest clue that the owner has to the condition of his battery is in the use of the hydrometer syringe. As the thermometer is to the physician, the hydrometer syringe is to the battery doctor. A completely charged battery will give a reading of between 1.275 and 1.300, and if any cell is found to be below this reading, continually, the battery should at once be brought into the service station.

Starving the Battery

Starvation can bring down the vitality and health of a man just as well as overfeeding can do so, and in the same way a battery may be put into bad condition through not receiving enough current. Insufficient charging may be due to the fact that the generator is not delivering enough current, that the battery has been in a car which has not been used or in which frequent demonstrations of the starter have been made without recharging the battery or through some other conditions of abnormal service which causes the current to be taken from the battery without restoring it.

A man who has been starved for a considerable time could not be set down before a heavy meal. To do so would be disastrous and the same rule applies to a battery. A battery which has been overdischarged or undercharged for some time cannot be given a heavy charge to bring it back to its normal condition. It must be fed slowly just as the man must be given a little food at a time in order gradually to bring back his organs to their normal condition.

If a heavy charge is sent into a battery that has been starved for some time it will immediately overheat and then destroy the active material. If the battery is brought to a service station it is given a slow reforming charge so that the temperature of the electrolyte does not rise above 100 deg. Fahrenheit at any time. The charge is continued until the gravity of the electrolyte rises as high as it will. When it is found that the gravity has remained the same for 2 or 3 days with continued charging the battery is considered to be rejuvenated as far as possible. In some cases, this rejuvenation may take place in a few days; at other times it may take from 10 days to 3 weeks. It must be remembered, however, that just as starvation has left its mark on the constitution of a man, regardless of his recovery, it has in the same way had its effect on the life of the battery.

Battery's Wear through Usage

Batteries are very much like tires in a great many ways. If they are kept filled they will last a much longer time than if neglected in this respect. This applies to both tire and battery. The better the care given either the longer they will last, although each has a normal life. A battery's life is about 18 months. A leaky cell must be repaired as quickly as a leaky tube would be. It very often happens that the liquid in one cell will be found to drop down much more rapidly than in other cells. This should be an immediate indication that something is wrong. There is a leak through which the electrolyte is running away. The result is that the plates in this particular cell are being left dry and they will suffer in the way in which plates described and illustrated have suffered if the matter is not attended to at once. A cracked jar is generally due to traveling over a rough road with the battery not firmly clamped down. This corresponds very closely to a cut in the tire due to traveling over sharp stones on the road. If the leaky cell is not repaired at once it throws an additional load on the good cells and not only causes the deterioration of the dry plates left uncovered by the escaping liquid

Fig. 15—Cell cut away, showing how the plates are fitted into place in the jar

Fig. 16—Negative plate at the left and positive at the right, showing appearance before charging has taken place

but causes the good cells to overheat due to too rapid charging.

If a tire is filled with too much air it is over-stressed and it is harmed just as much almost as with under-inflation. The same way with a battery. It should not be filled too full, because overfilling will cause the solution to get down into the battery box and the acid will quickly rot whatever metal or susceptible material with which it comes into contact. There is a little vent passage in the cell cover through which the water is put into the battery. The water should be well below this as when the battery is in use gas bubbles are forming which quickly causes the pressure in the battery to rise if relief is not offered by an uncovered vent. When this vent is not open the water and acid are naturally forced out and run down inside the box.

A mistake which is very often made is in the addition of acid to the battery in order to bring the specific gravity reading on the hydrometer up to normal. No acid should be added by the owner, except when far away from a service

Fig. 17—A cracked battery jar, due to vibration caused by insecure fastening

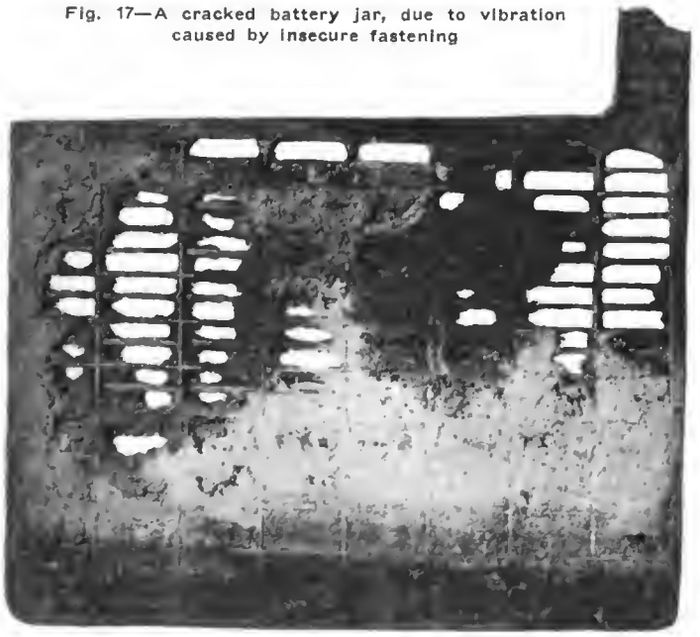


Fig. 18—Negative plate badly overheated, due to charging too rapidly. The acid line is clearly shown

station, as it takes a battery expert to know when the time has arrived for the acid to be put into the solution. If acid is added before it is necessary the solution becomes too strong and it immediately attacks the plates and separators, destroying the insulation and killing the entire battery. The effect is that when the battery is charged when the strong solution has been added the electrolyte becomes stronger and stronger until it is easily capable of breaking down the insulation.

At this time of the year many car owners are thinking of storing their batteries for the Winter. Improper methods of storing have destroyed many hundreds of batteries. There are two dangers in Winter: first, that the battery will remain idle in a discharged state, allowing the active material to become hard, or second, the battery may freeze. Normally a battery will discharge itself to a great extent if left standing idle two months. When discharged the electrolyte has a specific gravity of 1.12 and the battery will freeze at 20 deg. above zero. When the battery is fully charged and the electrolyte is up around 1.28 it will not freeze until 98 deg. below zero. Thus the danger of freezing is quite great on a discharged battery, but remote on a charged one.

What happens when a plate has been standing idle for some time is shown very clearly in Fig. 13 which is a positive plate that has remained in a discharged state until the material has become hard and stony. This can be corrected to a large extent by a very slow, long-enduring reforming charge. At the top left of this plate is shown a spot of gray sulphate which has resulted from the overheating acquired by an attempt to charge this hardened plate. The insulation has been broken down and the negative sulphate has come in contact with the positive plate. This plate is buckled but this cannot be seen in the illustration.

Results of Freezing

The results of a frozen battery can be seen in Fig. 12. The effect has been very much like water in stone or in a radiator. Owing to the discharged condition the acid has nearly all entered the plates leaving only water with very weak proportion of acid surrounding them. The result is that the water freezes at quite a high temperature, and as it freezes the little particles of ice expand and loosen the material, and even crack the grids containing it. As soon as a charge is given the battery the grids expand and the loosened material drops to the bottom, leaving the grids exposed as shown in the illustration. The whole battery has become disintegrated simply due to the fact that it was attacked by cold while in a discharged condition.

The battery should be fully charged when it is put away for the Winter and every 2 or 3 weeks should be given an additional charge to bring it up to its proper gravity reading. If the car is put away for the Winter and this is neglected a battery that readily starts the engine in the Fall may be nothing but a container and a mass of muddy, disintegrated material in the Spring.

An important point to remember in connection with batteries in which the material has been allowed to crystallize to a certain extent, due to the fact that it has been too long in a partially discharged condition, is that the specific gravity of the electrolyte cannot always be brought up to the proper gravity with the generator. In other words, the active material has gotten out of the control of the electric system on the car and must be reformed or given a fresh start. With a battery of this kind the charging should be given at about a 2 or 3 amp. rate and should not be allowed to rise beyond 5 or 6 amp. As explained in a case of this kind the temperature should not go over 100 deg. This tends to break up the crystals and to put the material back in the proper condition.

The more rapidly a battery is charged the hotter the solution becomes, and therefore when it is removed from the car and charged on an external circuit where there is plenty of time it is much better to charge at 3 or 4 amp. than it is to charge at a higher rate where the temperature of the solution goes above 100 deg. It must be remembered at all times that the solution becomes dangerous and a factor in the destruction of the plates if it goes above 110 deg. As soon as a battery is crystallized or sulphated to any extent the slow rate or reforming charge becomes imperative or else the plates will heat where the crystallization has occurred and remain cool in the normal places, thus giving unequal expansion to the plates, causing them to buckle and to drop the active material. A buckling plate exerts enough force to crack the container of hard rubber.

One precaution which is often neglected is to be continually on the alert for short circuits. These will drain the battery quickly, allowing it soon to come into its discharged state. In this condition sulphation or crystallization occurs, and the battery will deteriorate much more rapidly than if it were under a state of normal discharge.

Brake Design Not Up To Par

Engineers Could Improve Present Types with Comparatively Little Effort—Brakes Now Neglected Detail—Inefficient, Troublesome and Noisy Compared with Other Parts

By A. Ludlow Clayden

THAT the conventional automobile chassis is still many years from anything like finality of design admits of no argument. Studying the development of the past 10 years it seems that as soon as some feature becomes accepted as really nearly perfect a discovery is made which upsets that conception. At present there are a few remaining portions which have been improved but little since the beginning of things automobile, and one of the most important among them is the means for arresting motion, in other words, the brakes.

The average automobile brake suffers the following defects:

It is insufficiently powerful.
It requires too much effort to apply it.
It needs too constant adjustment.
Its surfaces need too frequent renewal.
It is harsh in action.
It is affected by oil and dirt.
It is a prolific creator or rattles and squeaks.

The most remarkable thing about the whole subject is that any good engineer could design better brakes if he would only take the trouble, but it is quite usual to find that a man who will spend months calculating the stresses in almost every other part of his car will accept any sort of brakes without a thought. This is not confined to any one country; it is true of every place where motor cars are made, though least true of Italy, because the Italian factories being all at the foot of the Alps the need for exceptional brakes is forced upon the designers. Still, even the brakes of Italian cars are not always ideal, as the requisite power is often obtained at the expense of harshness.

Magnitude of Forces

Before discussing any details of design it is well to consider the exact amount of work which the brakes have to do, and the starting point is, of course, the amount of energy that the brakes have to convert into heat while stopping the car. As a basis for calculation Table I gives the kinetic energy of cars of various weights, traveling at speeds from 20 to 60 m.p.h. From this table it is, of course, possible to obtain the amount of energy to be got rid of in reducing speed from one velocity to another by simple subtraction of the value of stored energy at the lower from that belonging to the higher rate of travel.

Just to get some idea of the magnitude of the forces, let us take a typical example. Assume a car moving at 60 m.p.h. and weighing 4000 lb. to be stopped in 15 sec. Then in 15 sec. we have to dissipate 484,000 ft. lb. of energy.

In 15 sec. the car will have traveled 660 ft. and to absorb 448,000 ft. lb. in 15 sec. will need a retarding force of $\frac{484,000}{660}$ or 733 lb. This force, of course, being applied in a direction opposite to the direction of motion.

Now the effect of applying a brake to the road wheel drums is to produce friction and create heat, and we need, in this example, to have a quantity of heat produced which will be equal to a force of 733 lb. acting through a distance of 660 ft. It is required to find the necessary pressure on the brake drum to create this amount of friction.

There is one fundamental thing which is often overlooked, but which is the basis of all brake design. This is that the size of the braking surface, its area that is, has nothing to do with the power of the brake. The retarding force applied by a brake is always the product of the pressure applied by the driver, multiplied by the leverage of the connecting links and again multiplied by the coefficient of friction between the two materials of which the brake surfaces are composed. This acts as a tangential pull on the brake drum, so making the drum wider does not add to the force.

The amount of energy absorbed by the brake for each revolution is the product of the retarding force and the circumference of the drum, so by increasing the diameter we can increase the amount of energy absorbed per revolution. By increasing the width we can lower the unit pressure per square inch on the brake and so increase its life, but we cannot increase its power.

Suppose, for the sake of simplicity that the brake drum is 3 ft. in circumference, and that the tire on the rear wheel is 34 in. A 34-in. wheel will turn seventy-four times in covering 660 ft., and a brake drum of 3 ft. circumference will cover a peripheral distance of 222 ft. while the 34-in. wheel is traveling 660 ft. This means that the retarding force applied at the brake drum must be three times the retarding force required to act on the whole car, or 2199 lb. Now the average coefficient of the friction materials commonly used for brake lining is between 0.5 and 0.3. It is safer to take the lower value so as to allow for possible greasiness. Doing this we see that the pressure which must be applied to the drum, *via* the brake band or shoe, is no less than 7257 lb. or nearly ten times the amount of the retarding force required to be applied to the car as a whole.

Of course, frictional resistance is independent of the areas in contact; it depends only upon the pressure between the surfaces; so we may spread this total pressure over as many

Table I—Kinetic Energy of Moving Vehicles

WEIGHT OF CAR	SPEED IN MILES PER HOUR					
	10	20	30	40	50	60
1,000	4,200	13,400	30,200	54,000	84,200	121,000
1,250	4,040	16,750	37,750	67,500	105,250	151,250
1,500	5,880	20,100	45,300	81,000	126,300	181,500
1,750	6,720	23,450	52,850	94,500	147,350	211,750
2,000	7,560	26,800	60,400	108,000	168,400	242,000
2,250	8,400	30,150	67,950	121,500	189,450	272,250
2,500	9,240	33,500	75,500	135,000	210,500	302,500
2,750	10,080	36,850	83,050	148,500	231,550	332,750
3,000	10,092	40,200	90,600	162,000	252,600	363,000
3,250	11,760	43,550	98,150	175,500	273,650	393,250
3,500	12,600	46,900	105,700	189,000	294,700	423,500
3,750	13,440	50,250	113,250	202,500	315,750	453,750
4,000	14,280	53,600	120,800	216,000	336,800	484,000
4,250	15,120	56,950	128,350	229,500	357,850	514,250
4,500	15,960	60,300	135,900	243,000	378,900	544,500
4,750	16,800	63,650	143,450	256,500	399,850	574,750
5,000	17,640	67,000	151,000	270,000	421,000	605,000

square inches as we like. The larger the surface the less wear will take place and the longer will be the life of the brake. Suppose we decide that 100 lb. per square inch is a good pressure to employ. Then the two brake drums ought to have an area in contact with the bands or shoes of 72 sq. in. Three ft. is 36 in., so two brakes 1 in. wide will give us enough surface. Probably, however, 100 lb. per sq. in. is a good deal too high, 50 lb. or even less is better, so let us calculate on a basis of 40 lb. per sq. in., and we see that the drum area necessary is 181 sq. in. Now, the whole drum is not effectively surrounded by braking surface. It is not safe, with the conventional sort of brake, to assume that more than half the circumference of the drum is operative, so we arrive at the stage where half the surface of two drums, or the whole surface of one drum, must contain 181 sq. in. If the circumference is 36 in., as before, this means that the width of each drum must be 5 in.

Maximum Braking Force

There is another way of approaching the problem, which is to calculate the maximum force which can be applied by the driver to the brake band through the linkage. In the case of a band brake the pressure normal to the drum is equal to the tension divided by the radium. Assume the brake pedal has an 8 to 1 leverage and the link which actually contracts the band a 4 to 1, giving a total leverage of 32 to 1. Then assume that the maximum comfortable pedal pressure is 100 lb., which is about right, and we see that the maximum tension applied to the band will be 3200 lb. and so the maximum normal pressure on the drum will be 20,096 lb. and the maximum frictional resistance 6029 lb. Acting on a drum of 36 in. circumference, this friction will absorb 18,087 ft. lb. per revolution, which means that to stop our 4000-lb. car at 60 m.p.h. would need 27 revolutions of the wheel, equal to a distance of 240 ft.

Suppose this is not considered good enough, we have only two alternatives, one to increase the pressure by increasing the leverage, and the other to increase the *diameter* of the drum, so that the circumference and the distance, "length of rub," so to speak, per revolution shall be increased.

Increasing the Leverage

Obviously it is not easy to increase the leverage, the limit of distance through which the pedal can be moved conveniently, and the need for proper clearance when the brake is off limits the leverage very definitely. Suppose, therefore, we want to stop in 100 ft. with the hypothetical car, we must make the drum $\frac{240}{100}$ times the diameter or 27 in. This again is not practical, or hardly so, but the example serves to bring out the exact effect of increasing diameter and shows that we ought to use the very largest diameter brakes that can be accommodated.

Let us now make a closer study of the possible leverage obtainable commercially. Assume a 16-in. diameter brake drum. Then we shall require a clearance when the brake is off of not less than 1/32 in. between drum and band. This means that the inner circumference of the band when free of the drum is 50.395 in as against 50.265 for the drum, a difference of 0.13 in. or just over ⅛ in. There will be some spring in the band and the lining is compressible to a small extent, so we cannot safely assume that the brake will be fully applied by a contraction of less than ¼ in. The little lever mounted on the brake band itself will give a 5 to 1 leverage, so the ¼ in. on the band will mean 1¼ in. movement of the actuating lever. Coming now to the pedal, for comfortable application of the brake this should not move more than 4 in., giving an additional leverage of 3.2 to 1 and a total leverage of 16 to 1. With the hand lever we can easily get three times this leverage or 48 to 1; so assuming a 100-lb. push on the pedal or a 50-lb. pull on the lever we can reckon a band tension of 1600 lb. for the foot brake and 2400 lb. for the hand brake, giving a drum pressure of 10,000 lb. in the first case and 15,000 in the second, approximately.

Avoiding Lost Motion

This rather laborious and lengthy excursion into elementary arithmetic has for its excuse a desire to show up strongly how vitally important it is to keep the clearances as small as possible and to avoid lost motion in the linkage. There are some metal transmission brakes which can be applied fully by a 2-in. pedal movement with a 20 to 1 leverage which means that only 0.1 in. of movement on the brake shoes or bands is necessary to make the difference between complete freedom and full application.

However, there is still another thing to be considered. The limiting power of a brake is the maximum tractive effort which can be exerted by the tire on the road. Of course, the coefficient of friction of a rubber tire on a road varies enormously according to the road surface; it is impossible to do more than take a very rough estimate of what its average is. However, it is fairly safe to base calculation on the assumption that the coefficient is not far removed from 0.5 on a dry, hard road. This means that the maximum tractive resistance which can be applied as a tangential force at the periphery of the road wheel is half the weight supported by that wheel. In the case of a 4000-lb. car the maximum resistance force would thus be 500 lb. if the weight is distributed equally. But this is 500 lb. *per wheel*, which at once shows us how front wheel brakes score. With all brakes on the two rear wheels, the maximum retarding force we can apply will be twice that for one wheel; with brakes on all four wheels it will be four times this amount.

Coming back to the brake itself, we now see that there are two limitations. At one end of the chain there is the adhesion of the tire on the road, and at the other is the effort which can comfortably be exerted by the hand or foot of the driver. The driver's effort, acting on a pair of rear wheel brakes, can be regarded as divided equally between the pair, so the driver's effort multiplied by the leverage, again multiplied by 2π and multiplied by the coefficient of friction for the brake lining, gives us the retarding force applied tangentially to the brake drum. This amount multiplied by the radius of the brake drum must be equal to the maximum tractive force the pair of road wheels can transmit, multiplied by the radius of the road wheel.

Putting this in the shape of a formula:

Let P, be driver's effort,

L, the mechanical advantage of the brake linkage,

u, the coefficient of friction of the brake surfaces.

Then

$2\pi P\,Lu = R$, the force resisting motion acting tangentially to the brake drum circle.

Let r, be the radius of the brake drum,

r_1, be the radius of the road wheel,

W, the weight on one wheel,

0.5 the coefficient of friction of rubber on a road.

Then for the two rear wheels,

$$R\,r = W\,r_1$$

Taking 100 lb. for the value of P and 0.3 as the value for the brake friction coefficient we get:

$$188\;L\,r = W\,r_1$$

Or,

$$L = \frac{W}{188} \times \frac{r_1}{r}$$

We have seen in a previous computation that it is reasonably easy to obtain a 16 to one leverage for the brake pedal. Therefore, assuming this to be the value of L we can vary the formula above as follows:

$$r = \frac{W\,r_1}{3008}$$

which enables us to obtain the proper diameter of the brake drum when the weight of the car and the size of the tire are known. Calculating out a set of values from this formula shows something very interesting, which appears in the following table:

W = weight on one wheel	$\frac{W}{3008}$
500	.166
600	.195
700	.233
800	.267
900	.299
1000	.332

This means that a car weighing 2000 lb. with 500 lb. on each wheel needs brake drums just a trifle over a sixth the tire diameter, and that a 4000-lb. car with 1000 lb. on each wheel needs drums less than half the road wheel diameter. What the table really shows is that the leverage must be increased as the weight of the car increases or that the driver must be called upon to exert a greater effort. There is no alternative, unless we gear up the brake drum so that it revolves faster than the road wheel. The effect of doing this is immense. If we gear up the brake drum four to one relative to the road wheels we can satisfy the conditions with a drum one-quarter the diameter needed on the road wheel itself. With a four to one rear axle ratio a 4-in. transmission brake is the equivalent of a 16-in. brake on the wheel so far as retarding force for a given pedal pressure and leverage is concerned. This accounts for the great power obtained from the usual sort of transmission brake with a very small pedal pressure.

It is not easy to make brake drums for a passenger car much larger than 16 in. and it is seldom possible to have the drums wider than 2½ in., 3 in. would be the absolute maximum on most cars. Thus, if the transmission brake is undesirable, and we are not content to have a heavy acting brake, the leverage must be made greater. There is only one way to enable this to be done and that is to cut the clearances very fine indeed and to put such accurate workmanship into all the details of the brake links that there will be practically no lost motion in the linkage.

The study of the forces needed to arrest the motion of a car suggests that it is really rather remarkable that so little progress has been made with power applied brakes. It surely would not be very difficult to devise ways for using the power of the engine to operate the brakes, either by purely mechanical means or via a compressed air tank or the electric storage battery. We have abandoned the manual labor of cranking an engine by making the power plant store up energy which can be drawn upon to do this work for us. Surely it is only reasonable to ask for a mechanical brake that could be controlled by a lever requiring no more effort to move than the spark advance. It is easy to obtain air, oil or electrical pressure from auxiliaries on a gasoline engine; why not make use of one or the other and so improve not only the convenience but the safety of the automobile?

Eliminating the Garage Repair Pit

ELIMINATION of the garage pit has been accomplished by the Harold L. Arnold establishment of Los Angeles, Cal. Arnold is distributer for Hudson and Dodge Bros. cars, and Vim trucks, and one of his aims is modern and efficient equipment for his shop.

Poorly lighted, greasy, damp pits did not appeal to Arnold's ideas of service, or to those of his mechanical superintendent, Paul Hinkley. Thus when Hinkley suggested raising the car from the floor on racks, instead of putting the men in holes beneath the floor, he was told to devise some practical means of doing so.

A trial pair of service racks were built up from channel iron, split to form legs, and securely bolted together to withstand excessive weight. These were designed to raise the running board of the car 6 ft. from the floor, and thus to permit free access to all underparts. From the time the room to work between the cars. By aid of the cranes two system was seen to be a success. Immediately a complete equipment was made up for the station.

The racks are arranged in rows along the sides of the repair shop, on lines so arranged as to allow the men ample room to work between the cars. By aid of the cranes, two men may hoist a car to the racks in a few moments, or in case of necessity one man may raise it alone.

Service racks used by Harold L. Arnold, Los Angeles dealer, to eliminate garage pits

The workman is thus enabled to work in a well lighted and ventilated room, with perfect freedom of motion. For the short man platforms are provided, and ladders are handy for the mechanic to climb into the cars when necessary. The whole tone of the work has been improved; better work is done in a shorter time than with the pits, and the health and comfort of the workman has been forwarded.

Riker Trucks Beat Mules

UNITED STATES ARMY Truck Train No. 13, composed of thirty-one 3-ton Riker trucks, recently covered the 800 miles from Columbus, N. M., to San Antonio, Tex., in 13 days' actual running time. The standard day's travel for a four-mule team is 17 miles; thus 47 days would have been required to make the trip with the old style army transport, according to the United States Army regulations.

Tractor Transmission Serious Problem

Average Power Lost in Drive 50 Per Cent—Big Gear Reduction Necessary Makes High Efficiency Difficult To Obtain

By A. Ludlow Clayden

¶ This is the fourth of a series of articles based on an intimate study of tractor requirements and the efforts of the tractor engineers to meet the problems in design and construction arising from the demands made upon the machines in active service. The author has been in close touch with the tractors and the manufacturers at the recent demonstrations, so that this series of articles accurately reflects the conditions discussed, besides giving a clearly defined idea of the principal trends in tractor engineering.

IN three previous articles the writer has given his impressions of the problems of tractor engineering as related to engines and arrangement of wheels or other driving methods such as caterpillar treads. In this, the last of the series, the problem considered is probably one of the most difficult of all, namely, that of reducing the engine speed to the final drive speed efficiently.

Supposing a road speed of 2½ m.p.h. and a piston speed of 1000 r.p.m., the ratio of piston speed to road speed is as 100 to 22, which does not look very great. When we translate both linear speeds into revolutions, however, the ratio looks very different. For example, assume a 6-in. stroke, giving 1000 r.p.m. for the engine, and also assume a 6-ft. driving wheel, which revolves at 11.7 r.p.m. at 2½ m.p.h. and the ratio becomes 10,000 to 117 or 87 to 1.

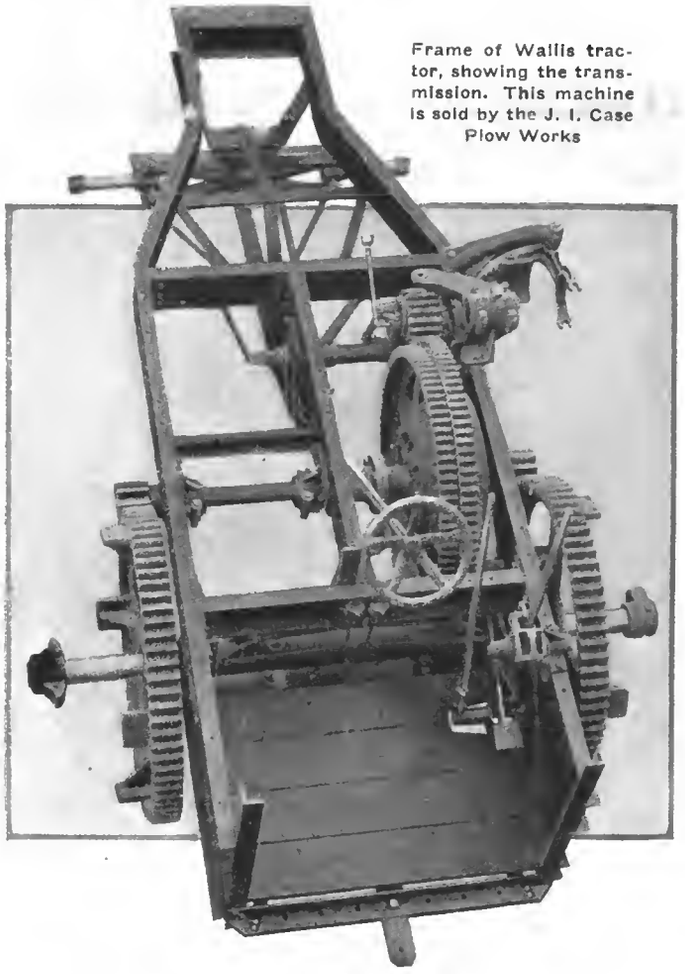
Now such a reduction as this is difficult to get efficiently in any sort of machinery; it is difficult in factory drives, where gearing can operate under ideal conditions, and it is still more difficult, therefore, under the poor circumstances of tractor operation. As to the means employed, nearly all tractor makers are now using an internal gear and pinion, or an external gear ring, on the driving wheels, this providing the major part of the reduction, in conjunction with a smaller step down in the gear train between the engine and the shafts of the final drive pinions. Often there is a spur gear reduction followed by a bevel gear reduction and then the final drive; three separate steps in all.

We can assume 90 per cent efficiency for a properly made and lubricated spur gear, and 85 per cent for the bevel gear, giving an efficiency of 76.5 per cent for the two reductions. The efficiency of the final drive is problematic. If it is a gear ring and pinion, either internal or external, the efficiency might be over 75 per cent with complete inclosure and proper lubrication. This would mean a total efficiency in transmission of 57.4 per cent, or a loss of 42.6 per cent. If the gear is unprotected and only haphazardly lubricated, as is almost always the case, the efficiency of the final drive may be much less than 75 per cent.

It is noticeable that the practice with regard to the final drive at present is to use teeth on the ring gear like those of a chain sprocket, and a pinion consisting of a cage with a number of small rollers mounted in place of teeth. This is not so efficient under the best conditions as properly cut teeth with true rolling contact, such as can be obtained with the small, accurate gears used in truck transmissions, but the distance between the center of the big wheel of a tractor and the pinion center obviously cannot be accurate within limits far too wide to permit of proper gear alignment, wherefore the roller pinion is possibly a good compromise.

Still, even if proper alignment is not possible, proper protection and lubrication could be obtained at fairly small cost, as we have not the complication of the brake drum introduced on truck layouts. A sheet metal case tight enough to hold grease is quite practical, as at least one tractor manufacturer has shown. Even then, however, a drive that cannot be accurate is not real engineering; it is satisfactory for places where we have plenty of spare energy,

An Aultman-Taylor tractor employing an external gear method of drive



Frame of Wallis tractor, showing the transmission. This machine is sold by the J. I. Case Plow Works

engineers who believe that nearly all the required reduction could be taken care of by a single worm gear, that 50 to 1 at least could be so handled. They point out that very great reductions are used on cranes, hoists and elevators with high efficiency. Others consider that better results would be obtained by using a slight reduction in a bevel drive on the axle, and then all the rest in an inclosed, lubricated gearbox. Still others think that gearing should be applied direct to the engine, so that a 2 or 3 to 1 reduction is obtained between flywheel and clutch.

However, having cited the disadvantages of driving the wheels by gear rings, it is right to look at the drawbacks of the other suggestions. A worm gear or a bevel gear applied to the axle means the use of a live axle instead of the simple, dead I-beam forging that can be employed with the ring gear drive. Such an axle has to be enormously strong, as the torque applied to the driveshafts by an 80 to 1 reduction from the engine can well be imagined. Not only must the driveshafts be very strong, but the hub and spoke construction of the wheel has to withstand a great deal more stress than it does with a drive applied nearer to the rim.

Summing up, the appearance is that a live axle drive would cost much more than the present prevailing custom, and the suggestion also follows that it would weigh a great deal more also. If we add to the excess weight we shall be throwing away again a proportion of the power saved by greater transmission efficiency, so there might be little or nothing gained for the extra first cost. But these contentions assume that the only way to use worm or other inclosed accurate gearing is to have a live axle of motor truck type, only bigger.

Is this necessarily true? Remembering that in tractor development we are going far outside the limits of motor truck and automobile engineering generally, may there not be other ways of applying gearing to road wheels?

As an example of the sort of possibility that exists a very peculiar design of truck put out in 1913 by the Austin company of England may be mentioned. This had a dead rear axle, and there was a very peculiar gearset admidships. Inside the gearbox was a change-speed transmission of the usual sort, a bevel drive and a differential. On the differential driveshafts were two bevel gears of peculiar angle, and these drove two propeller shafts which in turn operated individual bevel drives on the two back wheels. Of course the propeller shafts ran angularly from the gearbox to the wheels. This design is complicated to the last degree, it is impossible to believe that it could be efficient with all those bevel gears in the train, but it might be simplified. For very large tractors the use of two engines geared together is not an impossibility. It is easy to see how a spur gear reduction might be arranged to provide two propeller shafts that would drive the rear wheels through individual worm gears, for instance. Such ideas are not necessarily practical, not necessarily good even in theory, they are given merely to point out how much there is untried that might be tried; to emphasize how little we really know concerning the best way to set about getting 80 to 1 ratios.

Friction Drive Is Used

Leaving these realms of imagination and returning to the practice of the day, it is remarkable that many tractor makers favor friction drive for part of the transmission. It is seen applied to both light and heavy machines, and has been developed in several different forms. In the friction drive itself no very large gear reduction is obtainable; it is more often used more to provide a facile control than for obtaining the reduction, it takes the place of a clutch perhaps, or it provides a ready means for getting a reversal of direction.

In this connection the example of a particular machine may be mentioned. The Albaugh-Dover tractor has a unique friction drive which eliminates the differential, embodies the reverse, and gives all the gear reduction save that provided by the ring gears on the wheels. The following is not supposed to be an exact detail description, but it gives the principle. Fig. 1 is a diagram of the layout, and the friction drive pinions *A* and *B* are both mounted on a shaft which is practically an extension of the crankshaft. The driven wheels *C* and *D* can be so moved that they are brought into contact with either of the pinions.

Considering the wheel *D*, this can be put in driving contact with either *A* or *B*, and consequently *D* can be driven either forward or reverse: the same applies to the wheel *C* also, of

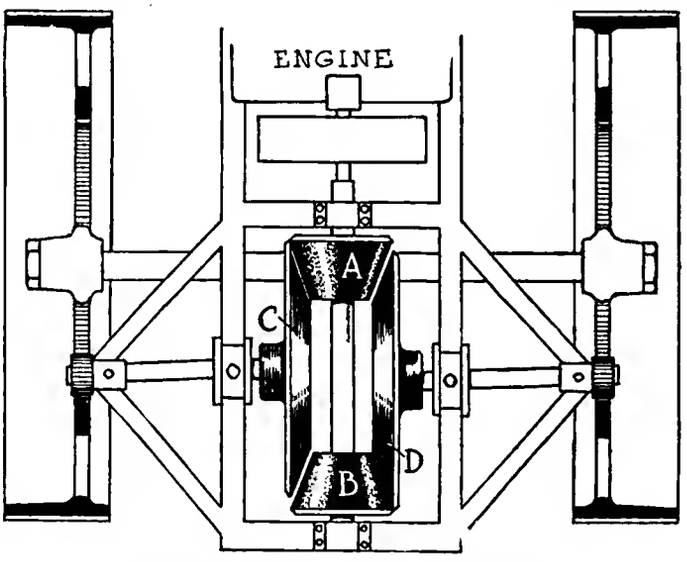


Fig. 1—Diagram of the friction drive used on the Albaugh-Dover tractor. This eliminates the differential, without sacrificing the reverse, and gives all the gear reduction except that effected by the ring gears on the wheels

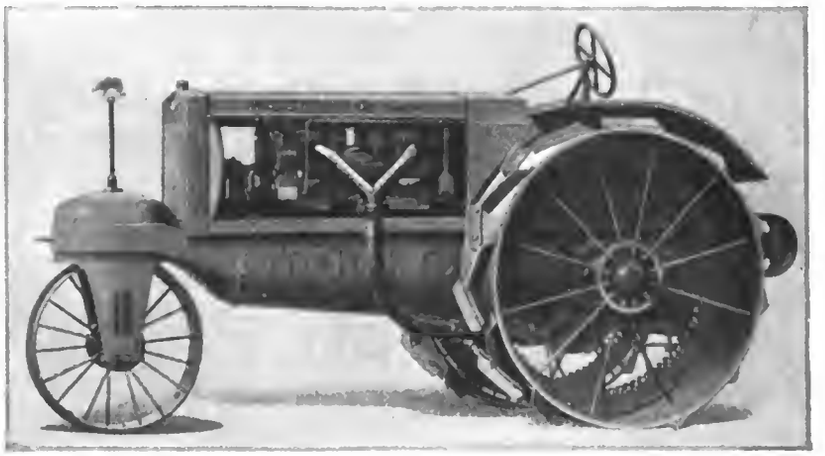
course. If *A* and *C* are in contact, and *B* and *D* the drive will be in one direction, while if the contact is reversed, so that *A* and *D* and *B* and *C* are the pairs the direction of drive will be reversed. Again, if both *C* and *D* are simultaneously engaged with *A* one will have forward motion and the other reverse, and engaging both *C* and *D* with *B* will reverse this action.

This means that by moving *C* and *D* the drive may be ahead or astern on both wheels, or ahead on either and astern on either in any combination. This allows the machine to turn in its own length. On the outer ends of the shafts *C* and *D* are the pinions of the ring gears that drive the road wheels, and there are no other gears.

A point which should be noticed especially is that the big wheels *C* and *D* are metal and the pinions *A* and *B* of compressed frictional material. This is very important, because the greatest difficulty with friction gearing is the liability to make a "flat" when starting. Where the metal part drives and the frictional material is driven it is easy to make a flat on the surface of the softer member of the pair, but when it is the softer that drives there is not much risk of flatting the hard metal of the driven member.

In operation it is noticed that the parts *C* and *D* get quite hot, but not nearly as hot as previous experience with friction drives would lead one to expect. Of course there is plenty of contact, and no differential slip such as is always taking place with the common form of friction drive that has a square-edged wheel in contact with a flat disk.

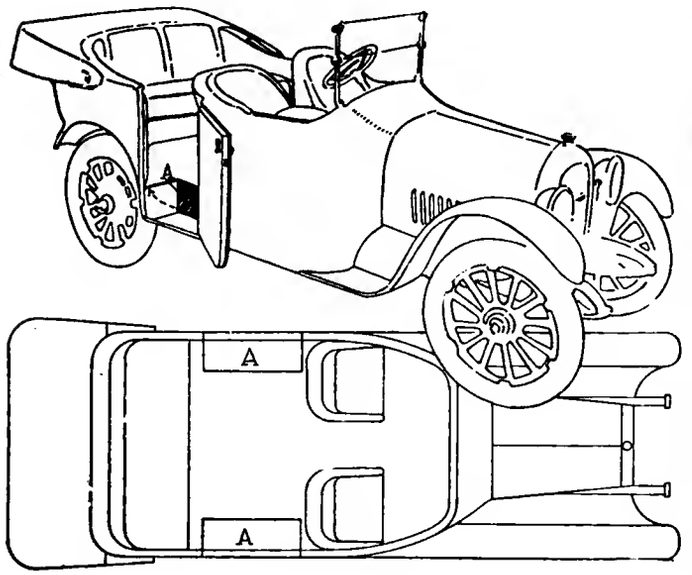
Several machines have a flywheel or its equivalent, edged with frictional material, and two metal disks placed one on each side so that one is used for forward motion and the other for reverse. In these cases the gear reduction on the friction drive is rarely as much as 2 to 1, and a spur gear train does the rest. Such applications simply replace the clutch by something a little more troublesome which absorbs a small amount of power, and the elimination of a reversing gear in the transmission seems hardly enough compensation. The main objection to friction gearing is twofold, it always absorbs perceptible power and it is subject to considerable wear both on the soft surface and on the metal one; further it is affected by moisture as a rule, in fact it is a form of transmission that takes a good deal of keeping in order one way and another. These difficulties may be overcome, they may be at a minimum in some of the existing tractor applications, but they have been prominent in all applications to passenger cars. The writer has driven a car with friction gear nearly 15,000 miles, so the statements as to its troubles are not theoretical, but are based on actual experience.



Wallis Cub tractor which has clutch and gears housed in a steel case forming the frame

Of course our old friend the hydraulic transmission is being mentioned, as are electrical transmissions, in discussing possibilities of the future, but it is not likely that anything requiring more understanding than a simple spur gear, or at most a worm drive, will soon find a place on a tractor. At the risk of painful reiteration it may again be said that the worst fault at present seen is lack of protection and lubrication. House the gears as well as the gears of a truck axle are housed; lubricate them as an automobile engine is lubricated, and the speed reduction will be obtainable without excessive loss of power. Nature has provided the horse with a skin impervious to weather and the steel mechanism of a tractor needs no less a protection, down to its uttermost detail of construction.

An Unusually Roomy Body Design



A BODY for which a patent has been applied has been recently designed by a Massachusetts man, in which the floor is enlarged to increase the carrying capacity. As shown in the illustration herewith there is a single entrance door for the driver and passengers, with divided front seats to allow him to reach his position. The side of the body is bent out and forms the fenders and in this way eliminates the running boards while the low step is secured by undercutting the floor in the manner shown. The body metal is bent out to serve as a mud guard on the rear wheels. The actual fenders here are eliminated as the wheels are within the body line.

Eliminating the Fenders

The idea of the designer, H. J. Childs, of Taunton, is that the fenders are unsightly and occupy space which could be included readily within the body. When the door is open for entrance the closure marked *A* drops, giving the undercut floor which allows of easy entrance. When the door is closed this part of the floor automatically goes up to the level of the remaining floor space, rendering the interior surface as flat as could be desired.

Automobile Inventors Active Abroad

Kerosene Carbureters Continue to Occupy Prominent Place Among New Ideas—A New Suggestion for Spring Inclosure—French Invention Includes New Valve Gear and Peculiar Gearset—Muffler Used to Generate Electricity—A Novel Drive System for Tractors

NEW ideas and inventions have been prominent in the British automobile journals in the past few weeks, covering a very wide range. *The Commercial Motor*, London, has been publishing a series of descriptions of kerosene carbureters, of which some have been reproduced in THE AUTOMOBILE. The most recent is the invention of Cyril Pullin, a well-known motorcycle racing driver, now of Beavor Lane, Hammersmith, London. The following is *The Commercial Motor's* account of the device:

"The passage of the fuel may be traced from the float chamber through the three-way cock (which is shown in section) along the inclined jet into the throttle barrel, which is designed so that the requisite volume of air is drawn past the jet at right angles to it, and causes thorough atomization of the liquid fuel. It passes thence through a tube, which is taper in form, being smaller at the bottom end than at the top. This choke tube—and, by the way, there are three of them, with a jet and passage in the throttle valve to each—is contained in an exhaust-heated vaporizer. Above the vaporizer is a pipe which serves to collect the gas issuing from these three tubes and to deliver it to the induction manifold, in which it is conveyed to the cylinders.

Separate Float Chamber for Kerosene

"The three-way cock connects the three jets to one or other of the two float chambers, one of which serves for gasoline, the other for kerosene. A reference to the sectional plan at the right-hand top corner of the drawing will enable the reader to understand how this is effected.

"The supply of kerosene to the three-way cock is regulated by means of a screw-down valve; this may be arranged so as to be operated from the dashboard. The supply to each jet is also capable of being regulated by a similar valve.

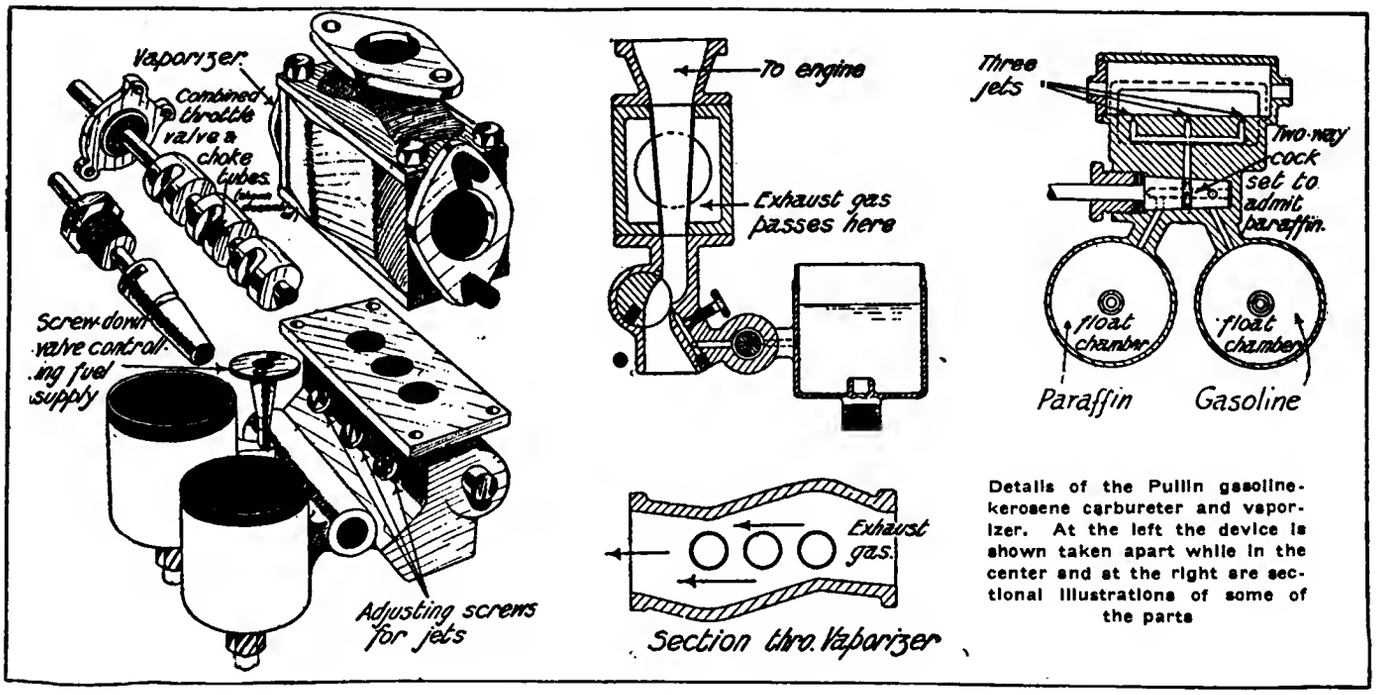
"In the central portion of our illustration, which shows the carbureter dismantled, is depicted the combined throttle valve and choke tubes. This throttle valve is cylindrical and is made in three parts, which are adjusted before the carbureter is sent out so that the jets, Nos. 1, 2 and 3, come into operation in turn; an additional slot in the throttle valve also allows of No. 1 being used as a pilot jet for idling or slow running.

"We have not space to deal at length with the theoretical considerations which led the inventor to this design of carbureter. It will be sufficient if we state that the tapering tubes are calculated as to their size with reference to any type of engine for which the carbureter may be intended, the object being to insure, so far as possible, that gas of practically atmospheric pressure and at a stated temperature enters the cylinders. By this means, packing of the cylinders with mixture at high temperature—and therefore liable to pre-ignition—is avoided.

"Attention is also directed to the peculiar shape of the vaporizer. This 'dog's hind leg' path along which the exhaust gases are forced to travel, causes them to impinge with greater frequency upon the vertical tubes containing the mixture."

Permanently Inclosed Springs

Quite a different sort of invention is quoted in *The Autocar*, Coventry, this being a cover of permanent metallic sort to inclose springs. The illustration is almost self-explanatory, so only a brief description is given:



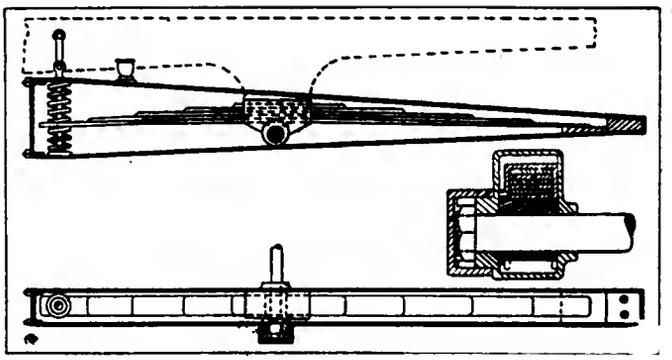
Details of the Pullin gasoline-kerosene carbureter and vaporizer. At the left the device is shown taken apart while in the center and at the right are sectional illustrations of some of the parts

"The accompanying drawings show a spring system designed by Lt. J. M. Sanders, Litchfield Lodge, Keynsham, Bristol, England. The object of the designer has been to provide a permanent protection and oil bath for the springs, and to attain this end he has inclosed a cantilever spring, as shown above, in a taper tubular torque and radius member on each side of the chassis. At the rear end each spring rests upon a special seating secured inside the end of the casing, and the casing itself is intended to be secured to the back axle while the spring moves within it.

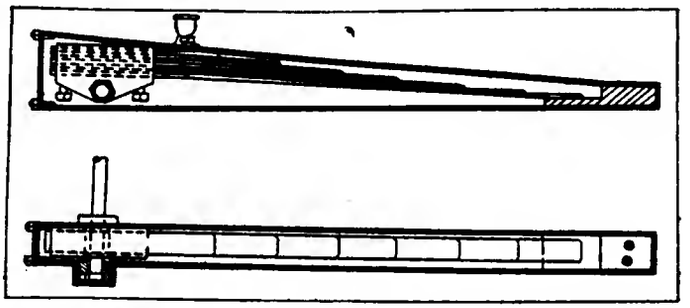
Two Helical Springs

"At the front end both the casing and the spring are supported by two helical springs, the longest leaf of the cantilever being supported between the two supplementary springs as shown, while the casing itself makes use of the same helical springs for its abutment above and below. Both cantilever spring and casing are pivoted on the same center, as shown in the cross-sectional view, so that there is no relative movement between them at this point, although this is not an essential feature.

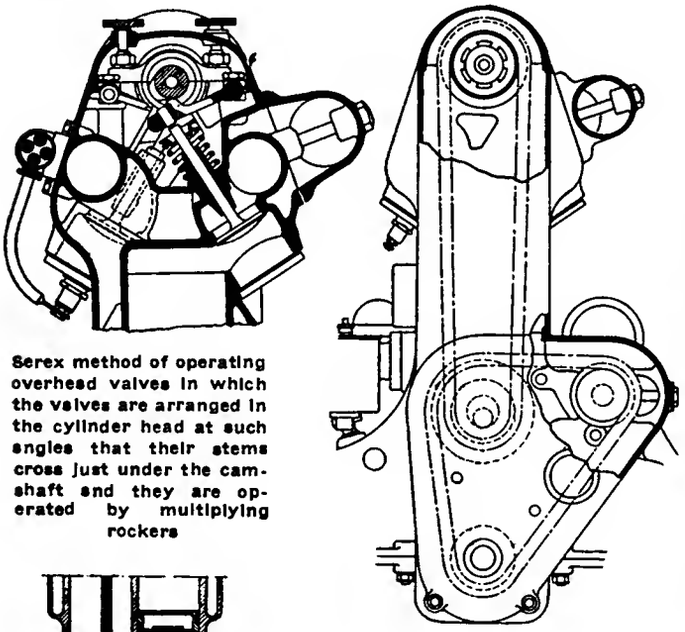
"In the case of a grasshopper spring the casing and the spring, as shown in the illustration below, are pivoted in a similar way to that adopted in the case of the cantilever spring on one and the same center, and the rear end of the spring rests upon the seating provided for it within the casing.



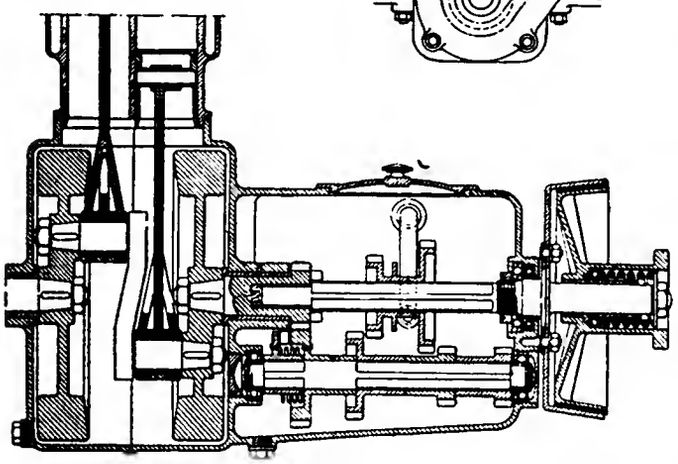
Sanders system providing a permanent protection and oil bath for springs as applied to a cantilever type, together with an enlarged view of the trunnion bearing



In the case of a grasshopper spring the Sanders system is applied as above, with the casing and the spring pivoted in a similar way to that employed with the cantilever, the rear end of the spring resting upon the seating provided for it within the casing



Serex method of operating overhead valves in which the valves are arranged in the cylinder head at such angles that their stems cross just under the camshaft and they are operated by multiplying rockers



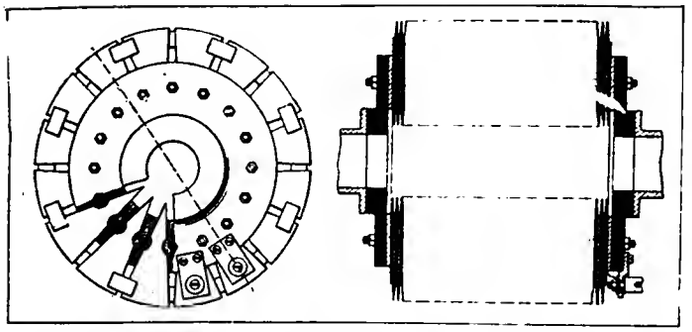
Morin gear set which has the first motion constant mesh pinion secured to the end of the camshaft so that the countershaft runs continuously. The clutch is at the rear of the gearset, the inner member being connected with the propeller shaft and the outer to the sliding gear shaft in the transmission

"In both arrangements the spring casing is closed at the front end and rendered oil-tight, and by means of the oil filler provided (shown in two of the views) the casing can be kept full of oil, so that the spring leaves themselves work constantly in an oil bath, and the pivot bearing of the spring and casing are kept thoroughly lubricated. In assembling the parts the spring is inserted through the open front of the casing, and the pivot bolt is then pushed through the side of the casing and the spring bearing. The cantilever type spring is mounted at the center on an eccentric pivot bearing in order that, when the body is fitted upon the chassis, the spring may be set to raise or lower the frame of the chassis so as to render the whole structure normally horizontal."

It is to be regretted that the inventor has apparently neglected to evolve a method for applying his inclosing system to springs of semi-elliptic type.

Ingenious French Valve Gear

The official journal of the British Patent Office is a record of practically all European inventive activity. One recent French invention is for a method of operating overhead valves by C. E. Serex, 81 Avenue Mozart, Paris. In this the intake and exhaust valves are arranged in the head at such angles that their stems cross just beneath the camshaft and they are operated by multiplying rockers. Presumably the object is to obtain compactness. Another part of the same patent consists of the method for driving the overhead camshaft. It is well known that there is always trouble when it is attempted to drive such a shaft by chain from the crankshaft, the length of the chain and its speed both being undesirable. To overcome these troubles Serex uses two chains. The first is a triangular layout with adjustment on the magneto or generator pinion, and this operates a large sprocket at half speed. From the half-speed sprocket a second chain is taken to the camshaft, it running at only half the linear speed of the chain in the triangular drive. To adjust the chains the half-time sprocket is first moved so as to take up the slack in



Combined muffler and electric current generator, current being obtained by heating one part of a thermo couple while cooling another part, the couple consisting of two different metals. By using a series considerable electrical pressure is obtainable

the upper chain, and the triangular chain is then tightened by moving the magneto pinion.

Inverts Transmission Layout

Another French idea is shown in a patent granted to G. H. Morin, Les Coteaux de Saint Cloud, France. This shows a gearset having the first motion constant mesh pinion secured to the end of the crankshaft so that the countershaft is running continuously. The clutch is at the rear end of the gearset, the inner member being connected to the propeller shaft and the outer to the sliding gear shaft in the transmission. The constant mesh gear on the countershaft is not mounted directly upon the countershaft, but is free to turn within the limits allowed by a coil spring, of which the fixed end is attached to an arm secured rigidly to the shaft. As shown, the gear changing would not be selective, but progressive. It will be noticed that the engine shown in connection with this transmission is apparently a four-cylinder V type, so it is probable that the patent has been secured while developing some entirely new sort of vehicle.

Muffler Generates Electricity

Electricity can be obtained by heating one part of a thermo couple while cooling another part, the couple consisting of two different metals. The potential obtainable from one couple is small, but a series can provide considerable electrical pressure. A series of such couples is usually known as a thermopile.

The idea of the inventor in this instance is to use some of the waste heat of the exhaust to generate electricity, and he therefore proposes to form a muffler from a series of thermo couples. The appliance as a whole consists of a pile column or chain of elements which according to one style of construction take the form of flat rings or annular vanes of metal or metallic alloys so arranged as to constitute a thermopile for generation of electric current, the rings of one metal or alloy alternating with rings of a different metal or alloy. These rings are arranged in couples and are joined near their outer and inner edges. Asbestos or other suitable insulating material is interposed between the rings except at their junctions. The exhaust gases and other heated products of combustion from the engine are directed to pass into and through the muffling chamber which the rings provide centrally in the appliance, and the rings are thereby heated at their inner junctions.

The outer junctions or contacts and adjacent parts are kept relatively cool by means of air circulation to assist in which the rings may have air holes, or cooling may be effected by water jacketing. Instead of being composed of rings as above described the silencer as constructed in accordance with a modification is composed of plates, vanes or discs, and these are so arranged as to provide and inclose the requisite space for expansion of the exhaust gases and other products of combustion.

Among the substances instanced by the inventor as suitable for composing the appliance are bismuth and antimony and alloys of these with zinc. Other substances may be employed, being of such nature as will insure generation of current of adequate power for effecting ignition lighting of lamps and charging of batteries.

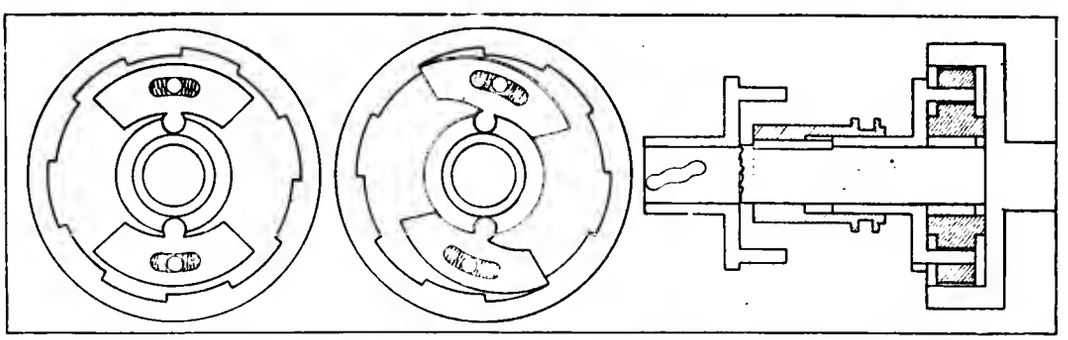
There would probably be some difficulty in regulating the current, as its voltage would depend upon the internal temperature, and this would change with the load on the engine and corresponding throttle opening.

Clutch Drives and Steers Tractor

The *Motor Trader*, England, describes a form of clutch which has been actually made and tried out in tractor service. How long the edges of the teeth on the clutch rings stand up is not stated. The description follows:

"The inventor and patentee of the free-wheel clutch layout shown in the accompanying two drawings is G. T. Taylor, proprietor of the West Kent Motor Works at Westerham, Kent, England. The district referred to provides about as good or drastic a test of the gripping and dirigible capacity of a field tractor as could be wished, and the invention in question is the outcome of Mr. Taylor's experience as a seller of such machinery, and discovery of the shortcomings in both respects of the normal petrol-paraffin tractor. Mr. Taylor has fitted his new mechanism to one such tractor, and we believe the results have been a great improvement of the tractor in question. Mainly, as will be seen, this device consists of a pair of pivotally mounted (clockwise and anti-clockwise) pawls free to engage against the ends of a series of slots in the periphery of a drum, provision being made for their engagement and disengagement at will by manual control. Following is the text of the description and claims furnished by the patentee:

"There are two gears fitted inside a bevel casing, or inclosed in oil-bath on back axle, each gear having a lever with three positions, giving forward, neutral and reverse positions, one controlling the right-hand wheel and the other the left, the drive being taken through a clutch to each wheel. In driving forward for, say, ploughing, both levers are used in the forward position, so that each clutch drives its respective wheel forward, but either wheel can over-run the other to allow for any deviation from the straight steering line. On turning to the right, the right lever is put in the neutral position, freeing the right wheel, then the left clutch only is driving, causing the tractor to turn sharp to the right, being driven by the



Left—Taylor's free-wheel clutch gear for tractors, consisting of a pair of pivotally mounted pawls free to engage against the ends of a series of slots in the periphery of a drum, provision being made for their engagement and disengagement by the operator. Right—The engaging mechanism of the Taylor clutch gear

outside wheel. For turning to the left, the left lever is put in neutral position and the right wheel takes the drive. For reversing one lever or both is put in the reverse position, accordingly as to whether it is desired to turn or go back straight. In driving on the road, where the brakes may be required, one lever is put in the forward position and one in the reverse, thus driving with one wheel and braking with the other. The ordinary gear levers on the tractor are worked in the usual manner.

Exporting Standard Tires

IN the *Motor Trader*, England, there has recently appeared the following note: "According to a report from Christchurch, motor agents in New Zealand, indeed throughout Australasia, are just now having difficulty with American motor car manufacturers owing to the latter endeavoring to force the importers to accept cars fitted with rims intended for straight-side tires in place of the standard clincher type."

Though our contemporary does not appear to think this small note of much importance, it is really a tiny cloud on the horizon foretelling the storm to come. It will be noticed that the term "standard clincher type" is used. This, of course means standard by custom and not standard in the sense that the S. A. E. standards are accepted ones.

So far as America is concerned there is little doubt that the straight side tire will be standardized by the society for nearly all the common sizes. If it were not for Ford cars the straight side type would probably displace the clincher pattern entirely. Of course the society has taken no action as yet, but the first meeting of the new tire and rim division of the standards committee showed that the tire makers are fairly well agreed as to the straight side being a *better* tire than the clincher. The straight side is likely to become standard because manufacturers of automobiles and the public are asking for it, not because the tire makers want to push it.

There are arguments both ways, but the straight side construction is certainly more mechanical than the clincher. The material which forms the casing, fabric cords or canvas as the case may be does not in the straight side tire, have to be bent and compressed into a close, hard formation in order to obtain an attaching bead. Instead it lies in a more natural position when the stresses upon it are examined.

Straight side tires have been known in Europe, they were used quite frequently about 1905, but the rims provided for them were mostly inconvenient, having a prodigious number of nuts and screws, so that changing a shoe was more trouble with a straight side than a with a clincher, for the soft bead clincher is easy enough to handle once the knack has been mastered. It so happened that the leading French and British tire makers preferred the clincher, because they were manufacturers of cycle tires first, and modeled their automobile sizes directly upon their cycle practice.

No doubt Europe will be slower in taking up the straight side type of tire again than America has been, but if a few years' experience proved that American tire makers and American automobile manufacturers and users are correct in their present belief that the straight side is the better design, the European tire makers will soon start making straight side tires to fit imported cars.

In Europe there has never been any real standards for pneumatic tires and it has always been realized that there are too many sizes in the metric schedule. The possibility of reducing the number of sizes has often been discussed, and there is no doubt that action will be taken some day in the not far distant future. When this day comes the European committee appointed to investigate the subject will certainly find it necessary to give close consideration to the straight side tire, as a very large number of cars have already been exported from America with straight side rims, and many more will be in the next year or two.

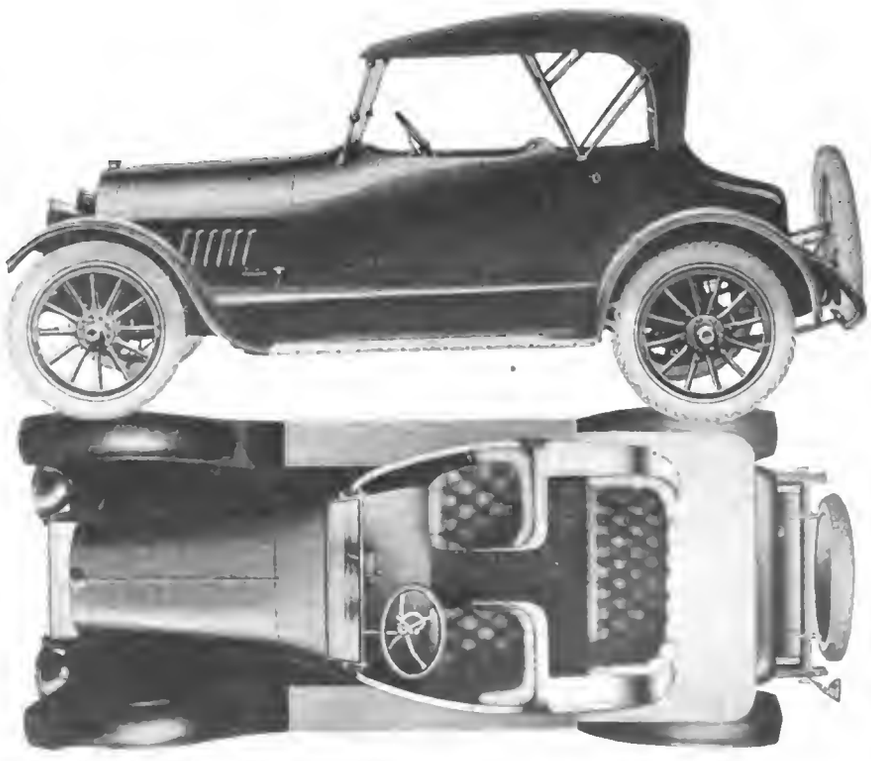
Sun Adds Four-Passenger Roadster

THE 1917 clan of four-passenger roadsters has another member in the new Sun light six. The new body has low, sweeping lines, a sloping windshield and a double cowl.

The front seats are divided with a generous passageway. The rear seat is built to seat two comfortably and allow plenty of leg room. The backs of both seats are high enough so that the passenger's shoulder has a support. Turkish rocker springs are used in the upholstery.

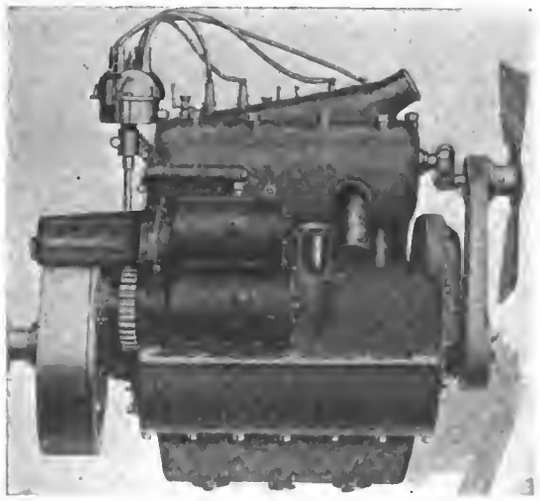
The compartment in the rear deck is sufficiently large to accommodate a couple of suit cases with room left for other touring necessities. The door is conveniently located at the extreme end of the deck, making an easily accessible carrying space.

There is a one-man top with Jiffy curtains. This top is provided with a visor that seals the front of the top with the top of the windshield, preventing rain from dripping in on the passengers. This four-passenger roadster is one of the five 1917 models built by the Sun Motor Car Co., Elkhart, Ind., including a five-passenger touring, a seven-passenger touring, a two-passenger roadster and a five-passenger sedan, all on the 116-in. wheelbase chassis.



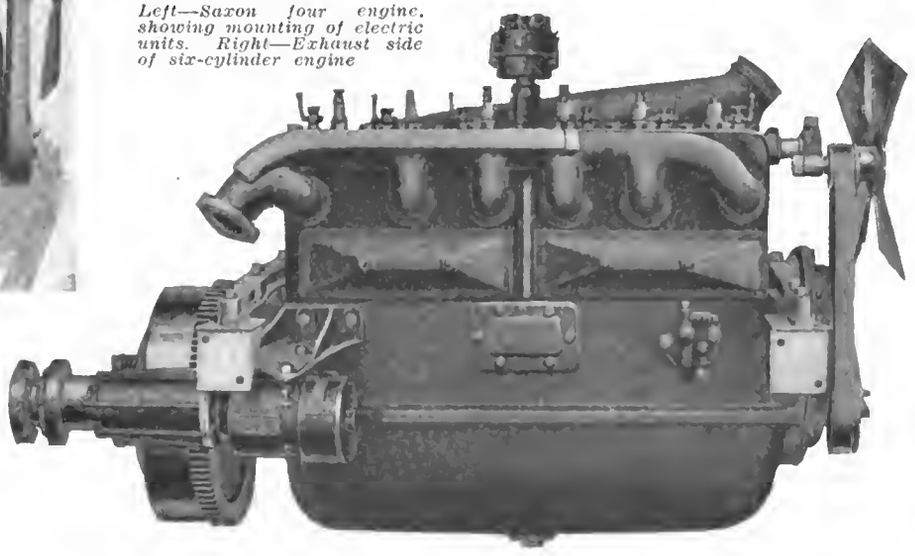
Side and plan views of the new Sun light six four-passenger roadster

New Saxons Improved in Design



Four Now Fitted With Electric Systems, Demountable Rims and Larger Tires— Six Is More Roomy — Better Bodies

Left—Saxon four engine, showing mounting of electric units. Right—Exhaust side of six-cylinder engine



MARKED improvements over the previous series distinguished the new Saxon six and the little four-cylinder roadster. Refinements both in the mechanical details of the power plants and chassis, and some important body changes make the cars better in performance as well as in appearance, the six remaining at $815, and the roadster selling in its new form for $495.

In this four-cylinder roadster model, which was the first type of car to bring the Saxon name into prominence, the equipment has been materially increased, and the body revamped to accord with latest ideas. It is true that the cost of the roadster has been increased, and while on the face of it, it would appear that $100 has been added to the price, it is really more of a value than heretofore when the added features are taken into consideration. In the new series, this model is supplied only with full electrical equipment, including a two-unit Wagner starting and lighting system and electric head and rear lamps. Then, too, the size of the tires has been increased from 28 by 3 in. on Q-D rims to 30 by 3 Goodyears on demountable rims. These two important equipment additions, together with an electric horn and a speedometer, lift the Saxon four to an equal plane with any other automobile in the matter of completeness. Last year a starter was furnished for this model at an additional cost of $50, bringing the total then to $445, and when this is considered, the new price, with every modern feature and a number of refinements not yet mentioned, is a different matter.

The six is a decidedly better looking car than its predecessor, although that car was a most attractive appearing vehicle. It has a somewhat altered body line to bring it into accord with present-day body fashions, the popular straight-line effect being well carried out. Being 4½ in. longer; wider and in every way more roomy, and having a slanting windshield and new style crowned fenders, the new model takes its place among the distinctive cars of the season, reflecting much credit upon the designers who were able to impart so many added features without increasing the purchase price.

In addition to added comfort due to softer and deeper cushions, the new six is fitted with new cantilever springs which are of the full cantilever type. In the previous model, the springs were of the half cantilever type at the rear and measured 30 in. in length. In contrast, the new rear springs are 41½ in. long, trunnioned to the frame in the middle and mounted under the axle tubes at the rear. This form of springing is undoubtedly one of the easiest riding arrangements yet devised, and it does a great deal in increasing the easy riding qualities of the Saxon six. The front springs remain of the semi-cantilever variety, 27¾ in. long.

Crankshaft Is Larger

In the six-cylinder engine, several changes are to be found, perhaps the most important of which is the increase in the size of the crankshaft to a diameter of 2 in., which is really large for an engine of this size—2⅞ in. bore by 4½ in. stroke and developing from 30 to 35 hp. This new shaft has been well balanced, and with its added rigidity it makes for a very smooth-running power unit free from crankshaft vibratory nuisances. Another important engine change in the six is the shifting of the carbureter from the left or valve side to the right side where it attaches directly to the cylinder block, and the gas passages are cored within the casting. Heretofore, the carbureter occupied a position on the left.

Two-Unit Electric System

As on the four, Wagner starting and lighting system has been adopted, the new system being a two-unit outfit, with the starting motor carried on the right rear, so as to temporarily gear to the flywheel teeth for starting; and with the generator placed on the left side and driven by silent chain connecting with the crankshaft.

There is a change in the ignition also, the Remy distributer replacing last season's make, though placed in approximately the same position on the right side of the engine and driven by gear connection with the camshaft. To make the valve springs still more serviceable, they are now made of

chrome-vanadium steel, rendering them almost immune from fatigue, and though a refinement that does not show, they are really a feature of utmost importance when the durability of the car is considered.

Another chassis change on the six is the increasing of the brake drum size from 11 to 12 in. diameter, a feature that cannot be too highly commended when the safety factor is considered. Many an accident could have been prevented if the cars involved had been fitted with more powerful brakes. Here is a point of chassis design which the engineer should overdo rather than take chances of smaller brakes doing the work.

Two other new features that add to the appearance of the six are the grouping of all of the instruments in a plate on the cowl dash, and the fitting of a new style of top having more of a curve at the rear. This top possesses what is called a Grecian rear bow, and it is surprising how much this one thing adds to the machine with the top up. The four-cylinder model is also fitted with this form of top.

Details of the Six

As previously, the Saxon six chassis has a wheelbase of 112 in., and runs on 32 by 3½ in. tires, non-skid in the rear.

On the testing block, the engine delivers 34.7 hp. at a speed of 3200 r.p.m., which indicates that it justifies to the advertised rating of 30 to 35 hp. The dimensions of 2⅞ by 4½ in. give a good relation between the bore and stroke, and among the first impressions one gets when looking at this power plant is the compactness of the whole thing. The cylinders, cast in a block, are integral with the upper part of the crankcase, which carries the bearings, thus insuring correct alignment between the shafting and the cylinders and also making for rigidity. The cylinder head, carrying a large water outlet connection, spark-plugs, petcocks and fan bracket, is removable for cleaning of the valve chambers, valves, cylinders and pistons. The lower half of the crankcase, carrying the oil reservoir, is a steel pressing that is light in weight.

As already explained, the only exposed manifolding is that of the exhaust system, this being on the right. Below it are the two pressed-steel covers that go over the valve compartments, inclosing the tappets and springs in the usual manner against dirt and preventing undue noise.

Aside from the increase in the crankshaft size, there is no internal change of note. The valves have a diameter of 1 7/16 in., and have nickel-steel heads welded to carbon steel stems, a feature of the valve assembly being the long guides in which the valve stems operate, this preventing undue wear and making a smoother operating valve. As heretofore, each piston is fitted with a Burd high-compression ring at the top, below which are two eccentric rings of conventional type.

Ignition Wiring Manifold Fitted

In connection with the adoption of Remy battery ignition, it might be mentioned that an ignition wiring manifold has been fitted, this attaching to the exhaust manifold, and running in such a way as to prevent the wires from dropping onto the hot pipe. The spark plugs are placed over the intake valves so that they are not subjected to the great heat that they would have to undergo if they were over the exhausts where they would get the hot gases sweeping past.

Combination force-feed and splash lubrication is continued, oil being pumped to the individual splash troughs under each connecting-rod and also to the timing gears at the front. From the troughs it is splashed onto the various bearing surfaces by the connecting-rod ends, and finally gets back to the reservoir. There is an oil pressure gage on the dash, and a level indicator on the side of the crankcase.

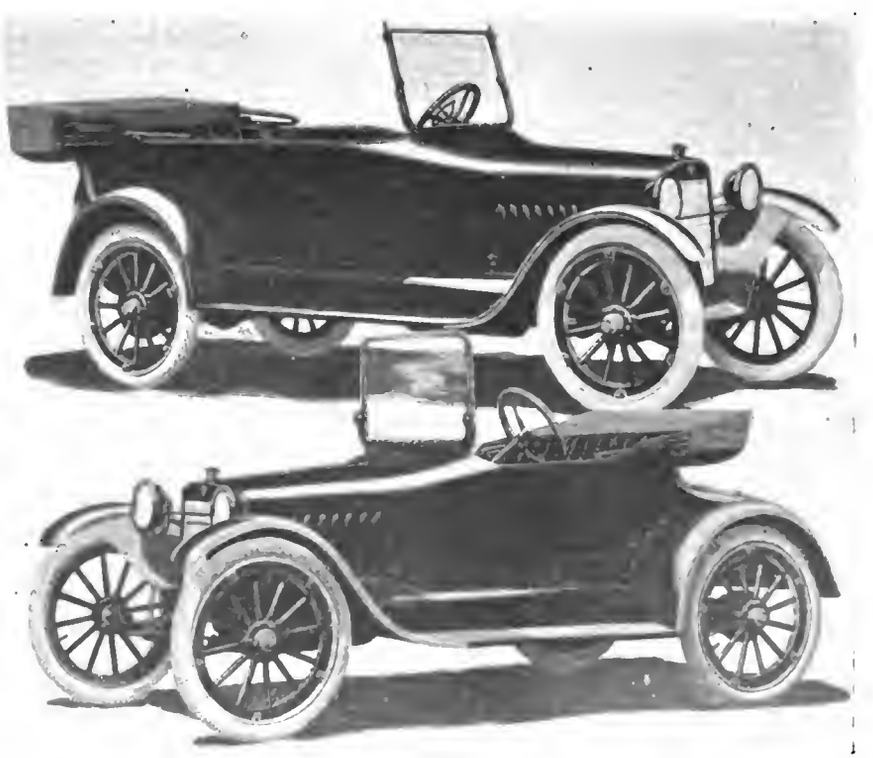
Back of the motor there is a dry-disk clutch housed in the flywheel, and then the power is transmitted through a universal joint to the propeller shaft. This shaft is inclosed within a torsion tube having a yoked front end that hinges to a frame cross member. The gearbox, containing the usual three forward and reverse gear changes, is mounted in unit with the rear axle, and between the rear end of the torsion tube and the front of the axle housing.

The rear axle is Timken, and has a pressed-steel housing that is very compact in design. The differential is of the two-pinion type, which is a factor for lightness, and it is carried on Timken roller bearings, as are also the rear wheels. Constructed of special steel stock 1 1/16 in. in diameter, the axle drive shafts are amply strong for the work they have to do. The driving gears are of the now quite generally used helical-bevel form, in which a rolling action is imparted to the mating gear surface, reducing gear noise to the minimum and because of greater tooth contact, strengthening the driving connection between the ring gear and pinion.

Saxon uses a pressed steel channel section frame of good proportions in this car, it having a channel depth of 4 9/16 in , width of flange of 1¾ in., and 5/32 in. stock. It is tapered to support the body in good manner, and has ample cross bracing so that there should be no trouble due to frame distortion from any cause in normal usage.

The Four-Cylinder Model

Like the six, the Saxon four also has a new body shape, and with its complete equipment, it is indeed an attractive little car. The increasing of the diameter of the tires by



Above—Saxon six-cylinder five-passenger touring car for 1917, showing the new streamline body and slanting windshield. This car lists at $815.
Below—Four-cylinder Saxon roadster, giving an idea of the improved body lines and larger tires. Fitted into a two-unit Wagner starting and lighting system and demountable rims, it sells for $495

2 in. gives a higher standing car with more road clearance, an advantage to be appreciated. The front axle clears the road by 11½ in., while there is 9 in. clearance at the rear axle. Another factor in connection with the larger tire equipment is undoubtedly important, this being the great excess of tire strength as compared with car weight, a fact which should reduce the owner's tire expense to a very considerable degree.

The new roadster appears with a change in the carbureter equipment also. The new Reichenbach atomizer type of instrument replaces the make used heretofore, finding about the same location, however, on the left side.

Comfort a Feature

Much thought seems to have been given to the matter of comfort in this new four, for with the wider seat and better upholstery, it is indeed on a par in riding qualities with its more complete fitments. The seat has a depth of 17 in. and is 40 in. wide, and a distance of 30 in. has been obtained between the heel board and dash. Doors also are amply wide, measuring 18 in. across. With the coming of electric lights, fitted with means of dimming for city driving, the side oil lamps have disappeared from the sides of the windshield, a change that will be appreciated.

The Saxon four has a 2¾ by 4 in. engine that is very similar to the six in general design. The cylinders and crankcase are integral, with an oil reservoir forming the bottom of the power plant, and the cylinder head detachable as a unit. The crankshaft has two large bearings, and is inserted through the end of the crankcase, which is of the barrel type. Internally the engine is conventionally designed with all parts substantially built. An output of 18 hp. is claimed for the unit.

This model has a dry-disk clutch in the flywheel, and the drive shaft is inclosed, a single universal joint being fitted ahead of the torsion tube. The gearset is interposed between the propeller shaft housing and the rear axle, and it has three speeds ahead. The wheelbase continues to be 96 in., and cantilever spring suspension is retained front and rear without change.

Overland Pumps Water Off 5 Acres

WHEN the ranch of J. L. Luck, near Los Angeles, Cal., became flooded recently, Mr. Luck used his Overland touring car to pump the water off 5 acres. The accompanying illustration shows how the rear wheel of the car was jacked up and attached to the pump handle by a hard wood block clamped to the rim, bolts being run through the space between the spokes to a block on the other side of the wheel. To this attachment the shaft was bolted and the engine started, the engine being run at a speed equivalent to about 5 m.p.h. on the road, this keeping the pump handle working forward and backward at a regular and effective pace. Three or four days' pumping drained the pool about the ranch house.

Maxwell Elite Model

THE illustration at the right shows the convertible roadster touring type body fitted to a standard Maxwell chassis by Harry J. De Bear, manager of the New York branch of the Maxwell Motor Sales Corp., and known as the Elite model. This car, which follows foreign tendencies in design, seats either two or four comfortably, the rear seat being accessible through the front door, as the right front seat folds forward to permit passage to the rear. The car is painted battleship gray and trimmed with red patent leather.

Two New Convertible Chandler Models

Four-Passenger Coupé and Seven-Passenger Sedan Are Mounted on Standard Six-Cylinder Chassis — Limousine Is Improved in Design

The new Chandler limousine and a view of the driver's compartment. Below—The four-passenger convertible coupé

THE Chandler Motor Car Co., Cleveland, Ohio, is prepared to give much more attention to closed body styles for winter use than a year ago and expects to manufacture from 750 to 800 closed jobs consisting of convertible types and limousines.

The Convertible Coupé

One of the newest closed jobs is the four-passenger convertible coupé at $1,895. The body is a Springfield design with the same seating arrangement as the present roadster, namely, a cloverleaf pattern with a wide rear seat accommodating four persons comfortably. The seating arrangement is more roomy than in the roadster as the baggage compartments at the sides have been removed and the space used in the seat. There is also more leg room; the glass sides are entirely removed and carried in a rear compartment, standard exterior body finish is in blue; the windows in the doors lower by straps; there is a door at either side; lighting is by a dome bulb; and the interior finish is a new blue weave with a small and quiet pattern.

The same tire sizes are used as on the runabout, and gear ratio and other chassis specifications are standard. Deliveries will start Oct. 1.

A Convertible Sedan

The other convertible is a seven-passenger sedan model at $1,895. The body is a Springfield job with the usual side windows that may be removed, giving an open body effect.

The limousine is quite improved over a year ago, so much so that it can be designated a new model listing at $2,595. There is capacity for five in the rear. The two auxiliary seats face forward and swing forward and down into compartments in the back of the front seats. The interior finish is simple yet effective, a feature being a 5-in. mahogany panel across the center of the door and around the compartment. An option is given on interior finish, four colors being offered.

Door windows are raised and lowered by patent openers and the glass back of the driver is made in halves which slide right and left past each other in place of being raised or lowered.

Chandler production last year was 6400 cars. This year it reached 15,000 cars and next year the figure aimed at is 20,000.

—

$15,000 in Prizes for Grand Prize and Vanderbilt Cup Race Winners

FIFTEEN thousand dollars will be the prize money paid to the winners of the Vanderbilt Cup and Grand Prize races to be held on the Santa Monica road race course in November. Each event will carry $7,500 in prizes divided as follows: First prize, $4,000; second prize, $2,000 third prize, $1,000, and fourth prize, $500. In addition the winner of the Vanderbilt Cup race will receive the William K. Vanderbilt, Jr., cup and the victor in the Grand Prize classic will receive the $5,000 cup awarded by the Automobile Club of America.

The FORUM

French Emissary Excluded from American Bearing Plants

By George L. Moskovics

Mechanical Engineer, George Automatic Roller Bearing Co.

THERE visited this country recently the representative of a large French organization, making automobiles, trucks and accessories. This gentleman was especially interested in the American methods of ball and roller bearing manufacture with a view to introducing in France some of our modern high-production, high-precision machinery and methods.

He was not trying to obtain any so-called secret information, except as the possessors thereof would be willing to sell their information under license, etc. In view of the way in which foreign manufacturers have always received representatives of American companies in their plants, he looked forward to no difficulty whatsoever in obtaining permission to inspect such parts of our American plants as were not kept closed to the public.

Much to the surprise of this gentleman, he was refused permission even to go over the more public parts of the great majority of our bearing plants, this refusal in some cases being none too courteously given. The result of such a narrow-minded policy of exclusion may be judged by the following quotation from letters, written by the gentlemen referred to:

"It was really very foolish of these people not to let me see the interesting features of their works, considering I wss prepared to purchase anything that was worth the trouble. I was prepared to buy any process, machine, patent or license that may have been interesting to my company. Furthermore, as we cannot find the machinery we need in France, we were willing to give our orders to any concern that would be interested. As it stands now, we don't need them any more and will soon be prepared to enter into competition here and abroad. I think our people in France will let no more foreigners go over their works."

Disregard of Consequences

In view of the commonly recognized fact that when Europe gets on her feet after the war we are going to have a hard scramble to compete with her in the face of the great lesson of efficiency she has learned, it strikes me that we are not building very securely when we treat her emissaries in such a cavalier manner as this.

Tractor Requirements for General Farm Use

By John Lefler

HEREWITH I am sending you some views on the tractor question as I see it, in THE AUTOMOBILE.

First as to size. It seems to me that for the man who can get his work done with a two-horse team it would not be profitable to change; but for one who has a little more than two horses can do or enough for four horses or more a part of the time, or all the time, it might pay him to make the change rather than to maintain two extra horses in idleness at a continual expense. A 4-hp. size then will probably be the most popular. This seems to be about Henry Ford's idea.

Second, the wheels will have to be shod with rubber tires or some successful substitute for rubber tires, a tractor will have to haul the farmer's crops to town as well as doing the plowing and cultivating, and the use of drive wheels with calks or grouters on them will be very destructive to good road surfaces either dirt or stone.

Third, it should have a comfortable seat for the driver. After a man has paid $1,000 or so for a machine he is entitled to something better than a mowing machine seat to ride around on.

Fourth, as to rating, the plan of rating a machine by the number of horses it will replace is not far wrong from a farmer's viewpoint. If a tractor manufacturer rates his machine as a 6-12 or 10-20, etc., this is intelligible enough to a farmer. He undestands by that, that the engine will do the work of six or ten horses and will operate as a gasoline engine at 12 or 20 hp. to drive feed cutters, pumps, thrashing machines, etc., we will leave that question of torque and ratio and drawbar pull in foot-pounds to the engineers.

Filter Dust from the Air

By Chas. E. Duryea

J. EDWARD SCHIPPER'S article on U. S. Trucks in Mexico calls attention to the need for air filters to take the dust out of the air before it passes into the engine cylinders. It seems hopeless to again refer to this matter for it has been before the public time and again since early days. If the air is passed through a bag, such as is used on the small vacuum cleaners for household use, it will leave all its dust behind.

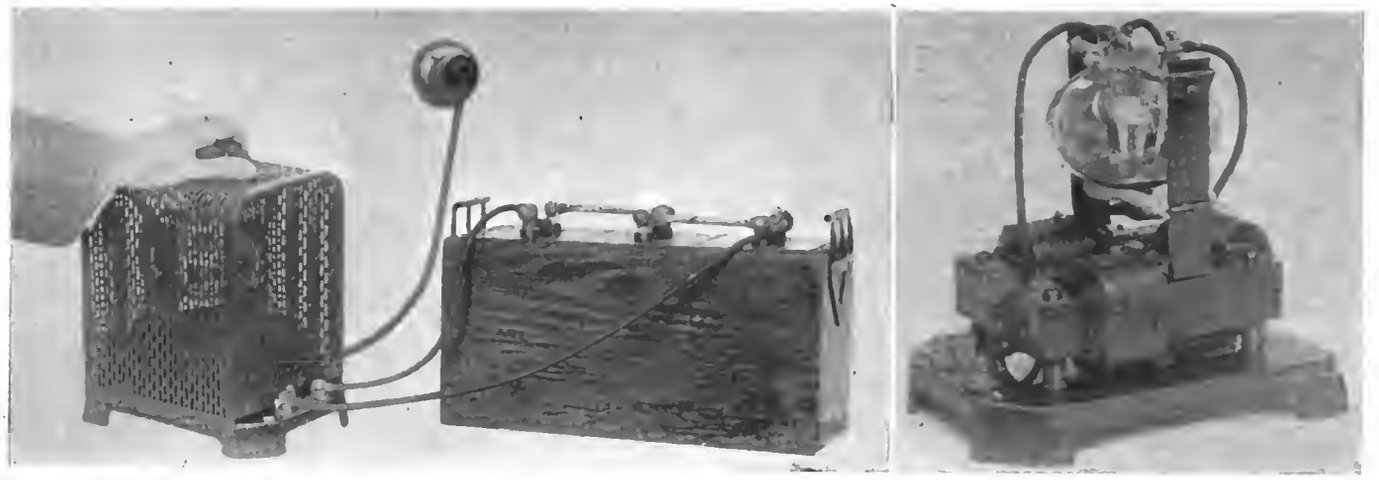
Must Be Washed

Several car makers fitted such screens or strainers at the beginning of the industry but users generally left them off after they became so clogged that running was not good. The right way is to send them to the wash every week just as one does one's clothes. Some users protest that an air filter lessens the amount of air the engine can get but this is not true appreciably until the cloth has filled with dirt. The small vacuum cleaners produce but a very slight vacuum and use a very close woven cloth, for milady will object if there is a smell of dust in the air. The engine suction will get air through a considerable resistance. I have been unable to notice any difference if the bag is fairly large.

Electric Omnibus Cost Averages 9 Cents Per Mile

IT costs 9 cents to run an electric omnibus a mile, according to the York Corp. Tramway Department, England. This organization has had over a year's experience with four electric omnibuses and finds that after a total mileage of 65,470, this is the resultant figure. Making some additional allowances for maximum tire maintenance, etc., this may be brought up to about 11 cents per mile excluding standing charges.

An interesting feature of the method of carrying out this work is in the charging stations at the terminus of the route. The charging cable with plug attached is drawn up from the roadway box and connected to the bus. A small door is opened, a button pressed causing the machine to start up and commence charging. A second pressing of the button shuts down the plant.



Left—Charging a storage battery with the G. E. small mercury arc rectifier. Right—Rectifier with cover removed

A Rectifier for Battery Charging

G.E. Small Mercury Arc Type Is Portable and Can Be Used To Charge the Battery in the Car

A SMALL mercury arc rectifier for charging starting, lighting and ignition batteries has been placed upon the market by the General Electric Co. of Schenectady, N. Y. The device is handy in size and easily portable, being rectangular in shape and of about the same bulk as a three-cell storage battery.

This rectifier is designed for charging one three-cell, one six-cell or two three-cell batteries, or it can be connected to a single battery cell and will charge it at approximately 6 amp. when connected to a 110-volt alternating current supply. The rectifier is made for 133, 60, 50, 40, 30 or 25 cycle, 110-volt alternating current circuit. The prices vary between $25 and $31.25.

Partial Discharge Shortens Battery Life

While long trips through the country help to keep the battery in condition it is stated by the General Electric Co. that periods of city driving with the many demands for starting, the horn and often for lights, tends to exhaust the battery while the low speed demanded by congested traffic holds the engine below the charging speed on the generator. These conditions of partial discharge tend to shorten the life of the battery if they occur frequently or for long periods. It is for this reason that this device has been brought out as a supplementary method of charging. This rectifier is marketed under the name of type MS form K. It will deliver 5 amp. at a maximum of 15 volts, direct current when connected to an ordinary lamp socket.

When charged, the positive plate of a storage battery cell contains peroxide of lead and the negative plate is metallic lead in its spongy form while the electrolyte or liquid is sulphuric acid at its highest specific gravity, 1.280. If the battery is then discharged to the normal limit, a large proportion of the peroxide of lead becomes lead sulphate, through the action of the acid. The negative plate too now carries lead sulphate and the gravity of the acid drops to about 1.170 (practically water) with few of the original characteristics of the acid left. The acid loses its identity through creation of the lead sulphate.

Charging as Needed

When the battery reaches this stage, it should be charged by the application of "direct" current properly adjusted as to voltage, for some hours depending on the amount of current drawn from it. In addition, about every fifth or sixth recharge a so-called "scouring" or "soaking" charge at a low current rate should be put in to bring the electrolyte up to full specific gravity and to remove all traces of the sulphate, etc.

Lead Sulphate Broken Up

In the processes of recharging, the lead sulphate on both plates is "broken up," to use the chemical phraseology, while the liquid resumes the characteristics and specific gravity of sulphuric acid. At the the same time the voltage across the terminals rises with the gravity of the electrolyte.

No harm will result to a battery as long as there is plenty of lead sulphate for the current going into it to work upon, but the necessity for close regulation of the current arises when the lead sulphate had nearly all been returned to its original form. Then the current tends to break the water into its component parts, hydrogen and oxygen, which causes gas and heat. If this condition is permitted to continue for any length of time it will ruin the battery.

This method of regulation has been devised to prevent such an occurrence.

Can Charge Battery on Car

The rectifier consists of a metal base on which are mounted the necessary reactance coils and rectifier tube in a suitable holder. The whole device is covered with a sheet metal cover. An attaching plug is supplied which may be inserted in any lamp socket. There are also two binding plugs marked plus (+) and minus (—) from which wires are run to the battery or batteries to be charged. The device weighs about 15 lb. and is easily moved. It is not necessary, therefore, to remove the battery from the car to charge it.

Tipping the rectifier slightly after connecting the two terminals of the rectifier to the battery and the rectifier itself to a lamp socket, will start it and no further attention is necessary until the battery is charged and the current shut off. Two batteries may be charged at the same time by connecting them in series, and connecting the rectifier to the extreme terminals of the batteries. In case the current is interrupted the batteries will not discharge back through the rectifier. At 10 cents per kilowatt-hour for a 10-hr. charge, it will cost about 15 cents for charging any of the batteries above enumerated.

The Rostrum

Power Delivered Through Outside Wheel

EDITOR THE AUTOMOBILE:—When a car turns a corner one wheel travels faster than the other; is the power all in one wheel or is there still an equal amount of power in both wheels, and if the power is all in one wheel while the car is turning the corner, which wheel is the power in?

Oklahoma City, Okla. D. J.

—In rounding a corner which is of such a radius that the inside wheel is stationary all the power would be delivered through the outside wheel. When the other extreme exists, that is, when the car is traveling along the circumference of a circle of infinite diameter, in other words, a straight line, both wheels are delivering the same power. Between these two extremes the ratio of power delivered varies with the ratio of speed of wheel travel. This becomes quite evident if it is considered that both wheels carry the same load, and hence the wheel which carries the load furthest is exerting the greatest power.

F. R. P. Chassis Suitable for Racing

Editor THE AUTOMOBILE:—Would an F. R. P. make a good racing car without many changes?

2—What is the highest speed made by an F. R. P. stock chassis?

3—Did the Packard Special driven by J. G. Vincent at the Sheepshead Bay Speedway have a specially-built engine?

Tacoma, Wash. E. V.

—The F. R. P. car would make a good racing car without many changes.

2—It is capable of 100 m.p.h. with the two-passenger body and 80 m.p.h. with the seven-passenger.

3—The Packard Special driven by Mr. Vincent had a special aeroplane engine which is entirely different from that used in the Packard stock chassis.

Toeing in the Front Wheels

Editor THE AUTOMOBILE:—If the front wheels of an automobile toe in slightly, by this meaning that the measurement between the felloes of the wheels when taken on both sides of the axle would not be the same, would this cause any excessive wear on the front tire? We understand, of course, that a slight dishing of the wheels would have no effect on the wear, but the other point is not clear in our minds.

Minneapolis, Minn. W. S. N. Co.

—Toeing in of the front wheels will tend to cause a slight sliding action of the tires over the road. This tendency, however, is offset by the castor effect given the wheels and by the added ease in steering.

Buick Air Pipe Now Shorter

Editor THE AUTOMOBILE:—Why does the Stewart feed on the Buick 45 have the air pipe extend from the feed to the dash? This is a great deal of extra copper tubing unless it is done for some purpose.

Lawrence, Mass. C. E. C.

—The reason that the Buick 45 had a long air pipe was to prevent the leakage of volatile gases through evaporation. With the heavier grade of fuel now employed the practice of carrying this pipe up to the dash has been discontinued and the Buick company is now simply bending it over to one side of the tank. They have found that with the present rate of fuel there is practically no danger of the volatile products escaping by means of this vent.

As you are no doubt aware, the grade of gasoline generally marketed has been growing steadily heavier and less volatile. Hence it is no longer necessary to take the same elaborate precautions as were essential when the fuel used was considerably lighter and more dangerous to handle. It has also resulted in an entire revision of the methods of carburetion.

Formula Rating of Ford is 22.5 Hp.

Editor THE AUTOMOBILE:—Will you kindly state the horsepower of the Ford engine according to the S. A. E. rating and explain how this rating is computed?

2—At what r.p.m. does the Ford engine develop its maximum power?

Timberville, Va. W. B. F.

—The horsepower of the Ford car is 22.50, as the bore is 3¾ in. This formula is $\frac{B^2N}{2.5}$ where B is the bore and N the number of cylinders.

2—The peak of the Ford horsepower curve is at 1600 r.p.m.

Data on Expansion of Metals

Editor THE AUTOMOBILE:—Kindly give me the relative expansion of metals used in automobile construction at the following temperatures, using Fahrenheit unit. 212, 300, 400, 500, 750, 1000, 1500, 2000, 2500 and 3000.

2—Please state at what point of temperature lubricating oils are burned, light, medium and heavy oils? That is to say, at what point would these three oils become ignited when brought in contact with heated metal?

Mt. Vernon, Ill. E. E. E.

—Cast iron expands 0.00000556 times its length for every degree rise in temperature on the Fahrenheit scale. Babbitt metal has the co-efficient of expansion of about 0.00000986. Steel expands at about 0.00000689.

2—The fire point of these oils is around 450 deg. Fahr. for the light oils, running up to about 500 for the heavy.

Adjustable Pedals on Many Cars

Editor THE AUTOMOBILE:—What car selling under $1,000 has the most comfortable seating for driver who is 6 ft. 3 in. tall?

Roselle Park, N. J. C. E. M.

—Any of the cars that have adjusted pedals could be made to accommodate you, provided that the cowlboard is not too low.

Carrying Two Spare Wire Wheels

Editor THE AUTOMOBILE:—How can I carry two Houk wire wheels with tires mounted on the rear of a 1916 Hupmobile touring car, the wheel carrying 34 by 4 shoes?

I would like them to look as much like the Mercer sport-

ing model as possible. Can you suggest where I could get tire holders to fit this car and be strong enough to carry the weight? I now carry one mounted wheel on a wheel carrier furnished by the Hupp company, but want to carry two wheels.

Alamo, Tenn. R. W. F.

—At the present time the Houk Mfg. Co., Buffalo, N. Y., can furnish a double hub which can be bolted to the bracket on the rear of your car in place of the single hub now attached. This double hub will carry either one or two wheels. Before attaching this double hub the bracket in the rear of the hupmobile should be raised a trifle so that the hub will be parallel with the ground.

Should you not care for the double hub arrangement, a cradle suitable for carrying two wheels can be obtained from practically any supply house. The brackets on these cradles can be made so that they will fit any car.

Removing Scale from Radiator

Editor THE AUTOMOBILE:—Please give complete directions for removing scale and other deposits from the radiator of an automobile.

I have seen general directions, but they never seem to be complete. If sal soda or soda ash is used, please state how much per gallon and under what conditions to use same, how long it should be left in the radiator, etc?

Uniontown, Pa. E. T. P.

—Scale can be removed from radiators by using a saturated solution of common washing soda and water. Thoroughly flush the radiator out with the solution then clean with fresh, pure water. A mixture of ordinary washing soda in which 4 oz. is used to the gallon of water will do the work properly.

Wiring and Connections of Allis-Chalmers

Editor THE AUTOMOBILE:—Can you inform me about the wiring and principle of operation of the cut-in and regulator of an Allis-Chalmers electric system as installed on a Grant six?

2—Kindly give reasons why the fuse on this same system should blow when the engine speed reaches 200 r.p.m.?

Windham Junction, N. H. A. A. W.

—A full wiring diagram of this system is given in Fig. 1. This shows both the internal and external connections of the entire system. The regulator is a vibrating type and the mechanism is clearly illustrated in the drawing. As shown, there is a lead from the battery around an armature winder, then through the cutout contact and over to the generator. When the current from the generator becomes strong enough to overcome the tension of the spring on the cutout contact piece the battery starts charging. When this current falls below that strength the cutout is open. The vibrator throws a resistance into the circuit of the shunt field every time the charging rate increases above normal. As soon as this resistance is thrown into the field the current drops, thus automatically regulating the charging rate.

2—In the particular case you mention it is probable that the small contact inside the starting switch is not making good connection, or that the vibrating regulator contacts are stuck, or both. If the small contacts inside the starting switch are not making good connection it opens the charging circuit. As the regulating contacts do not start to vibrate until the charging current rises to about 10 amp., these contacts will remain closed, putting a full field on the generator with no load. The voltage and field current will then rise to a high enough value to blow the fuse. It is very possible that the contacts carrying this high field current may fuse and stick before the fuse itself blows, as this has frequently been known to happen under conditions which are similar to those you have described.

To remedy the trouble the bottom of the starting switch could be removed by unscrewing it and contacts cleaned and the tension of the spring adjusted so that the small contact makes good connection. If the fuse continues to blow after this has been done, the regulator should be replaced with a new one.

Oiling the Clutch on 1917 Paige

Editor THE AUTOMOBILE:—I have a 1917 Paige with a multiple disk cork insert clutch and have been using 600 W oil which will run for a while and then gradually run out into the pan, causing the clutch to slip.

2—Kindly advise if this is the correct oil to use and if it is possible to correct this oil wastage.

Cumberland, Md. L. S.

—The clutch compartment of the 1917 Paige should contain 1 pt. of a very light grade of lubricating oil and during the Winter months it would be well to mix this with one-third kerosene. This compartment should be drained at least once a month, washing it thoroughly with kerosene or gasoline and refilling with fresh oil or the same oil may be used, providing it is strained.

2—600-W oil will not only be wasteful, but will prevent proper operation. It would be well to drain off this oil, making certain that the compartment is washed out thoroughly and it will pay you to be sure to use nothing but a very light grade in the future.

Horsepower and Pulling Power

Editor THE AUTOMOBILE:—Suppose two automobiles each weigh 2600 lb., one having a horsepower of 25 and the other 26; about how much more weight would the 26 hp. one move at usual driving speed than the 25-hp. car? Would it be as much as 500 lb.?

Rochester, N. Y. W. A. P.

—Assuming that both cars had the same frictional losses in transmission of power and had the same gear reduction, the ratio of pulling power under most circumstances would be 25 to 26. It is impossible to give definite figures.

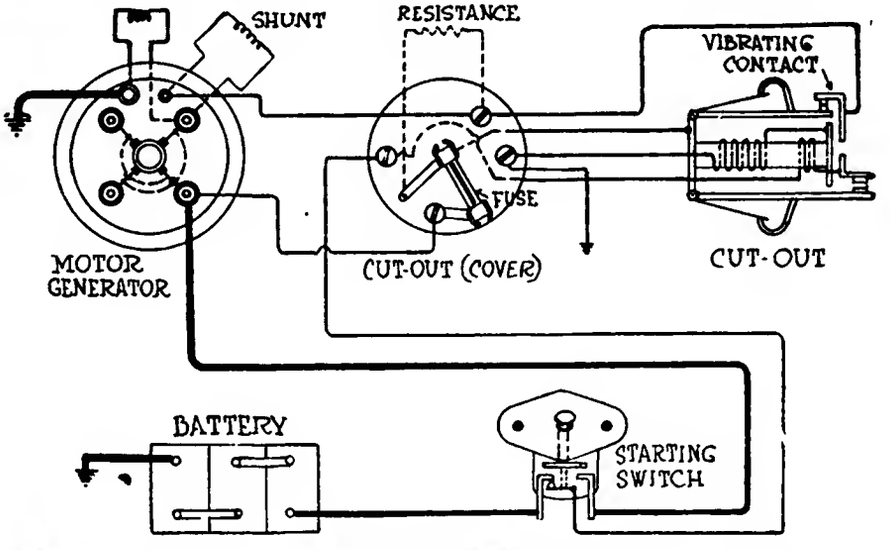


Fig. 1—Wiring diagram of Allis-Chalmers electric system as installed on six-cylinder Grant

Cleveland—Rising City in the Industry

More Automobile and Accessory Factories Have Been Added to Its Roster in the Past Year than to That of Any Other City—Many New Plants

CLEVELAND, OHIO, Sept. 23—The progress that Cleveland is making in the automobile industry is one of the topics of the day with manufacturers. Within the last year Cleveland's list of automobile and accessory factories has grown more rapidly than that of any other city, and each week brings announcements or rumors of other concerns moving to this city.

Within the last few months several new factories for automobile concerns have been built, and others are being built and arranged for at the present time. The Jordan Motor Car Co. located here some months ago and is now nearly at schedule production. The Grant Motor Car Co., Findlay, Ohio, has its new factory nearly completed and will occupy it in the near future. Within the last few weeks the Abbott Corp. of Detroit announced that it would locate here. A new factory is now in the process of construction for the Dann Products Co. of Chicago. Within the last few months the Denneen Motor Co., truck manufacturer, has located here and is now well under way with production.

Four H. A. L. Cars a Day

The H. A. Lozier Co., which started deliveries of the H. A. L. car last April is now turning out four cars per day and hopes to be on a schedule of six in a short time. The factory is located on the second floor of the old Royal plant and employs upward of 300 men. It is expected that the production for the fiscal year of April to April will be 1000 cars. Already a selling organization covering approximately half the country and embracing upward of forty dealers has been organized.

Baker-R. & L. Progress

The Baker-R. & L. Co., which a year ago secured a license for the manufacture of Owen-Magnetic cars, started the delivery of these early last Spring, and has now an output of sixty cars per month, and which is being increased each month. The electrical transmission systems for these are manufactured in the Fort Wayne plant of the General Electric. All bodies, including closed types, are built in the R. & L. plant, the company at present building closed types ranging from $3,500 for a coupé to $6,000 for a limousine. Optional colors are given at list prices. In the closed work much variety is given in upholstery, trimmings, etc. In addition to the manufacture of Owen magnetic cars, the Baker-R. & L. Co., is continuing its electric passenger vehicles.

Cleveland is admirably located as a railroad distributing center. It has excellent shipping facilities over the New York Central system and the various lines controlled by it, such as Lake Shore & Michigan Southern, and Big Four. It has every facility over the Pennsylvania lines, not to mention the many other railroad systems entering the city. This fact in itself is a big consideration with automobile shippers.

In addition to new concerns locating in Cleveland, the automobile and accessory industry has been growing rapidly. Many factory additions are at present under way and new plants are being built.

Willard's Great Plant

One of the greatest factory building activities is that of the Willard Storage Battery Co., which started its new factory 5 miles from the heart of the city 3 years ago and which it has since operated in addition to its old factory near the center of the city. At present the new factory is being quadrupled in size and when completed, in a few months, will have a capacity of 10,000 to 12,000 batteries per day. At present the capacity of the two plants is 4500 per day, with a working force of 2000.

The new factory is located in that section of the city known as Collinwood, which is served by the Cleveland Belt Line railroad, which furnishes ideal shipping facilities, Willard having switching accommodation of thirty-eight cars. The company has 16 acres of land, 10 acres of which are already built upon.

The new buildings now in process of construction will give every manufacturing facility. One building for the molding and grid pasting department measures 78 by 304 ft. Work is nearly completed on a special building for assembling and battery forming which will have 90,000 sq. ft. of floor area. The building is one story, 300 by 300. There is another building 85 by 200 to be used as an engine room and power house. When the new buildings are completed there will be a special one for the manufacture of batteries for train-lighting purposes which is a growing part of the work. It is hoped that by Jan. 1 all of the Willard work will be carried on in this new plant.

Every feature to hasten production has been looked after. It is a daylight plant all through. The wood working department where battery boxes are made has capacity for 10,000 boxes per day. In connection with these boxes all metal parts are lead plated, lead plating being a new process in which a coating of lead approximately 5/1000 in. thick is deposited on all handles, metal screws, wood screws, etc. By this means there is no deterioration or corrosion due to acid.

A feature of the new plant is an electric testing device for the different battery jars by which the smallest holes or thin spots can be detected. An alternating current of 24,000 volts is used in the test, which is proving so complete that the company replaces any jar in six months if returned to the branches or service depots.

An important department of the new factory is the die-casting division where all of the grids are manufactured. This department is housed in a long rectangular room down the center of which are twenty-four furnaces for heating the metal, and with facilities for four or five men with die-casting machines working from each furnace. Factory arrangements are such that the grids are transported but a short distance to the trimming presses where all of the surplus metal is punched off.

A novel feature is a smelter department in which all the good metal is reclaimed from the cleanings of castings, etc.

A Refrigerating Test Room

The new factory incorporates a refrigerating test room in which it is possible to test a manufacturer's engine with starting-lighting apparatus, battery, etc. The motor unit with battery, etc., is mounted on a heavy truck which runs on a track into the refrigerating room where a temperature of 20 below zero is maintained. The engine is controlled from the outside, so that it is possible to test the efficiency of the battery for starting all kinds of motors in this temperature.

In the grid pasting department motion study has resulted in the use of an endless belt which passes between the work benches of those pasting material in the grids. Once the grid is pasted it is placed on a traveling belt which carries it to other parts of the factory where the drying is done. Another example of labor economy is the use of eight Ellwell-Parker high-low industrial trucks used for transporting trays laden with plates, or other goods around the factory. In no part of the new plant has anything been left undone to economize labor and make working conditions better.

Air Changed Frequently

In the plate forming room, which is 140 by 300 ft. there is a change of air five times every hour and ten times if necessary. This is because of the gases given off in charging and forming the plates.

The factory is well supplied with automatic machines for the manufacture of terminals, bolts, and other small parts entering into the battery. There are other gangs of presses to stamp the handles of the battery boxes. On the boxes embossed lead nameplates are now being used. These avoid corrosion.

White on Double Shifts

The White company has been operating its factory on double shifts for the past 2 years. In its truck department it has had a great deal of European business but domestic trade has been exceptionally good during the past year. Factory additions are at present being carried out.

Winton Output Sold

The Winton company has increased its output over 1915 and is still one month behind in orders. Its 48 model is now in its tenth year, in other words for 10 years the company has been a devotee of six-cylinder design. Practically the entire Winton output is sold with different colors, color options being a part of every car sale. Thirty per cent of the output is sold with wire wheels. In all thirty-four different body styles are furnished, and 33 per cent of the business is closed winter jobs. Winter job business is one-half greater than a year ago. To take care of the various colors for the different bodies a very complete battery of drying ovens has been made a part of the factory equipment.

400 Stearns-Knights a Month

The Stearns company is busy on its 1917 production. During the fiscal year, July 5 to July 5, 3000 Stearns-Knight models were produced, 2100 four-cylinders and 900 eights. The present factory schedule is 400 per month, divided equally between the two models. There are 1400 men at present and since Dec. 1, the machine shop has been working three shifts per day. During the past year the factory has been enlarged by an assembly building 70 by 200 ft. five stories, and of cement construction.

Peerless Plans Expansion

The Peerless company is at present engaged on its European order of trucks calling for seventy 4-ton trucks per week which order will carry the factory into the Spring months. The factory employs 3000 men and in addition to its truck business is producing fifty eight-cylinder passenger cars per week. Factory enlargements are planned for the near future and will include three new buildings, one will be for the exclusive manufacture of passenger car work and will have 150,000 sq. ft. floor space.

Chandler Boosts Production

The Chandler company, which has had such a phenomenal growth has new enlargements under way which will give a capacity of 80 to 100 cars per day for the spring. One new four-story building 60 by 500 ft. will be built for general assembly work, and will be ready for spring production. In addition a special service building 160 by 160 and one story is being added.

Walker Mfg. Co.'s Shop

Many people have the misapprehension that Chandler is an assembled car, and that motors, axles, gearsets, etc., reach the factory as assembled units ready to be incorporated in the car. This is not so. All of these units, with the exception of the gearset, are not only assembled in the Chandler factory but the machining work is done in plants working specially for the Chandler organization. One of these is the H. J. Walker Mfg. Co., whose factory joins the Chandler. This Walker plant is a huge machine shop 120 by 200 ft. employing 500 men. Over $100,000 worth of new machinery is being added, and over $125,000 worth of new machinery was added in the last 6 months. Much of the Chandler machining is done in this factory but the assembling in the Chandler plant. Rear axles are entirely assembled in the Chandler factory as are front axles. In the motor testing department the twenty-eight testing blocks are constantly filled.

A Briggs Body Plant

Adjoining the Chandler factory is a small factory of the Briggs Mfg. Co., to take care of the Chandler bodies. The bodies are built at the Detroit plant of the Briggs company and the small Briggs factory adjoining Chandler is for final painting and trimming. This plant does nothing but Chandler jobs. The growth of the Chandler factory has been one of the most rapid in Cleveland. The factory was started in February, 1913, and the first cars were shipped July, 1913. Last year production was 8000, this year 15,000, and next year the figure aimed at is 20,000.

Jordan's New Plant Rushed

The new Jordan factory is at present producing six to seven cars a day and by Oct. 1 will be at its schedule of ten cars per day. The first car was turned out Aug. 14, and on Sept. 1, just two weeks later, the schedule was three cars per day. The factory is a new structure, 30,000 sq. ft. floor space. Ground was broken on April 5, and the factory occupied May 25. Between ninety and 100 men are working there at present. Sixteen chassis are going through assembly at the same time. The company has a good stock of materials on hand, upward of one hundred frames, and other materials in like proportion being on hand. The bodies are finished in two standard colors, maroon and green. The bodies are received at the factory minus the finishing coat, and two special body painters from the body company give them these final touches. Seventy-five per cent of the cars are shipped with wire wheels. The company plans to build 2000 cars and reports all but 129 of these already contracted for. At present there are thirty to thirty-five dealers.

Perfection's Committee Management

The Perfection Spring Co., one of the largest spring producers, has worked many changes in its factory organization and equipment during the past year. One of the most important of these is the introduction of the committee system's management in contrast with individual management of the different departments. There is an executive committee for the general management of which Christian Girl, president of the company, is a member ex-officio. Such departments as purchasing, sales, engineering, factory management, etc., etc., instead of being in the hands of an individual, are in the hands of committees. The system has been working for some months and is giving good satisfaction. Committee management, while new in the automobile field, is not new in the industrial world, and has been worked with satisfaction by many large organizations. There is a regular schedule of committee meetings, all taking place during office hours, and constituting a part of office work. Committees consist of three to five or more members according to the work.

One of the leading advantages of committee work is that broader consideration is frequently given to many factory matters. For example, in the purchasing department it might be possible for an individual purchasing agent to favor one firm over another, due to old friendships,

or other reasons, but such favoritism is scarcely possible under the committee system. The committee work has been carried to the extent of salary increases being handled by committee rather than by an individual.

The Perfection plant employs 1800 men who work in three shifts of 600 men to a shift. The plant has been working on a day and night schedule since July, 1914, and has been working on the three shifts of 8 hr. each since July, 1915. The factory output approximates 6500 springs per day and upwards of 125 tons of steel are consumed. During the past year the factory has developed. One building is a steel warehouse and the other a two-story structure 88 by 67 for factory welfare, hospital, and other uses.

Unit System of Spring Making

In its factory the Perfection Spring Co. has made many changes. One of the most important is the unit system of spring manufacture. In this system the factory is divided into rectangular areas, each area constituting a unit in spring manufacture. The capacity of each unit is one finished spring every minute of the twenty-four hours of the day, or 1440 springs per unit per day. At present six of these units are operated. Each unit can take raw spring stock from the stock room and have it converted into a completed spring in the shipping room in 4 hours. By this unit system of manufacture it has been possible to apply the latest efficiency factory methods. Motion study has largely entered into the work and three improvements have been incorporated into each unit. These improvements are all for conveyor systems of doing work faster. For example there are conveyor furnaces for heating the leaves of steel that go into the spring; there are conveyor ovens for annealing these leaves, and there are conveyor tables to hasten the assembly of the leaves together, forming the complete spring.

Strips Heated Slowly

In the conveyor furnaces the cold steel strips from which the leaves are formed are fed into the furnace at one side; they slowly travel through it, being heated as necessary, and come out at the other side red or white hot as necessary and ready to be bent or cambered into proper shape. If the grade of steel varies the speed of going through the furnace must also vary.

The conveyor annealing ovens operate on the same system.

The conveyor assembly table is a huge table along the sides of which are twenty-one men whose work it is to put the leaves together and add center bolts, clips, bushings for the eyes, etc. In addition to bringing parts together small milling operations such as bushing the sides of the eye are done. The leaves are also graphited.

Another feature added during the past year is a huge steel warehouse which is a separate building and into which all of the steel stock coming from the steel factories is placed. It is a huge building, 380 by 105, one story high, but measuring 42 ft. from the floor to the roof. From end to end, along either side of the central aisle, are central stacks of steel in flat bars ready to be cut into lengths for spring leaves. There is capacity for 80,000 tons of steel of this stock. Overhead is a huge traveling crane operating from end to end. This crane picks the steel stock direct from the railroad cars, which enter a bay in the side of the building. The stock is deposited where needed.

Along the center aisle are various electrically operated cutting machines which cut the steel stock into necessary lengths for springs. These cutting machines are on the central track and can be moved along to any point closest to the particular stock that has to be cut. The cut stock is then transported by electric trucks to the necessary parts of the factory.

Denneen Starts Delivery

One of the new Cleveland truck concerns is the Denneen Motor Co., an organization with $225,000 capital which is building two models of Denmo trucks. The factory occupied is a one-story building with 25,000 ft. of floor space and formerly used as railroad shops. The concern is just starting delivery on its 1¼-ton truck and is bringing out a new 1000-lb. vehicle. Manufacturing plans are to build 1000 of the former and 5000 of the latter. Present capacity is ten trucks per day. The company is under the management of F. S. Denneen, who for 5 years was connected with the engineering department of Chalmers, and later with the Ferro company of this city. Possession was obtained of the present factory 6 months ago, and the development of the present truck has been under way for the past 18 months. A feature of the trucks is that they are sold with complete electrical equipment, including starting and lighting. The storage battery is carried on a spring mounting to overcome truck vibration. The generator is driven at engine speed and is regulated to start battery charging at 5.5 m.p.h. and to be at its maximum charging rate of 12 to 14 amp. at 11 m.p.h.

Standard Welding Plant Doubled

The Standard Welding Co., manufacturer of all kinds of rims for automobile passenger cars and commercial vehicles, has practically doubled its factory during the past year, and has added about $250,000 worth of new machinery. Approximately 85 per cent of this plant has been operating night and day for the last 6 months, prior to which time 75 per cent of the plant was on night shift for several years. To-day 2500 men are employed, and the floor area of the factory is 11 acres. There is capacity for 15,000 rims for passenger cars per day. In addition there is capacity for 1500 bands for truck wheels and 1200 bases for truck wheels per day.

Large Output of Metal Tubing

The entire Standard Welding plant is not given over exclusively to the manufacture of rims, but there is a large production of metal tubing. The factory produces 3,500,000 to 4,000,000 ft. of tubing per month. The company has not experienced any shortage of material, and at present has over $1,000,000 worth of steel stock on hand. It ships fifteen to sixteen carloads of finished product per day, and has three railroad sidings for accommodations for fifty cars.

Next week other Cleveland concerns engaged in the manufacture of motor parts, etc., will be handled.

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Racing Engine for Ogren Has Integral Oil Leads

LOS ANGELES, CAL., Sept. 22—The Harry A. Miller Mfg. Co., this city, has completed a new racing engine for Hugo W. Ogren of the Ogren Motor Car Co., Chicago, Ill. This engine has recently developed 135 hp. on the block at 2900 r.p.m.

The engine has several unusual features. All oil leads are cast in a crankcase and cylinders, eliminating pipe lines, the water manifold also being cast integral with cylinder head and side plate. The valve action has a follow cam that makes the rocker arm follow the cam. Thus lighter inlet and exhaust springs are used on the valves, as they only have to close the valves and do not have to return the rocker arms. This arrangement enables the motor to attain a speed of 4500 r.p.m.

Four Ball Bearing Crankshaft

The engine has a bore of 3⅝ and stroke of 7 in., and a four ball bearing crankshaft, a double set of ball bearings being used on the flywheel end of the shaft. All valve mechanism is inclosed. Ignition is by two independent Bosch magnetos and a Miller carbureter is employed.

Mr. Ogren intends to place the engine in a chassis of his own design for speedway work.

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Thirty U. S. Ambulances for Salonica

PARIS, Sept. 22—The American Ambulance Corps has sent to Salonica an ambulance field section with thirty cars provided with full equipment and manned by veterans of the American ambulance service in France.

The Automobile

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Battery Care

A MAN looks after his health only after he is sufficiently acquainted with his physical make-up to know exactly what happens when he does not do so. When he is ignorant of what goes on in his body because of certain forms of neglect or abuse, he will generally change his mode of life. The same applies to the property of a man. It is one thing to say vaguely this or that is harmful without stating specifically what harm occurs. It is entirely different to say definitely that a certain kind of neglect will do a clearly defined damage.

The storage battery represents a considerable investment and forms a noteworthy part of the value of the car. Upon its good performance depends most of the comfort of the owner. It is therefore extremely desirable that the owner of the battery should know exactly what he is doing and what harm will result from definite kinds of neglect. He should be taught to know the symptoms of battery illness as he knows the symptoms of his own illness, or of the mechanical ailments of the car.

Concerns have spent hundreds of thousands of dollars merely on educating the public on the storage battery. These instructions have had their effect and the life of the average battery has been lengthened. Nothing is so valuable, however, in carrying the lesson home as to clearly show the exact nature of the damage caused by neglect.

Develop the Tractor

THE short series of articles on tractor engineering concluded in this issue have contained many severe criticisms of conventional practice in the tractor field, but these must not be regarded as destructive criticisms. There is no man of any engineering intelligence who does not know that the tractor of 1925 will be a far more efficient machine than the tractor of to-day. The rapidity of automobile development was due largely to the immense amount of criticism applied to the early machines, both by the public and by the engineers themselves.

The tractor will have no yearly model convention to maintain the pace of progress, so the tractor engineers will have to be even more introspective than their colleagues in the automobile world. The gas tractor is already a wonderfully efficient machine in terms of work done per dollar expended. When its mechanical efficiency is doubled, as it will be easily, its commercial efficiency will be enhanced enough to repay the huge amount of work that has to be done to attain the desired end.

Stop!

THERE is no chain without a weakest link, and there is no automobile without a portion less excellent than the remainder. This must always be so, for it is an attribute of all man-made things, but the weak link ought not too often to be at the same place.

A few years ago the weak spot in nine automobiles out of ten was the electric wiring and connections. It was recognized as a weakness and concentrated engineering work soon removed the troubles and made wiring one of the strongest links.

Now there is no question that the brakes are the weak link in very many cars, and it is equally certain that a little thought and the taking of a little trouble in altering designs would have just as powerful an effect as did similar treatment on the wiring problem. It is manifestly up to the engineering side of the industry to see that the work is done.

Automobile Securities

PERMANENCE and stability as characteristics of the automobile, motor truck and accessory industries are nowhere more strongly in evidence than in the confidence with which the general public invests in their securities. Even before the great bull movement of the past few weeks on the exchanges these stocks were more strongly in demand than those of any other industrial group. The bull activities in steel and copper have perhaps been more prominently featured in the newspapers, but even there the motors, as they are technically termed, are recognized as one of the most important factors in the financial world of the country to-day. The reason for this is that the securities of established automobile companies present substantial investment possibilities, as well as speculative attractiveness due to the phenomenal expansion of the industry.

Star Rubber Co. Is Reorganized

Capital Increased from $200,000 to $400,000—New Stock Is Preferred

AKRON, OHIO, Sept. 22—The Star Rubber Co., this city, has been completely reorganized and its capital stock increased from $200,000 to $400,000. L. H. Firey of Kansas City, a brother-in-law of F. A. Seiberling, president of the Goodyear Tire & Rubber Co., will become president and treasurer of the Star concern. Russell L. Robinson, vice-president of the Robinson Clay Products Co., is the new vice-president, and J. B. Huber, attorney, will serve as secretary temporarily. These officers succeed C. Mulcahy, president; J. W. Miller, vice-president, and W. E. Wright, secretary and treasurer. Fred Gostlin succeeds E. M. Cauldwell, former manager, as superintendent.

The company's original capitalization was all common stock; the new issue of $200,000 is all preferred. It is understood that the old stockholders surrendered their common for equal amounts of the preferred, giving the new management control of the common stock.

The company intends to expand its facilities immediately, starting production with 200 tires a day.

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Kentucky Wagon Promotes Executives

LOUISVILLE, KY., Sept. 23—W. I. Shaw, who has been sales manager of the Kentucky Wagon Mfg. Co., and the Dixie Motor Car Co., this city, has been made general sales manager of these companies. Stephen K. Miller, who has been assistant sales manager is promoted to sales manager of the wagon department Frank H. Holman has been appointed sales manager of the gasoline truck department and A. B. Challinor will become sales manager of the passenger car department. These promotions and additions have been made necessary by the increase in the company's business. The number of employees is one and a half times the number a year ago.

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Gemco to Market Products Direct

MILWAUKEE, WIS., Sept. 23—The Gemco Mfg. Co., which heretofore has marketed its products through manufacturers' representatives, hereafter will market direct. Following are the names of those who will represent them in the various centers: Martin E. Dewey, Jr., formerly with the United Engine & Mfg. Co., Hanover, Pa., will look after the trade of New England, Eastern Canada, New York, Pennsylvania and Atlantic Coast, including Florida. Headquarters will be opened in New York. John Craig, formerly of the Benford Mfg. Co., Mt. Vernon, N. Y., will have all of the West, Central West and Southwest to the Rocky Mountains; he will also make the Canadian Northwest. F. W. Jonas will make his headquarters in Los Angeles and cover the territory East to and including El Paso. C. N. Jonas, with headquarters in San Francisco, will look after the Central Pacific section and Rocky Mountain States, including Colorado. R. D. Jonas, with headquarters in Seattle, will cover Washington, Oregon and Vancouver, B. C.

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5,000,000 Cars in 1919 Is Briscoe's Prediction

JACKSON, MICH., Sept. 22—In a booklet bearing the title "Looking Forward in the Automobile Industry," president Benjamin Briscoe, of the Briscoe Motor Corp. analyzes interestingly the past, present and future of the industry, predicting that by July 1, 1919, there will be 5,000,000 automobiles in use in the United States. Estimating that there are at the present time 2,500,000 cars in use throughout the country and that after deduction of the 1911-made cars which will go out of commission sometime in the course of the present year there will be added to the number now in use about 900,000. Mr. Briscoe thinks that with the start of 1917 there will be 3,300,000 automobiles in operation.

"For the year 1917," writes Mr. Briscoe, "we would deduct the 1912 production of 400,000 and add 1,100,000 which probably will be the production for 1917—production still being influenced by shortage of material and labor—giving us a total at the end of 1917 of 4,000,000 cars in use. At the end of 1918 deduct the production of 1913 of approximately 500,000 and add 1,500,000, making a net increase of 1,000,000 automobiles in use. Estimating these figures as being approximately correct—and they may vary up 500,000 or down 250,000—there will then be operating in the United States a total number of about 5,000,000 automobiles."

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Toledo-Findlay Tire Directors Elected

FINDLAY, OHIO, Sept. 23—The stockholders of the Toledo-Findlay Tire & Rubber Co., met here recently and elected a new board of directors, as follows: V. T. Spitler, C. I. Moffitt, Frank MacMannes, Charles Rieck, H. O. Fellers and A. O. Hamilton.

The directors abolished the Toledo office and also passed a resolution requesting each member to subscribe for one share of stock. There are 1400 stockholders.

Gramm-Bernstein Co. To Expand

Name Changed to Gramm-Bernstein Motor Truck Co.—Capital $4,000,000

LIMA, OHIO, Sept. 23—The Gramm-Bernstein Co., this city, has been reorganized, its capital stock increased to $4,000,000 and the new company has been incorporated under the name of the Gramm-Bernstein Motor Truck Co. Officers of the new company are: M. Bernstein, president and treasurer; B. A. Gramm, vice-president and general manager; H. O. Bentley, secretary and legal advisor; and R. H. Spear, director of sales. The board of directors consists of Messrs. Bernstein, Gramm and Bentley and two New York bankers whose names will be announced later.

The $4,000,000 stock of the new company is made up of $3,000,000 in common and $1,000,000 in preferred, the par value of all shares being $10. The subscription will be handled by Walston H. Brown & Bro., New York City.

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Maxwell Ships 550 in Day

DETROIT, MICH., Sept. 23—The Maxwell Motor Co. made a new high record last week when it shipped over 550 cars in one day. This is at the rate of over 160,000 cars per year, although the daily average is at the rate of 120,000 cars annually. The working capital of the Maxwell company is now more than double the plant valuation as given in the report for the year ending July 31.

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Bradt Is A. B. C. Sales Manager

DETROIT, MICH., Sept. 23—W. J. Bradt, formerly with the Herring Motor Co., Des Moines, Iowa, has been appointed sales manager of the A. B. C. Starter Co., this city.

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Donahue Is Ross Asst. Sales Mgr.

DETROIT, MICH., Sept. 25—The Ross Automobile Co., has appointed R. W. Donahue assistant sales manager. Mr. Donahue was formerly connected with the E-M-F company, the Oakland Motor Car Co., and more recently with the Liberty Motor Car Co. C. LeRoy Coe, certified public accountant, also has joined the Ross company as its auditor and office manager.

—

Apperson Denies Sales Rumors

INDIANAPOLIS, IND., Sept. 25—Representatives of Apperson Bros., Kokomo, Ind., last week denied rumors to the effect that the company is to be sold to a syndicate.

Kellogg Adds to Factory

Pump Maker Lets Contract for Three-Story Addition—To Enlarge Offices

ROCHESTER, N. Y., Sept. 25—The Kellogg Mfg. Company, this city, maker of Kellogg engine-driven tire pumps, has let contracts for a new three-story building, 100 by 50 ft. The plans also provide for a new heating and power plant, more office room and new offices on the top floor of one of the present buildings. The company's business exceeds that of any previous year by 50 per cent, and contracts with manufacturers now call for more pumps than the company ever produced in one year.

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Massnick Mfg. Co. Is New Name

DETROIT, MICH., Sept. 25—The Massnick-Phipps Mfg. Co., which makes automobile motors, has changed its name to that of Massnick Mfg. Co.

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$2 Wheel Tax in Cleveland

CLEVELAND, OHIO, Sept. 23—A wheel tax of $2 a year for all vehicles using Cleveland streets was approved by the City Council Committee on Streets yesterday. An amendment to the traffic rules prohibiting the use of iron tires on motor trucks and requiring rubber tires to be at least ¼ in. thick at the wheel flange was approved.

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Fostoria Light Car Petitions

TOLEDO, OHIO, Sept. 23—The Fostoria Light Car Co. has filed a voluntary petition in bankruptcy. Liabilities are given as $223,387.42 and assets, consisting of real estate, machinery and materials, at $398,768.44.

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Campbell Mfg. & Foundry Co. Formed

MUSKEGON, MICH., Sept. 21—The Campbell Mfg. & Foundry Co. has been incorporated, its capital stock being $100,000. The principal stockholders are: H. D. Campbell, J. D. A. Johnson, J. C. Nolen, R. W. Smith, E. G. Filer. The concern has several contracts for forgings and castings for Detroit automobile manufacturers.

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Studebaker to Enlarge Forge Shop in Detroit 35 per Cent

DETROIT, MICH., Sept. 22—On the announcement last week of the additions to the plants of the Studebaker Corp. to cost $1,500,000, these to be made both here and at the South Bend, Ind., factories, specific information as to just what the Detroit appropriation would be used for was not available.

It is now definitely stated by officials of the big corporation that an increase of 35 per cent in the forge shop capacity here is to be made, as a result of contracts which have just been let for a battery of nine steam hammers, together with all necessary trimming presses, forging and heat-treating furnaces, representing an investment of $150,000. All of this equipment must be installed and in operation by Jan. 1, 1917, according to the contracts.

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Liberty Appoints Representatives

DETROIT, MICH., Sept. 23—The Liberty Motor Car Co., this city, has appointed R. J. Laciar, Edward Coyle and D. C. Reeves direct sales representatives in the North Atlantic, Central West and Southwest States, respectively. W. J. Davidson, formerly associated with the Cadillac Motor Car Co., this city, has joined the factory sales force of the Liberty concern.

The total value of sales of the new Liberty six, produced by the Liberty Motor Car Co., have passed the $5,000,000 mark. The sales department now is well organized, distributors having been established in most of the principal trade centers.

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Haynes to Extend Office

KOKOMO, IND., Sept. 25—The Haynes Automobile Co. will build an extension to its present office building 100 by 116 ft. Two lots were purchased last week to make the extension possible. Work will be started at once.

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Keystone Tire Plant for Pittsburgh

PITTSBURGH, PA., Sept. 23—The Keystone Rubber & Tire Co., Inc., has been formed here to manufacture automobile and motor truck tires. A plant has been secured at Penn Station on the main lines of the Pennsylvania railroad and will be ready for operation within 90 days. The building is a three-story steel and brick structure, 60 by 190 ft., with power house. It will be operated in three 8-hr. shifts, employing about 600 men at full capacity.

Officers of the company are: G. C. Goelitz, president; M. R. Haymaker, vice-president; and R. S. Robb, treasurer. Among the directors are: Cornelius C. Scully of the law firm of Mehard, Scully & Mehard; John D. Graham, recorder of Alleghenw County; Max J. Spann, of the law firm of Dunn & Moorehead and John A. Sharpe, real estate.

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Silvex Offices to South Bethlehem

NEW YORK CITY, Sept. 23—The Silvex Co. has removed its general offices from 171 Madison Avenue, New York, to South Bethlehem, Pa.

H. & N. Plant in L. I. City

Carbureter Manufacturer Buys New Factory—Will Enlarge N. Y. Service Station

NEW YORK CITY, Sept. 23—The H. & N. Carbureter Co. has purchased a new and completely equipped plant at 138 West Avenue, Long Island City, close to the Queensboro Bridge. The company will maintain and enlarge its service station at 38 West Sixty-second Street, but the main office and retail sales department will remove from 1790 to 1675 Broadway, Oct. 1. The company has branches in Boston, Philadelphia, Los Angeles and Detroit, besides agencies and service stations in the larger cities of the country.

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Fraud Order Against Piqua Tire

PIQUA, OHIO, Sept. 23—Postmaster General Burleson issued a fraud order against the Piqua Tire & Rubber Co. and M. B. Miller, sales manager, at Piqua, Ohio. The report of the inspector, which was made public with the promulgation of the fraud order, says that Miller advertised in papers, especially those that reach rural communities, that he had automobile tires for sale that were absolutely punctureproof and guaranteed for 6500 miles; that the tires were twice as thick as ordinary makes, and that he would sell them at prices ranging from 10 to 20 per cent less than the cost of standard tires.

The inspector reported that between May 1 and Aug. 19, 1916, the postoffice at Piqua cashed seventy-eight money orders for Miller, which amounted to $1,617.53, and that in none of the cases did he place any orders for tires with the manufacturers.

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League Agent Pleads Guilty

INDIANAPOLIS, IND., Sept. 23—Harry Van Auken, said to be vice-president of the International Automobile League, of Buffalo, who has been in jail at Uniontown, Pa., since March 8, has entered a plea of guilty and been paroled for 2 years. He was accused by Fayette County officials of conspiring to defraud. The National Vigilance Committee will not prosecute A. C. Bidwell, president of the league, in Uniontown, inasmuch as Bidwell has been forced to pay back all the money taken from Fayette County people, and has paid the expense to which the county and individuals have been put in prosecuting him and his agents. Bidwell, however, will be brought before the federal courts of New York and criminally tried in the near future.

Sparks - Withington Dividend

Directors Declare Initial Payment of 2% on Common and 1¾% on Preferred

JACKSON, MICH., Sept. 22—The Sparks-Withington Co., has declared a dividend of 2 per cent on the common stock. This is for a 6 months' period and places the stock on a 4 per cent annual basis. The dividend is payable Oct. 1, to holders of record Sept. 23.

The regular quarterly dividend on preferred has been declared payable at the same time and to the same record. A quarterly dividend of 1¾ per cent has also been declared on the preferred payable Jan. 1 to holders of record Dec. 15.

There is outstanding $265,000 preferred stock and 768,500 common. The common sold last on the Cleveland exchange at 75. The company was formed in May this year as a consolidation and this is the intial Sparks-Withington common dividend.

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Wright-Martin Capital $5,000,000

NEW YORK CITY, Sept. 25—Capital of the Wright-Martin Aircraft Corp., comprising the Wright Aeroplane Co., the Glenn H. Martin Aeroplane Co., and the Simplex Automobile Co., will consist of $5,000,000 of preferred stock par $100 and 500,000 shares of common stock without par value. Old stockholders of the Wright Aeroplane Co. can subscribe pro rata to the preferred stock of the new corporation, receiving in addition to each share of preferred bought two shares of the common stock. This privilege expires Oct. 3. It is expected that a public offering of the new stocks will be made shortly.

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Harroun Treasurer's Office in N. Y.

NEW YORK CITY, Sept. 26—The Harroun Motors Corp. will maintain the treasurer's office in this city. George G. Worthley, former president and treasurer of the Fairbanks Co., having been elected treasurer. F. A. Vollbrecht, former secretary and treasurer of the King Motor Car Co., will handle the factory finances at Detroit.

The Harroun car, which will sell at $595, will have a 3¼ by 5¼-in. four-cylinder block engine, developing 35 hp. at 2800 r.p.m. Valves are carried in a detachable cylinder head, ignition is by Bosch high-tension magneto and the car is designed to make 30 miles per gallon of gasoline. Wheelbase is 107 in. and the tonneau is 40 in. long, the rear seat being 48 in. wide. Tires are 30 by 3½.

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Dividends Declared

Yale & Towne Mfg. Co. quarterly of 1¾ per cent payable Oct. 2 to stock of record Sept. 26. Also extra dividend of 5 per cent payable Oct. 2 to stock of record Sept. 26.

C. M. Hall Lamp Co., 2 per cent payable to stock of record Sept. 20.

W. K. Prudden Co., 2½ per cent payable Oct. 10 to stock of record Oct. 1.

Stock Prices Soar, Then React

Share in General Upward Movement of Market and Close High

NEW YORK CITY, Sept. 26—The automobile securities have participated in the general upward movement which has characterized the activities of the New York and Detroit stock exchanges during the past week. Many of them have also been affected by the reactions at the beginning of this week, but, on the whole, the tone is considerably stronger than before. Firestone, common, gained 35 points its bid price now being 1050 with the asked at 1080. Goodyear common gained 22, bringing its bid price to 270. General Motors advanced 20 points to a bid of 700 . Saxon was strong, increasing its bid price from 75 to 82. All the Maxwell stocks registered a gain, the common of 4½ points, the first preferred 1⅞ and the second preferred 3 points. Other gains worth mentioning are: Paige-Detroit 2 points; Regal preferred 1 point; Fisk common 3 points; and Reo Motor Car 1 point. United Motors also gained 1¼.

The largest decline was in Packard common, which closed yesterday 14 points below its bid of last Tuesday. Chalmers common lost 13 points and Swinehart Tire 9.

Holders of Willys-Overland common and preferred cannot exercise their rights to subscribe for the new common

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co.	..	..	64½	65½	—1
J. I. Case T. M. Co. pfd.	79	84	82	84½	+ ¼
Chalmers Motor Co. com.	116	120	145	155	—13
Chalmers Motor Co. pfd.	96	101	96	99	—1
*Chandler Motor Car Co.	..	..	105	106	..
Chevrolet Motor Co.	..	..	204	208	—4
Fisher Body Corp.	..	..	40½	42	+ ¼
Fisk Rubber Co. com.	..	..	100	110	+3
Fisk Rubber Co. 1st pfd.	..	..	110	120	..
Fiak Rubber Co. 2d pfd.	..	..	100	110	—1
Firestone Tire & Rubber Co. com.	540	..	1050	1080	+35
Firestone Tire & Rubber Co. pfd.	111	..	110	112	..
*General Motors Co. com.	344	345½	700	725	+20
*General Motors Co. pfd.	113	115	124	126	—2¼
*B. F. Goodrich Co. com.	69	71	72¼	72½	+ ⅛
*B. F. Goodrich Co. pfd.	108	109	112	114	—1½
Goodyear Tire & Rubber Co. com.	310	..	270	290	+22
Goodyear Tire & Rubber Co. pfd.	109	..	106½	108½	—1½
Grant Motor Car Corp.	..	..	8	10	+1
Hupp Motor Car Corp. com.	..	..	6	6¼	— ¼
Hupp Motor Car Corp. pfd.	..	..	80	100	..
International Motor Co. com.	29	31	5	9	—1
International Motor Co. pfd.	58	62	15	22	..
*Kelly-Springfield Tire Co. com.	230	235	83	83½	+ ⅛
*Kelly-Springfield Tire Co. 1st pfd.	90	92	98	100	..
*Lee Rubber & Tire Corp.	..	..	45¾	46½	— ¼
*Maxwell Motor Co. com.	52	53¼	96	96½	+4½
*Maxwell Motor Co. 1st pfd.	92	94	87½	88	+1⅞
*Maxwell Motor Co., 2nd pfd.	44	46	58	58½	+3
Miller Rubber Co. com.	190	195	250	275	..
Miller Rubber Co. pfd.	107	109	104	106	..
Packard Motor Car Co. com.	120	..	150	175	—14
Packard Motor Car Co. pfd.	100	..	95	105	—2
Paige-Detroit Motor Car Co.	..	..	32	34	+2
Peerless Truck & Motor Corp.	..	..	26	26½	..
Portage Rubber Co. com.	55	58½	160	170	..
Portage Rubber Co. pfd.	93	94	160	170	..
Regal Motor Car Co. pfd.	..	..	18	22	+1
Reo Motor Truck Co.	16½	†17½	43½	45½	..
Reo Motor Car Co.	32¾	†..	44½	46½	+1
Saxon Motor Car Corp.	..	..	82	83	+7
Springfield Body Corp. com.	..	..	82	88	—2
Springfield Body Corp. pfd.	..	..	120	130	..
Standard Motor Construction Co.	..	..	6½	7	+ ½
Stewart Warner Speed. Corp. com.	74	76	112½	113	— ½
Stewart Warner Speed. Corp. pfd.	106	..	..	..	..
*Studebaker Corp. com.	139	140	130½	131	+ ⅜
*Studebaker Corp. pfd.	107	108½	107⅜	109	—1⅜
Swinehart Tire & Rubber Co.	86	90	90	96	—9
United Motors Corp.	..	..	67¼	67¾	+1¼
*U. S. Rubber Co. com.	52	53½	59	59¼	— ½
*U. S. Rubber Co. pfd.	106	107½	113	114	—1
Wbite Motor Co.	110	..	54¼	54¾	— ¾
*Willys-Overland Co. com.	213	214½	45⅞	46	—1½
*Willys-Overland Co. pfd.	107	109	102¾	104	—1½

*At close Sept. 25, 1916. Listed N. Y. Stock Exchange. †Ex-dividend.
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co.	..	..	39	41½	..
Chalmers Motor Co. com.	..	121	..	158	..
Chalmers Motor Co. pfd.	97½	102½	..	102	..
Continental Motor Co. com.	280	..	38¾	39	+ ⅛
Continental Motor Co. pfd.	85	90	9½	10½	..
Ford Motor Co. of Canada	1500	..	320	335	..
General Motors Co. com.	340	350	..	725	..
General Motors Co. pfd.	112½	115	124	128	—2
Maxwell Motor Co. com.	53	59	91	94	+3½
Maxwell Motor Co. 1st pfd.	91½	94½	86	88½	..
Maxwell Motor Co. 2d pfd.	45	47	56	59	+3
Maxwell Motor Car Co. com.	123	130	168	..	+5
Packard Motor Car Co. pfd.	100	..	..	101	..
Paige-Detroit Motor Car Co.	..	450	32¾	34	+1¾
W. K. Prudden Co.	20½	22	50	52	+4½
Reo Motor Car Co.	32⅜	34⅜	44½	45¼	+ ¾
Reo Motor Truck Co.	16⅜	17⅜	44	45	+1½
Studebaker Corp. com.	137	142	130	132½	+1½
Studebaker Corp. pfd.	106	110	107	..	+2
C. M. Hall Lamp Co.	..	..	26½	30	+1

INACTIVE STOCKS

Atlas Drop Forge Co.	..	31	..	33	..
Kelsey Wheel Co.	205	..	55	60	..
Regal Motor Car Co. pfd.	..	21	18	..	..

stock at $44 a share after the close of business Sept. 28.

The syndicate formed by Allen A. Ryan & Co. to underwrite the Stromberg Carbureter Co. stock has been dissolved and checks mailed to participants, who, it is said, realized profits of about 20 per cent.

On the Detroit exchange Packard common gained 5 points, Prudden 4½ and Maxwell common 3½, while Maxwell second preferred advanced 3 points. Other changes are shown in the tabulation on page 548.

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Texas Co. Offers New Stock

HOUSTON, TEX., Sept. 22—The Texas Co. directors will ask the stockholders, meeting Nov. 14, to ratify an increase of 25 per cent in the capital, the new stock being offered to old stockholders at par. The increase will make the total capital $55,500,000, the proposed addition being $11,500,000.

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Materials Market Steady

NEW YORK CITY, Sept. 27—Comparatively few changes took place in the prices of materials used by automobiles, motor truck and accessory manufacturers during the past week. Tin advanced 25 cents per 100 lb. and cottonseed oil went to $10.50 per bbl., an increase of 22 cents. Other changes were: An advance in the price of linseed oil of 3½c., another of ½c. per bbl. in both electrolytic and Lake copper, and decreases of ½c. in antimony and 1½c. in first latex Ceylon rubber.

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Takes 500 Bour-Davis Cars

DETROIT, MICH., Sept. 25—A contract for 500 Bour-Davis cars for 1917 delivery has been placed by Morton W. Smith of New York, with C. F. Stewart, vice-president and general sales manager of the Bour-Davis company. A large number of additional cars will be taken by Mr. Smith as the company's production increases, and all told the deal involves about $500,000. At the present time Mr. Smith has sales quarters on Fifty-second near Broadway, but contemplates the erection in the automobile district of a ten-story building, to be devoted exclusively to Bour-Davis service and sales.

The Bour-Davis company is now located in its new plant at West Fort and Twenty-third Streets, Detroit, where it occupies a four-story building, 100 by 130 ft. The offices of the company front the second floor, while the remainder of this floor will be used for final testing. The third floor is used for assembling, the fourth for painting and finishing, while the first floor has the stock rooms, wash racks, and stands. The plant has a capacity for thirty cars per day.

Kelsey Wheel to Expand

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Two Additions, Each 140 by 600 Ft., Will Provide 50% More Space

DETROIT, MICH., Sept. 25—Two additions, both 140 by 600 ft. to the plant of the Kelsey Wheel Co. will be started in a few days and when completed they will provide at least 50 per cent more manufacturing room. The working force, which now totals about 2000 men will be increased to start with by 500 to 600 men and eventually by 1000.

"Our business has never been better," said an official of the Kelsey company to-day. "The general outlook for the automobile business is exceedingly good, and the general increase during the present year is only a forerunner of a much bigger business in 1917."

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Changes in Capital

LANSING, MICH., Sept. 27—The Atlas Drop Forge Co., this city, has increased its capital from $200,000 to $500,000.

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Indiana Truck Capital $100,000

MARION, IND., Sept. 23—The Indiana Truck Co., this city, has increased capitalization from $50,000 to $100,000.

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Akron Rubber Mold Increases Capital

AKRON, OHIO, Sept. 23—The Akron Rubber Mold and Machine Co., has increased its capital from $60,000 to $300,000.

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American Motors Plant Completed

PLAINFIELD, N. J., Sept. 24—The American Motors Corp., of which Louis Chevrolet is vice-president and chief engineer, has completed its factory. The plant has a capacity of 10,000 cars annually. It has finally decided that the car to be produced will be a five-passenger, six-cylinder model, with 122 in. wheelbase at $1,100. Marcus I. Brock, formerly with the Autocar Co. and with the E. R. Thomas Motor Car Co., has been appointed director of sales. John C. Speirs, formerly with the Autocar Co., the Locomobile Co., Mercer, S. G. V. and Standard Roller Bearings Co., has been made general manager in charge of production.

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Darling Motor Co. Incorporated

WILMINGTON, DEL., Sept. 23—The Darling Motor Co. has been incorporated here to manufacture automobiles, the capital stock of the company being $300,000. Incorporators are: George W. Dillman; M. M. Dugan, J. D. Frock, all of Wilmington.

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Dayton Steel Wheel Co. Incorporated

DAYTON, OHIO, Sept. 23—The Dayton Steel Wheel Co. has been formed here with $50,000 capital to manufacture automobile wheels. Incorporators are: George Walther, Jacob Walther, Katie Walther, W. A. Pierce and G. E. Nocholas.

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Holihan Capital Now $100,000

DETROIT, MICH., Sept. 25—The Holihan Mfg. Co., which makes radiators and other automobile parts, has increased its capital stock from $80,000 to $100,000.

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Four Drive Capital $200,000

BIG RAPIDS, MICH., Sept. 20—At a meeting of the stockholders of the Four Drive Tractor Co., it was voted to increase the capital stock of the company from $50,000 to $200,000. The stock will be offered to the present stockholders during a period of 10 days at the par value of $10 per share.

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Two Perfection Heater Contracts

CLEVELAND, OHIO, Sept. 23—The Perfection Spring Service Co., this city, has closed contracts for putting its Perfection heater to the Owen-Magnetic closed cars and to the six- and twelve-cylinder Springfield type bodies on the Haynes.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.61	.61	.61	.61	.61	.61	...
Antimony, lb.	.11¼	.11¼	.11½	.11½	.11½	.11	— .00½
Beams & Channels, 100 lb.	2.76	2.76	2.76	2.76	2.76	2.76	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28	.28	.28	.28	.28	.28½	+ .00½
Copper, Lake, lb.	.28	.28	.28	.28	.28	.28½	+ .00½
Cottonseed Oil, bbl.	10.45	10.45	10.40	10.45	10.45	10.50	+ .22
Fish Oil, Menhaden, Brown, gal.	.58	.58	.58	.58	.58	.58	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.08	1.08	1.08	1.08	1.08	1.08	...
Lead, 100 lb.	7.05	7.05	7.00	7.00	7.00	7.00	...
Linseed Oil, gal.	.70	.70	.70	.70	.73	.73	+ .03½
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.30	2.30	2.30	2.30	2.30	2.30	...
Rapeseed Oil, refined, gal.	.90	.90	.90	.90	.90	.90	...
Rubber, Fine Up-River Para, lb.	.73	.73	.73	.72	.72	.72	...
Rubber, Ceylon, First Latex, lb.	.62½	.62½	.61½	.60	.60	.60	— .01½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	38.62½	38.62½	38.62½	38.50	38.50	38.75	+ .25
Tire Scrap, lb.	...	.05¾	.05¾	.05¾	.05¾	.05¾	...

36 Entries for Astor Cup Race

Leading Drivers and Fastest Cars to Start in 250-Mile Sheepshead Classic

NEW YORK CITY, Sept. 27—Some very high speeds have been made in practice for the 250-mile Astor Cup Race to be held on the Sheepshead Bay Motor Speedway next Saturday. Louis Chevrolet seems to have his Sunbeam in good shape, as he is credited with two circuits at an average of 114 m.p.h., tying with Christiaens' Sunbeam, which did an equal speed over the four miles. Resta has covered a lap at 109 m.p.h. and Pullen on the Mercer has done five laps at a speed of 104 m.p.h. If the weather is cool and free from wind there is every reason to expect that the record for 250 miles will be lowered Saturday.

Elimination Trials Thursday

When entries closed Monday, thirty-six entries had been received. Since the number of cars which can start in the race is limited to thirty-two, elimination trials will be held on Thursday, Sept. 28 to decide which cars shall participate in the classic. The complete list of entries follows:

Car	Driver	Car	Driver
Crawford	Merz	Maxwell	Rickenb'cher
Crawford	Klein	Premier	Unnamed
Crawford	Chandler	Peugeot	Aitken
Delage	Lecain	Maxwell	Henderson
Delage	Devigne	Premier	Lewis
Dans L'Argent	Muller	Peugeot	Wilcox
Duesenberg	Devlin	Olsen	Watson
Peugeot	Resta	Olsen	McBride
Hudson	Vail	Pugh Sp.	Meyer
Adams Sp.	Adams	Hoskins	Hughes
Sunbeam	Christiaens	Erwin Sp.	Bergdoll
Sunbeam	Chevrolet	Mercedes or Peugeot	DePalma
Duesenberg	Milton	Erbes	Gable
Dusenberg	D'Alene	Omar	Toft
Mercer	Pullen	W. Duluth Sp.	Raw'gs
Mercer	Ruckstall	Ogren	Henning
Duesenberg	Buzane	Ogren	Burt
Kleinart	Unnamed		
K W P Sp.	Packard		

Pittsburgh Speedway Buys Land

PITTSBURGH, PA., Sept. 23—The Pittsburgh Speedway Assn. has closed a deal for 600 acres of land and work on the speedway to be constructed here at a cost of $1,000,000 will begin shortly.

The speedway, which will consist of a 2-mile track for automobile and motorcycle racing inside of which will be a track for horse racing, which will be located a short distance southeast of the city.

A. A. A. Contest Board in Session

FRANKLIN, PA., Sept. 23—Richard Kennerdell, chairman of the Contest Board of the American Automobile Assn., entertained the members of the board at his home in this city during the past 3 days. In addition to board meetings, much time was spent at the Wanango Country Club, where golf was the order of the day. Among the board members present were Messrs. Folwell, Ireland, Croselmire, Sinsabaugh, Beecroft and Barnes. John Wetmore and Claire Briggs of New York were among the guests. The board decided to continue the schedule of championship speedway events for next year and, if possible, to increase the number. It is possible that such large speedways as New York, Chicago, Indianapolis, and Cincinnati may have two championship dates and the other speedways one. It is possible that the method of championship awards may be altered in several respects.

Ask New Receiver for Twin City Motor Speedway Assn.

MINNEAPOLIS, MINN., Sept. 27—Attorney D. F. Simpson of Minneapolis, representing bondholders, has asked the district court for a new receiver for the Twin City Motor Speedway Assn. on the ground that the present receiver named by the Ramsey county district court is unable to protect the property properly for lack of funds. The receiver, P. W. Herzog, is believed to oppose foreclosure of the mortgage held by the bondholders and is said to have canceled $100,000 fire insurance because there is no money to pay premiums.

Safety First Federation Appoints Bureau of Standards on Devices

NEW YORK CITY, Sept. 24—The Safety First Federation of America has appointed a bureau of standards, which will investigate the merits of various safety articles or devices submitttd to it. The committees' recommendations will be submitted to the directors for approval and such devices as come up to the standards of the federation will be officially endorsed. Darwin P. Kingsley, president New York Life Insurance Co., is chairman of the bureau and associated with him are Ernest P. Goodrich, E. E. Rittenhouse, Charles Bernheimer, William Guerin, George H. Robertson, Joseph Tracy and William Bondy. Wayne D. Heytecker has been appointed executive secretary of the association, succeeding Frederick H. Elliott, who has resigned.

N. Y. Electric Sociability Run Oct. 4

NEW YORK CITY, Sept. 23—The fourth semi-annual sociability run for electric car owners will be held Wednesday afternoon, Oct. 4, under the auspices of the Electric Vehicle Assn. The run will be from the Electric Garage, Central Park West and Sixty-second Street to Longue Vue Inn, Hastings-on-Hudson, 18 miles, the start being made at 1.45 p. m. The participants will be the guests of the association at tea. Entry cards may be secured from the Electric Garage.

Must Refund Fines in Wisconsin

County Highway Commissioner Cannot Appoint Policemen To Patrol Roads

MILWAUKEE, WIS., Sept. 23—County highway commissioners in Wisconsin have no police power, nor have they authority to appoint policemen to patrol newly improved or any other highways, according to the opinion of the attorney general. Scores of motorists arrested in Brown county in recent months on charges of exceeding the speed limit will receive a refund of fines under the opinion. It appears that Brown county constructed a fine concrete pavement. The county highway commissioner then appointed a motorcycle policeman who used his authority to the utmost. One motorist looked up the law and resisted arrest, and his contention now is upheld by the attorney general.

The State convention of Wisconsin police chiefs, in session at Milwaukee, decided to go before the State Legislature at its next session, beginning in January, 1917, and ask for the passage of a uniform automobile code to apply to all communities and cover all angles. Although there now is a code on the statute books, passed in 1913 and amended in 1915, it has become antiquated because of the rapid development of new conditions affecting the use of motor cars. The chiefs admitted that many unnecessary arrests are caused by conflict in traffic and speed regulations in various communities.

Bosch Closes Eleven Contracts

NEW YORK CITY, Sept. 23—The Bosch Magneto Co. has contracted with the following concerns for the use of Bosch magnetos during the coming season: American Motor Truck Co., Hartford, Conn.; W. H. Gabriel Carriage & Wagon Co., Cleveland, Ohio; Rowe Motor Mfg. Co., East Downingtown, Pa.; Sheffield Car Co., Three Rivers, Mich.; Tiffin Wagon Co., Tiffin, Ohio; Gramm-Bernstein Co., Lima, Ohio; Central American Cars Co., Guatemala, C. A.; H. E. Wilcox Motor Co., Minneapolis, Minn.; Fleetwood Chassis Co., Fleetwood, Pa.; Wolverine Automobile Co., Toledo, Ohio, and Woods Mobilette Mfg. Co., Harvey, Ill.

Hamilton, Ont., Gets Tire Co.

MONTREAL, QUE., Sept. 25—The Richam Mfg. Co. has been incorporated for $150,000 to deal in tires and accessories at Hamilton, Ont.

Pa. Rubber Lowers Prices

Announces Reduction of 10% Effective Oct. 1 on Tires and Tubes

JEANNETTE, PA., Sept. 26—The Pennsylvania Rubber Co., this city, has reduced the prices approximately 10 per cent on its Vacuum Cup, Ebony Tread and Bar Circle tires and Puregum and Paruco tubes effective Oct. 1. These reductions have been made possible, according to the company, by the increase in its volume of production.

The new and old prices on three popular sizes of casings, serving to give an idea of the scale of reduction, are as follows:

Size	Old Price	New Price
VACUUM CUP		
30 x 3	$14.20	$12.40
34 x 4	30.30	27.60
37 x 5	52.75	46.80
EBONY TREAD		
30 x 3	12.05	11.15
34 x 4	25.75	24.85
27 x 5	44.80	42.15
BAR CIRCLE		
30 x 3	10.35	9.70
34 x 4	22.50	21.15
37 x 5	37.05	34.85

Goodrich Adds to Agents

(*Continued from page* 512)

single dealer; still, he would not be given an exclusive territory, the company reserving the right to sell there if it should choose. In fact, one dealer might be placed next door to another.

One tire man states that while the Goodyear company 2 years ago ceased to sell at retail, many of its sales at its branches have been of single tires to small dealers and garagemen who maintain no stock and have no service facilities, they buying one tire at a time as needed.

It is interesting to note that the Goodyear movement is in the opposite direction from the Ford merchandising plan. Whereas Ford extended the number of dealers, Goodyear is decreasing the number.

Buckwalter Is Timken Bearing Engineer

CANTON, OHIO, Sept. 27—T. V. Buckwalter has been appointed chief engineer of the Timken Roller Bearing Co., this city, filling the vacancy caused by the recent resignation of C. E. Vanderbeek. Mr. Buckwalter was formerly connected with the electrical engineering department of the Pennsylvania Railroad at Altoona, Pa., and is the designer of the Buckwalter industrial electric truck.

Briscoe Holds Get-Together Banquet

JACKSON, MICH., Sept. 22—A few days ago the Briscoe Motor Corp. held its first get-together banquet, at which its foremen, sub-foremen, superintendents, department heads, and many other officials were present. The idea originated with H. S. Humphrey, vice-president in charge of manufacture, who explained the reason for the gathering as the need of teamwork to speed up production.

General Manager Frank Briscoe; A. B. Willemin, superintendent of purchases; Chief Inspector K. L. Hermann; K. C. Leverton, factory manager; Dr. DeLong and other officials also spoke.

Court Refuses Standard Roller Bearing Co. Receivers' Petition

PHILADELPHIA, PA., Sept. 27—*Special Telegram*—The United States court here to-day refused the petition of the committee and receivers for the organization of the Standard Roller Bearing Co. and for the transfer of the license which was granted by the Hess-Bright Corp., holder of the Conrad patents on ball bearings, which is about to expire. Judge Thompson's decision supports the opposition of the stockholders' protective committee that the legality and the interpretation of the contract are involved.

Bache, of Bound Brook Bearing, Dies

BOUND BROOK, N. J., Sept. 24—Leigh Stanley Bache, for the last 5 years first vice-president and general manager of the Bound Brook Oilless Bearing Co., died here Sept. 21. He was born Sept. 18, 1870. Mr. Bache had been continuously connected with the Bound Brook company since 1899.

1000 Cars in Highway Demonstration

CHICAGO, ILL., Sept. 26—Approximately 1000 cars took part in a tour of protest along Sheridan Road, the main highway between this city and Milwaukee, the object being to compel improvement of this route which is in a very bad condition. The tour was arranged by the Sheridan Road Improvement Assn. and was run in two parts, one headed by Gov. Dunne of Illinois.

Aitken Used Goodrich Silvertown Cords

NEW YORK CITY, Sept. 27—In the report of the recent Indianapolis race the tire equipment of the winning Peugeot, driven by John Aitken, should have been given as Goodrich Silvertown cords. The tabulation of equipment published in THE AUTOMOBILE gave the tires of this car as of another make.

More Capital for Kelly Truck

Special Stockholders' Meeting Oct. 10 To Increase Common To $2,000,000

SPRINGFIELD, OHIO, Sept. 27.—A special meeting of the stockholders of the Kelly-Springfield Motor Truck Co., this city, will be held Oct. 10 to increase the common stock of the company to $2,000,000. Preparatory to this step the company has decreased its capital from $2,500,000 to $1,914,000 in accordance with the requirement of the law of Ohio that a company cannot increase its stock unless all its original capital stock has been subscribed. The increase is to provide for the rapidly expanding business of the company.

The preferred stock of the Kelly-Springfield company is $1,014,000, the outstanding common since the reduction being $900,000. The common was originally $1,000,000.

A few days after the stockholders' meeting the directors of the company will meet to determine the amount, if any, of the new common stock to be issued.

$100,000,000 G. M. C. Corp.

(*Continued from page* 511)

New York, the plan of the readjustment was formally approved. The new company, which will be a Delaware corporation, will absorb the old, and will consist of 1,000,000 shares of the par value of $100. Of these, 200,000 will be 6 per cent cumulative non-voting preferred stock, redeemable on and after Sept. 1, 1918, at the option of the company, at $110, plus accrued dividends. The basis of exchange follows:

(a) For each share of present preferred stock, one and one-third shares of the new preferred stock.

(b) For each share of present common stock, five shares of the new common stock.

Stock to be exchanged may be deposited with the Guaranty Trust Co., New York on and after Oct. 18, and not later than Dec. 15, 1916.

The annual statement of the General Motors Co. is the most favorable that the company has ever made. The net profits are practically double what they were

GENERAL MOTORS SUBSIDIARY COMPANIES

Company	Stock Outstanding	Owned by General Motors
Buick Motor Co., preferred	$500,000	$500,000
Buick Motor Co., common	2,000,000	2,000,000
Cadillac Motor Car Co., common	1,500,000	1,500,000
Oakland Motor Car Co., common	800,000	800,000
Olds Motor Works, common	3,132,390	3,132,390
Northway M. Manufacturing, common	725,000	725,000
Champion Ignition Co., common	100,000	75,000
Jackson, Church, Wilcox, common	240,000	240,000
McLaughlin Motor Car Co., common	1,003,000	500,000
Weston-Mott Co., common	1,500,000	1,500,000
General Motors Truck, common	250,000	250,000

last year. Out of the surplus the company was able to pay off $2,328,000 notes; $1,048,964 preferred dividend; $10,730,150 common dividend; $3,726,752 for plant additions. This makes a total deduction of $17,833,875, and the cash was increased $7,950,451.

Under the head of Operating Expenses full charges have been deducted to cover all depreciation in inventory which at the close of the year were in a conservative basis of valuation. The increase of $11,051,051 in the value of inventories is due to increased volume of business. The company has no funded debt, the $2,328,000 first lien 6 per cent notes having been paid at maturity when the voting trust was dissolved Oct. 1, 1915.

The total indebtedness of the company and its subsidiaries consisted of $7,264,443, which was for current accounts payable, mostly for merchandise, and $2,690,832. Liabilities accrued but not due were payrolls, taxes, etc.

The company has at present in the hands of the public $14,985,200 in 7 per cent cumulative preferred stock and $16,511,783 in common stock. This represents an increase in the common stock of $5,000 during the year.

The gross sales of the company amounted to $156,900,296 as compared with $94,424,841 for 1915, a gain of $62,475,455. The number of cars sold was 132,088 as compared with 76,068 during the previous year, an increase of 56,020.

First Common Dividend 50 per Cent

The common stock paid its first cash dividend Oct. 15, 1915, when 50 per cent, or $50 per share, was paid to stockholders. Subsequently quarterly dividends of 5 per cent have been paid up to date. The rate of dividends follows:

	1909	1910-11	1912	1913-14	1915	1916
Preferred	7	7	7 7/12	7	7	7
Common	150*	..	....	..	50	20

*Paid in common stock.

The General Motors Co. was incorporated under New Jersey laws on Sept. 16, 1908, under a perpetual charter. The purpose given in the charter was to manufacture and deal in motors, automobiles and machines and to acquire from other businesses of the same general character. At the present time the General Motors Co. is composed of ten subsidiary companies, as shown in the tabulation on page 551.

Most of these subsidiary companies produce complete automobiles and the others produce the various units, such as motors, ignition specialties, steering gears, gearsets, rear axles, etc.

The estimated present capacity of the various General Motors car-producing subsidiaries is 139,000 cars per year. At the present time General Motors companies operate factories having an aggregate of 5,711,000 sq. ft.

W. C. Durant is president of the General Motors Co., the other officers being as follows: Vice-president, A. G. Bishop; secretary, Standish Backus; treasurer, James T. Shaw; and comptroller, W. H. Alford. Pierre S. DuPont is chairman of the board of directors, other directors being F. L. Belin, H. E. Bishop, W. P. Chrysler, R. H. Collins, W. L. Day, W. C. Durant, J. A. Haskell, L. G. Kaufman, W. C. Leland, J. H. McClement, C. S. Mott, J. J. Raskob, C. H. Savin, F. W. Warner, A. H. Wiggin.

Commerce Truck Expands

Increases Capital To $400,000—To Build 3000 of New 1-Ton Trucks

DETROIT, MICH., Sept. 27—The Commerce Motor Car Co. has increased its capital stock from $200,000 to $400,000. Of this, $100,000 is subscribed for by present stockholders. The company is bringing out a new 1-ton truck, of which 3000 are to be built during the fiscal year. The price is $1,175 for the chassis with seat. There will also be made 1800 ¾-ton trucks. An addition 250 by 60 ft. is being added to the plant.

Profit and Loss Account of G. M. C. and Subsidiaries

	1916	1915
Profit and loss at beginning of year	$19,985,159	$6,689,427
Add undivided profits per income account	27,740,596	13,408,439
Less		
Cash dividend on common stock		
October 15, 1915, 50 per cent	8,253,391	.....
February 15, 1916, 10 per cent	1,651,178	.....
May 1, 1916, 5 per cent	825,589	.....
Profit and loss surplus	36,995,597	19,985,159

Condensed Comparative Consolidated Balance Sheet of General Motors Co. and Subsidiary Companies

Assets	1916	1915	1914	1913	1912	1911
Fixed assets; real estate, plants, equip	$24,347,500	$22,753,422	$21,515,065	$20,458,978	$19,280,889	$17,632,682
Less reserve for depreciation	5,981,095	6,933,370	6,082,149	3,613,029	.....	.....
Patents, agreements, etc	355,800	413,500	471,200	1,508,672	1,871,436	2,049,831
Miscellaneous investments	358,428	467,184	352,734	367,063	560,500	854,804
Cash in bank and on hand	22,476,574	14,526,124	13,452,663	6,236,251	3,080,921	4,054,844
Marketable securities	286,000	1,001,000	.....	.....	.....	.....
Notes and accounts receivable	5,629,633	3,944,680	3,219,187	3,449,335	4,229,112	4,637,077
Inventories	25,100,349	14,049,298	11,642,370	18,170,907	17,578,366	17,303,716
Prepaid expense	389,630	533,586	387,578	412,756	422,736	191,180
Total current assets	53,882,188	34,054,689	28,841,402	28,269,250	25,311,136	26,186,817
Good will, representing excess of appraised value over book value of capital stock of subsidiary companies owned, less reserves	7,934,198	7,934,198	7,934,198	7,934,198	7,934,198	7,663,939
Total assets	$80,897,019	$58,589,423	$53,032,451	$54,925,131	$54,958,159	$54,388,072
Liabilities						
Preferred stock	$14,985,200	$14,985,200	$14,985,200	$14,985,200	$14,936,800	$14,393,500
Common stock	16,511,783	16,506,783	16,501,783	16,476,783	16,371,183	15,822,330
First lien, 6 per cent notes	.....	2,328,000	7,852,000	10,935,000	12,452,000	14,002,000
Outstanding capital stock par value and surplus of subsidiary companies being the portion not owned by General Motors Co.—capital stock	540,500	528,000	573,000	578,000	578,000	1,436,000
Surplus	687,958	454,423	431,142	409,252	413,838	1,169,528
Reserve for contingencies	958,464	888,406	965,288	2,162,276	4,299,472	3,203,076
Accounts payable	7,264,443	1,380,908	3,772,123	4,821,744	2,853,022	2,143,847
Taxes and payrolls accrued and not due	2,690,832	1,270,302	1,000,247	1,048,970	929,855	641,768
Reserve for preferred dividends	262,241	262,241	262,241	262,526	261,394	335,848
Surplus	36,995,597	19,985,160	6,689,427	2,945,379	1,262,595	1,240,175
Total liabilities	$80,897,019	$58,589,423	$53,032,451	$54,925,131	$54,958,159	$54,388,072

Income Account of General Motors Co. and Subsidiaries

	1916	1915	1914	1913	1912	1911
Net profits after deducting expenses of manufacture and maintenance, selling and administration, taxes, insurance and depreciation	$29,146,107	$14,926,322	$7,947,413	$8,284,140	$4,838,449	$4,447,146
General Motors Proportion thereof	28,812,287	14,794,191	7,819,968	8,184,053	4,746,756	4,066,251
Accrued interest on General Motors 6 per cent, first lien notes	27,727	336,387	570,235	724,581	850,463	750,000
Preferred dividends at 7 per cent	1,048,964	1,048,964	1,048,679	1,048,534	1,040,210	842,074
Net income	28,798,560	14,457,804	7,249,733	7,459,472	3,896,293	3,316,351
Undivided profits	27,740,596	13,408,839	6,201,055	6,410,937	2,856,083	2,474,177

Factory Miscellany

Apperson Moving—The most recent addition to the Apperson plant, Kokomo, Ind., is completed and the machine shop is being moved over from the old building. The addition of more than 90,000 sq. ft. has been made by the building of the new plant which is known as plant No. 2. It is an entirely modern structure and houses several departments as well as the machine shop. It also embodies a large shipping platform.

Hudford Takes Larger Plant—The Hudford Co., Philadelphia, Pa., maker of the Hudford attachment for converting Ford cars into trucks, has moved into a building at Sixteenth Street and Glenwood Avenue in order to permit an increase in production.

Moline Plow Adds—The Moline (Ill.) Plow Co. will complete a new addition to the plant about Nov. 1 which will give employment to 600 men. The addition will be devoted exclusively to the manufacture of farm tractors. The principal building now under construction will be 100 feet by 785 feet. Another building 180 by 360 will be used as a foundry and for housing the metal parts. The company is far behind in its orders for tractors, and the expansion is imperative.

Indianapolis Firm Increasing—The Metal Auto Parts Co., Indianapolis, has bought 4 acres of land in West Indianapolis and will build four additions to its plant. Production will be more than doubled.

Overland in Green Bay—The Overland-Green Bay Co., Green Bay, Wis., has awarded contracts for the erection of a $40,000 branch house, service station and repair shop, 100 by 122 ft., at Pearl and West Walnut Streets. It will be of reinforced concrete, two stories and basement and will be used for the distribution of Overland cars in northeastern Wisconsin.

Specialize on Hearses—The Houghton Motor Co., Marion, Ohio, announces its production scheduled for the coming year as 500 ambulances and hearses. Fifty of the vehicles are to be delivered by Jan. 1, 1917. All vehicles are to be delivered by Oct. 1, 1917. The concern has been devoting the past year to experimental work.

Heider Tractor Builds—Work commenced this week upon the new building of the Rock Island (Ill.) Plow Co., to be used as an assembling plant for the Heider tractor. Parts for the tractor are manufactured in the general plant of the plow company, and will be put together in the new structure, which will cover a city block, eight houses being removed to make room for the addition. Only steel and concrete will be used in the construction. Last December the Rock Island Plow Co. acquired control of the Heider tractor, then in operation at Carroll, Iowa, and the equipment of the latter plant was removed to Rock Island.

Goodyear to Have 20,000 Men—Twelve hundred and fifty men are engaged in erecting new buildings for the Goodyear Tire & Rubber Co. at Akron, according to H. S. Quine, secretary to President Seiberling. Goodyear building operations now include more room for the office force as well as factory space. The company expects to be employing 20,000 men within a year.

Goodyear's New Cooling Tanks—To provide for the constant flow of electric power and at the same time conserve the water supply which rotates the great 10,000-K.V.A. turbine at the plant of the Goodyear Tire & Rubber Co., Akron, Ohio, the company is erecting a battery of five cooling towers, the first to be installed by any of the large rubber companies of the country. The cooling battery is being installed in five sections, each equipped with a 12-ft. rotary fan. In Europe, cooling systems of this type have been in use for some years.

To Make Motors—The Carle Motor Parts Co., Buffalo, N. Y., has filed incorporation papers to manufacture motors for automobiles and commercial vehicles. Harold Carle, 652 Humboldt Parkway, A. L. Dixon and J. F. Meha, all of Buffalo, are the incorporators.

Complete Michigan Stamping Plant—Work is progressing rapidly on the new plant of the Michigan Stamping Co., Mack Avenue, Detroit, Mich., and by Oct. 1 it is expected that the building will be ready for occupancy. It is rectangular in shape, 370 ft. wide, 650 ft. long. Over 1000 men will be employed and this force will eventually be doubled. The total expenditure will be approximately $1,000,000 for buildings, general equipment and new machinery. Automobile frames, gasoline tanks and many other car parts are made by the company.

The Automobile Calendar

ASSOCIATIONS

Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.
Oct. 2-7 — Kansas City, Mo., Dealers' Show, American Royal Live Stock Show; Kansas City M. C. Dealers' Assn.
Oct. 13—Flint, Mich., Fall Meeting National Assn. of Automobile Accessory Jobbers.
Dec. 2-9—Electricians' Country-wide Celebration.
Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.

CONTESTS

Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30—Astor Cup Race, 250 miles, Sheepshead Bay Speedway, Sheepshead Bay, N. Y.
Oct. 7.—Philadelphia Speedway Race.
Oct. 7—Omaha Speedway Race.
Oct. 7-14—Troy, N. Y., Show, Motor Mart Bldg.
Oct. 14 — Chicago Speedway Race.
Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.
Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.
Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race, Arizona State Fair.
April, 1917—Los Angeles to Salt Lake City Road Race.

SHOWS

Sept. 25-30—Salem, Ore., State Fair, Joseph M. Rieg, manager.
Oct. 6-11—St. Louis, Mo., Open Week, Dealers' Assn.
Oct. 9—Kansas City, Mo., Fourth Annual Trade and Booster Tours, Kansas City Motor Car Dealers' Assn.
Oct. 14-21 — Pittsburgh, Pa., Thirteenth Annual Show, Motor Square Garden. Automobile Dealers' Assn. of Pittsburgh.
Oct. 14 - 21 — Dallas, Texas, Show, State Fair.
Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 13 - 20 — Montreal, Que., Show, Montreal Automobile Trade Assn.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Jan. 27-Feb. 3, 1917 — Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.
March 3 - 10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

TRACTOR

Oct. 14-29—Dallas, Tex., Demonstration, Texas State Fair.

The Week in the Industry

Williams Gets Liberty Agency—C. R. Williams will handle the Northwest agency for the Liberty six, at Twelfth Avenue and Pine Street, Seattle, Wash.

Capen Goes to Chicago—Wallace C. Capen, St. Louis, will become manager of the Chicago branch of the White company. He will take with him C. F. Feltz, manager of the service department in St. Louis.

Handles Cadillac in Delaware—For the purpose of handling the Cadillac in Delaware, the Delaware Motor Sales Co., Wilmington, Del., has been formed. It has taken over the business of the Harris Engine Co. in the State.

Celebrate New Building—For 3 days recently the Connell & McKone Co., Boston, Mass., agents for the Overland, had open house in their new building. More than 1500 people visited the salesrooms during the 3 days. More than twenty-five orders for new cars, twenty used cars and ten trucks were booked.

Ohio News Notes—The Winders Motor Sales Company, central Ohio distributer for the Chevrolet, has moved into a new and larger building at 182-184 East Long Street, Columbus, Ohio.

The Logan Garage & Machine Co., Toledo, Ohio, has again enlarged its quarters. The present location of the concern is 329-331 Broadway.

Pathfinder in Philadelphia—The Hetherington Motor Company, of Philadelphia, has been organized and will handle the Pathfinder. The incorporators are Albert G. and S. C. Hetherington, the latter formerly head of the Crow-Elkhart Sales Company, which will be absorbed by the new company. The company is located at 5 North Twenty-first Street.

Spalding Missouri Packard Vice-President—H. W. Spalding, St. Louis, general manager of the Packard Missouri Motor Car Co., has been elected vice-president of the company and placed in charge of the sales department. He is succeeded as general manager by Gilbert S. Loomis, who has been in charge of the Packard interests at Louisville, Ky.

St. Louis News—W. E. Finney, St. Louis, recently manager of the Goodyear Tire & Rubber Co. branch in that city, has been assigned to the mechanical goods department at the Goodyear factory at Akron, Ohio.

O. E. Hoerger, St. Louis, recently assistant to Wilson C. Dodd, manager of the Goodyear branch, has been promoted to operating manager of the Goodyear branch in Boston.

Nebraska Trade Items—J. Roy Smith, Tecumseh, Neb., and Guy L. Mastin, Auburn, Neb., have formed a partnership with headquarters at Tecumseh, to handle the Oldsmobile in nine Nebraska counties.

Oscar Weibel, Dewitt, Neb., has sold his garage to C. M. Messmore, Nebraska City, Neb.

Jay Wiggins, Lincoln, Neb., has disposed of his garage to Frank Harding.

Hamilton & Cornish, Craig, Neb., have procured the Bovee Garage from Tamisiea & Morehouse.

John P. Michelson, Nebraska City, Neb., has bought the garage of John DeFord.

Iowa Trade Notes—Charles Coons, Carson, Iowa, has bought out his partner, Orville Henry, and will conduct the business of the Main Garage alone.

Chris Bunderson, Harlan, Iowa, has bought the interest of Fred Mortensen in the Court Street Garage.

Barney Boysen, Schleswig, Iowa, has bought out his partner, Charles Reinking, in the Boysen & Reinking garage.

H. H. Dufty and J. H. Blackmore, Tingley, Iowa, have bought the Tingley Garage from Jonas Fender.

J. A. Weber, Stacyville, Iowa, has bought the Stacyville Garage from R. I. Galloway.

Peter Mathre, Ames, Iowa, has purchased the Lou Robertson auto repair shop and opened for business.

Jack Chauncey, Ute, Iowa, has opened a new garage.

Nebraska Items—Northrup & Bolton, Omaha, Neb., are installing a service station for Chandler owners. The firm recently took over the line, which was formerly handled by the W. L. Huffman Automobile Co.

The L. F. Strubbe Auto Co., Omaha, Neb., has been organized by L. F. Strubbe and C. D. Bothwell, experienced automobile men of Lincoln and Omaha, respectively. They have opened at 2415 Farnam Street and will handle the Ross Eight.

W. M. Clement, Omaha, Neb., for several years treasurer for the W. L. Huffman Automobile Co., has launched into business for himself at 2006 Farnam Street. He will handle the Scripps-Booth.

William H. Gestring, Benson, Neb., has opened a Ford service station on Military Avenue.

New England Trade Items—Hon. Taber D. Bailey, one of the proprietors of the Bangor Motor Company, at Bangor, Me., has sold his interest to Horace W. Chapman, son of a partner in the company.

The Reliable Tire & Rubber Co., at Boston, Mass., has been reorganized and its name changed to the Inter State Rubber Company. It has moved into new salesrooms, 392-394 Newbury Street.

M. D. Kidder, Eastern sales manager for the Reo Motor Car Company for five years, and until recently wholesale manager for New England, has taken over the Maine agency at Portland.

Arthur S. Lee has formed the Union Motor Car Company at Providence, R. I., to handle the Mercer and Stearns Knight, with salesrooms on Broad Street. He was formerly secretary of the Rhode Island Automobile Dealers' Association, and handled the Stevens-Duryea there for years.

Horace S. Putney has joined the Oldsmobile agency at Manchester, N. H., as sales manager. He was formerly with the Noyes Buick Company.

The United States Light and Heat Corporation, Buffalo, N. Y., has closed up its Boston, Mass., branch and turned the business over to the Boice-Perrine Company as an agency proposition.

H. C. Darling has been appointed manager of the Western Massachusetts Longford Company, succeeding E. E. Hildreth.

South Bend Activities—The Monroe Motor Car Co. will open a salesroom in a short time which will be a branch of the Monroe Motor Car Co., Pontiac, Mich. The Kirby brothers will have charge of the place. L. J. Stevenson, a factory representative, will be in South Bend to assist in the opening. The salesroom is expected to be one of the most attractive in this section.

The Studebaker Corp. will erect a large service garage in South Bend which will handle the product of the concern's factories, according to plans now being considered. The structure will be approximately 100 by 165 ft. No idea of the cost of the garage has so far been given out. Plans and specifications will be prepared soon. Mr. Fish, chairman of the board, said: "We contemplate building a garage and will begin construction as soon as we have obtained our plans and specifications so that the contracts may be let.

King Dealers Move—The New Ogden King Eight Co. have found it necessary to find larger quarters for their showroom and have moved to 2564 Washington Avenue, Ogden, Utah.

The AUTOMOBILE

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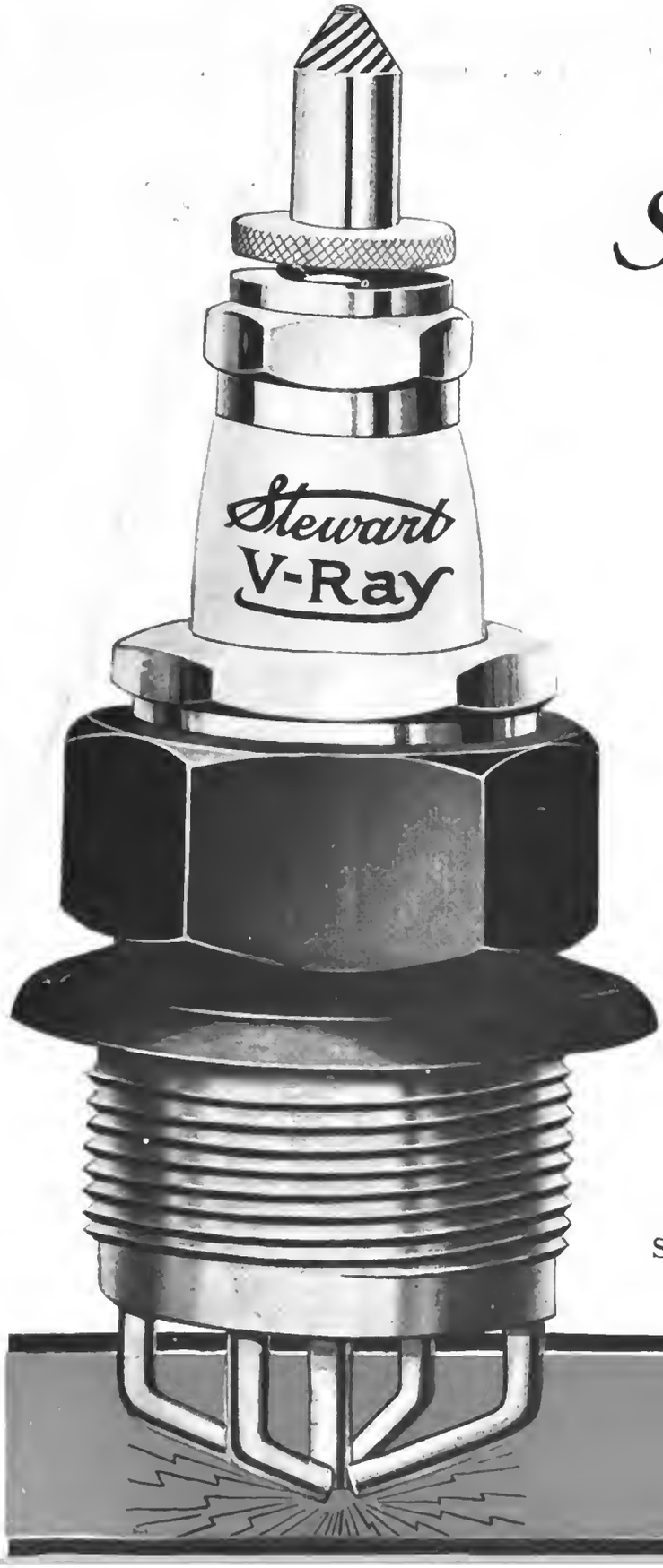
Three dollars a year



Stewart V-Ray Spark Plug

Like a Bolt From the Blue

No sooner had we announced the fact that we were making and marketing the famous V-Ray plug than an avalanche of inquiries and orders began pouring in from dealers in all parts of the country.

Such enthusiasm simply swept us off our feet.

It was like a bolt from the blue.

Dealers know V-Ray quality and realize the bigness of the V-Ray market.

They know that all that held back V-Ray sales in the past was limited production facilities.

That handicap has been removed.

And V-Ray production is keeping up with the V-Ray demand—a demand that is on a rapid increase.

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The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, OCTOBER 5, 1916—CHICAGO NO. 14

Fisk Capital Now $39,500,000

Stockholders Vote To Add $24,500,000 in Preferred and Common

CHICOPEE FALLS, MASS., Oct. 2—At a special meeting of the stockholders of the Fisk Rubber Co. here to-day it was voted to authorize an increase in the capital stock of the corporation from $15,000,000 to $39,500,000, adding $24,500,000, divided as follows: $7,500,000 first preferred convertible stock of which $5,000,000 will be issued at once; $5,000,000 second preferred of which $2,500,000 will be issued and $12,000,000 common stock which will remain in the treasury.

The additional issue of second preferred is being taken by the junior security holders, being offered to them on a basis of one share for every four shares of common and second preferred owned in the aggregate. The first preferred has been underwritten by a syndicate headed by Estabrook and Co. of Boston. The new cash is to be used for working capital.

—

Morse Succeeds Paul Smith

DETROIT, MICH., Oct. 3—E. C. Morse has been elected vice-president of the selling division of the Chalmers Motor Co., this city, succeeding Paul Smith, who died last July.

Mr. Morse resigns as sales manager of the Hudson Motor Car Co., this city. He will have charge of Chalmers sales service and advertising.

—

Offer $1,500,000 Winton Preferred

CLEVELAND, OHIO, Oct. 4—Borton & Borton have purchased and will offer shortly to the public, $1,500,000 7 per cent cumulative preferred stock of the Winton Co.

Although the Winton Co. is not disposed to change its policy of limited production, the company will devote the proceeds of this issue to expansion of the plant.

The company's balance sheet will show total assets of approximately $300 for each share of preferred stock to be issued. Average earnings over the last 7 years have been at the rate of about four and a half times the preferred stock dividend requirements.

The company agrees to maintain net quick assets of 125 per cent of preferred stock issue. A sinking fund will be operative beginning 1919, which will retire the issue at the rate of $75,000 annually. It will be redeemable at 105 and accrued dividends.

—

Warner Is Oakland President

PONTIAC, MICH., Sept. 29—F. W. Warner has been elected president of the Oakland Motor Car Co., succeeding C. W. Nash, who resigned some time ago. C. B. Voorhis, who has been its general sales manager, has been made vice-president of the company. Both Mr. Warner and Mr. Voorhis have been made members of the board of directors. Mr. Warner has been general manager of the company since June, 1915.

—

U. S. May Develop Gasoline Standard

WASHINGTON, D. C., Oct. 1—The price of gasoline may be regulated by the Federal Government as the result of an investigation now being conducted by the Department of Commerce which is trying to determine what is gasoline and what is not. It is hoped to arrive at a basis for fixing a standard for gasoline.

—

Young Is Dort Experimental Engineer

DETROIT, MICH., Oct. 3—M. S. Young has resigned his position as chief engineer of the Regal Motor Car Co. to accept the position of experimental engineer for the Dort Motor Car Co., Flint, Mich.

Paige 1916 Gain $1,000,000

$1,058,300 Cash on Hand—Net Worth $1,994,644—Surplus $994,644

DETROIT, MICH., Oct. 2—The Paige-Detroit Motor Car Co., this city, showed a net gain of $1,072,152.35 for the year ending Aug. 31, 1916. The net worth of the company at the end of August, 1916, was $1,994,644.79 and at the end of the same month in 1915 was $922,492.44.

The company in its financial statement shows cash on hand and in banks amounting to $1,058,300.66. Its surplus amounted to $994,644.79 and its capital stock to $1,000,000.

Paige Financial Statement Ending Aug. 31, 1916

ASSETS

Cash on hand and in banks		$1,058,300.66
Municipal bonds (for investment)		47,463.45
Accounts receivable	$179,866.17	
Less reserve for bad debts	450.00	179,416.17
Store (manufacturing material)	1,150,976.03	
Less reserve for depreciation	13,500.00	1,137,476.03
Plant account	363,007.31	
Less reserve for depreciation	156,036.98	206,970.33
Prepaid expenses		24,685.14
Total assets		$2,654,311.78

LIABILITIES

Notes payable	$150,000.00
Accounts payable	423,358.72
Accrued pay roll	29,313.77
Dividends	30,000.00
Dealers' deposits	26,964.50
Surplus	994,644.79
Capital stock	1,000,000.00
Total liabilities	$2,654,311.78

Net worth August, 1916	$1,994,644.79
Net worth August, 1915	922,492.44
Gain in net worth	$1,072,152.35

—

Hatch Perfection Spring Sales Manager

CLEVELAND, OHIO, Oct. 3—After 9 years of successful work in the sales department of the Perfection Spring Co., C. W. Hatch has been appointed sales manager.

21,660 Carloads in September

Gain of 2720 Over Shipments in 1915—Freight Car Shortage 14,000

CARLOAD SHIPMENTS OF AUTOMOBILES

Month	1916	1915
January	18,054	8,369
February	21,502	11,273
March	28,600	16,442
April	28,000	17,112
May	24,000	13,642
June	23,879	15,325
July	18,079	12,517
August	18,254	16,959
September	21,660	18,940

NEW YORK CITY, Oct. 4—At the regular meeting of the board of directors of the National Automobile Chamber of Commerce, Inc., held here to-day the traffic committee reported that shipments of automobiles and trucks during the month of September totaled 21,660 carloads, as compared with 18,940 in September, 1915, a gain of 2720 carloads.

The American Railway Assn. reported to the chamber that there is a shortage of 14,000 freight cars and automobile manufacturers are making strenuous efforts to induce their dealers to empty their cars promptly so that they can be put into use again with minimum delay.

The patents, good roads, legislative, safety first and show committees reported and their reports were accepted.

Show Space Drawings

The directors' meeting to-day was preliminary to the meeting to-morrow when drawings for space at the national shows will be held.

—

Smith Form-A-Truck Takes License Under Cook Patent

NEW YORK CITY, Oct. 4—The Smith Form-A-Truck Co., Chicago, has taken out a license from the Redden Motor Truck Co., this city, to manufacture converted trucks from touring cars, under the Cook patent, controlled by the Redden company. The Smith company has up to the present converted Ford touring cars into delivery vehicles, having as its patent in this work No. 1,147,131, granted to W. P. Wynne, July 20, 1915, and applied for June 29, 1914. The Redden company controls patent No. 1,180,475 granted to A. E. Cook and T. Van Tuyl, April 25, 1916. It was applied for under date of Dec. 17, 1910.

The Smith-Form-A-Truck Co. will continue manufacture of apparatus for converting Ford touring cars into delivery wagons as heretofore, but will do so by payment of royalty on the Cook patent. The contract between the Redden and Smith firms is apparently based on the validity of this patent. The Smith Form-A-Truck Co. is one of the largest manufacturers of these truck-making attachments. It was in 1914, when A. D. Smith built his first truck attachment in Seattle, Wash. In May, 1915, the first one for the Chicago trade was manufactured. In August, 1915, the Smith-Form-A-Truck Co. established a Chicago plant and started the manufacture of these attachments on a large scale.

The scope of the Cook patent is well defined in some of the patent claims, No. 32 of which reads:

"The combination with an automobile of a pair of tractor wheels, a frame supported thereon and affording means to elevate the rear end of the automobile thereon, means on said frame for rigidly engaging the rear end of the automobile thereon, means supporting the front end of the frame on and securing the same to the front end of the automobile, and driving connections between the tractor wheels and the power plant of the automobile."

—

Madison Motors Co. Absorbs Old Company

ANDERSON, IND., Oct. 1—The Madison Motors Co., with a capital of $2,000,000, has been organized here to absorb the Madison Motor Co., formed in the spring of 1915 with a capital of $500,000 to manufacture the Dolly Madison car. The new corporation will take over the local plants of the old company and will continue the present models on a larger scale of production.

Cecil Gibson, president of the old company, remains at the head of the new one. The board of directors will include C. D. Edinburg, general manager of the American Maize Products Co., New York City; W. F. Wickham, president of the Wickham Coal Co., St. Louis, Mo., and of the Wickham & Burton Coal Co., Chicago; P. P. Haynes, an attorney in Anderson; G. S. Sarber, formerly of Indianapolis and associated with Mr. Gibson in all his enterprises; and H. M. Caldwell, Evanston, Ill., capitalist and corporation attorney, who, it is said, is largely responsible for the new capital which goes into the company.

—

Perrin Resigns from Timken Axle

DETROIT, MICH., Oct. 1—J. G. Perrin resigned to-day from the Timken-Detroit Axle Co. because of serious illness and other business plans.

—

Automobile Crank Shaft Corp. Formed

DETROIT, MICH., Oct. 4—The Auto Crank Shaft Co. has sold its entire business and assets to the Automobile Crank Shaft Corp., recently incorporated under the laws of New York with a capital of $1,000,000.

There will be no change in the officials of the company.

Columbia Motors Buys Argo

New Company Capitalized at $500,000—To Make 3500 Electrics in 1917

DETROIT, MICH., Oct. 2—The Argo Electric Vehicle Co., Saginaw, Mich., has been purchased by the Columbia Motors Co., this city. The Columbia Motors plans to begin the manufacture of its new car Jan. 1, 1917. This company is capitalized for $500,000 and expects to produce approximately 3500 cars during the coming year at a price of about $1,000. The first Columbia was produced early this summer, but further production was delayed pending the Argo purchase.

The new merger admits the Columbia Motors to a membership in the National Automobile Chamber of Commerce, and allows them to exhibit their product in the national automobile shows in New York and Chicago this next winter.

The officers of the Columbia Motors Co. include: J. G. Bayerline, president and general manager; A. T. O'Connor, secretary and treasurer; T. A. Bollinger, vice-president in charge of manufacturing; Walter L. Daly, sales manager; Ray Long, chief engineer; W. E. Metzger, vice-president, and John Mohrhardt, superintendent. All are members of the board of directors.

—

Standard Welding Makes Promotions

DETROIT, MICH., Oct. 4—Following the resignation of H. A. Flagg, sales manager of the Standard Welding Co., and C. E. Miller from the management of the Detroit office of the same company. P. W. Gilbert, assistant sales manager for nearly 5 years, becomes sales manager; B. A. Quayle, in charge of the Chicago office for many years, and one of the company's first salesmen becomes general representative, with headquarters at the factory. B. G. L. Dodge, in charge of advertising and publicity for over 5 years, becomes manager of sales promotion.

W. C. Voss, formerly in charge of the Cleveland district, moves to Detroit, where he will assume charge jointly with Ted Palmer, long connected with the Michigan office. Willis Stutson, of the Indianapolis district, is placed in charge of the Chicago office with A. J. Brandt as assistant. Mr. Stutson will also handle the Indianapolis district from Chicago. O. L. Miller, formerly of the order department at the factory, replaces Mr. Voss at Cleveland. T. E. Hauser, formerly head of the order department, becomes assistant to the sales manager, while W. Paxton becomes head of the order department.

26,304 Reo Production in Year

23,753 Cars and 2551 Trucks—Gross Sales Total $27,884,000

LANSING, MICH., Sept. 29—During its 1916 fiscal year the Reo Motor Car Co. delivered 23,753 passenger cars and the Reo Motor Truck Co. 2551 trucks. All told, 26,304 Reos were delivered to purchasers. The gross sales during the year totaled approximately $24,363,000 for the car company and $3,521,000 for the truck company, or a total of $27,884,000 for all Reo sales. In the case of the passenger-car company the increase over the fiscal year 1915 is 33.08 per cent and the increase for the truck concern is 33.38 per cent, or an average increase of 33.24 per cent for all Reo business.

These are some of the facts which were brought out in the report submitted to stockholders who met this week with regard to the merger of the two Reo companies, which is now an accomplished fact. In the report it was further stated that at the close of the fiscal year 1915 the Reo Motor Truck Co. had capital stock issued and outstanding of $937,250 and about $250,000 surplus. The net earnings of the year were $502,000. The Reo Motor Car Co. at that time had $3,000,000 capital stock outstanding and $3,662,000 surplus. Upon the present capitalization of $6,000,000 the surplus would have been $662,000 and the net earnings for the 10 months ended then were $2,569,000. This, prorated by months, would show an earning of around $3,000,000 for 12 months. Both corporations were earning at the rate of approximately 50 per cent of their present capital.

As a result of the merger it was decided that the stock will be exchanged on a share-for-share basis, the holders of truck stock receiving 93,725 shares.

After having been delayed because building material was slow in being received, the Reo Motor Car Co., now having received a large supply, is rushing the completion of its new large machine shops. Part of the structures are three stories high, 407 ft. long by 175 ft.

Plans Clearing House

The Reo company is planning to establish a clearing-house division in its welfare department for the benefit of its employees. The object of the clearing house will be to help Reo employees having real estate or personal property in selling or buying and otherwise taking care of their property, and it will also do away with intermediaries.

To Export 2000 Harroun Cars Per Annum

NEW YORK, Sept. 28—A contract involving the exporting of 2000 Harroun cars per annum for 5 years and a total of $5,000,000 was entered into to-day between the Harroun Motors Corp. and Speyer, Cole & Company in association with Graham & Co. of London, and Norton Lilly & Co. of New York is announced by John Guy Monihan, president Harroun Motors Corp.

The contract provides for the exclusive dealing in Harroun cars in England and the colonies except Canada. For 8 years these gentlemen have been the export dealers and managers for the Hupmobile company, which they continue to handle with the Harroun.

Tompkins in Ward Leonard Organization

MOUNT VERNON, N. Y., Oct. 2—William Miller Tompkins has been made Philadelphia representative of the Ward Leonard Electric Co., Mount Vernon, N. Y.

Aug. Exports Total $10,068,538

5254 Cars Valued at $3,574,485 and 1565 Trucks at $4,442,158

WASHINGTON, D. C., Oct. 2—Figures made public to-day by the Department of Commerce show that 6819 automobiles, valued at $8,016,643, were exported in August last, as against 5453 cars, valued at $7,509,027, shipped abroad during the same month of last year. The August exports this year were divided as follows: commercial cars, 1565, valued at $4,442,158; passenger cars, 5254, valued at $3,574,485; parts, not including engines and tires, $2,051,895. During August of last year there were 1614 commercial cars, valued at $4,387,193; and 3839 passenger cars, valued at $3,121,834, exported, together with parts, not including engines and tires, to the value of $2,038,321.

The big feature of the exports for the 8 months ended August, 1916, was the number of passenger cars exported, the number being 43,661, valued at $29,472,228, as against 26,736 cars, valued at $23,576,188, exported during the corresponding period of 1915. On the other hand, the exports of commercial cars dropped from 15,042, valued at $41,886,961, during the 8 months of 1915 to 12,938 cars, valued at $35,167,840, during the same period of this year. Exports of parts, not including engines and tires, increased from $9,381,440 during the 8 months of last year, to $15,227,161 during the same period of this year.

The large gain in our automobile export trade in recent years is indicated by the figures for the 8 months of 1914, during which time 509 commercial cars,

(*Continued on page* 592)

Exports of Automobiles, Truck and Parts for August and 8 Previous Months

	August				8 Months Ending August			
	1915		1916		1915		1916	
	Number	Value	Number	Value	Number	Value	Number	Value
Passenger cars	3,839	$3,121,834	5,254	$3,574,485	26,736	$23,576,188	43,661	$29,472,228
Commercial cars	1,614	4,387,193	1,565	4,442,158	15,042	41,886,961	12,938	35,167,840
Parts, not including engines and tires	....	2,038,321	....	2,051,895	.....	9,381,440	.....	15,227,161
	5,453	$9,547,348	6,819	$10,068,538	41,778	$74,744,589	56,599	$79,867,229
By Countries								
Denmark	....	.....	190	140,872	.....	.....	786	$575,111
France	196	$661,972	398	1,147,602	4,464	$11,209,798	6,053	15,005,294
Germany	....	.....	....	.....	4	2,800	.....	.....
Italy	13	11,203	6	7,678	121	74,498	232	140,467
Russia	....	.....	789	1,963,526	.....	.....	2,182	5,955,120
United Kingdom	2,290	3,530,831	294	534,359	16,784	25,528,943	6,575	10,392,259
Other Europe	722	1,652,280	503	526,931	5,544	14,741,288	2,854	3,634,840
Canada	721	480,677	860	750,361	4,682	3,673,203	9,476	6,777,656
Mexico	8	9,100	31	32,427	69	65,406	366	340,648
West Indies and Bermuda	368	193,725	417	314,611	2,072	1,110,173	3,797	2,439,481
South America	274	149,319	....	.....	1,486	793,037	.....	.....
Argentina	....	.....	145	86,470	.....	.....	3,798	1,863,625
Brazil	....	.....	29	14,715	.....	.....	280	184,447
Chile	....	.....	151	85,355	.....	.....	702	446,788
Venezuela	....	.....	25	19,648	.....	.....	386	240,982
Other South America	....	.....	42	32,383	.....	.....	609	367,759
Australia	....	.....	437	327,956	.....	.....	6,250	4,748,695
British East Indies	....	.....	513	367,559	.....	.....	2,778	2,074,153
British Oceania	391	322,689	....	.....	2,760	2,368,736	.....	.....
Asia and Other Oceania	330	393,771	1,241	1,443,344	2,508	4,703,181	6,076	7,430,398
Other countries	140	103,460	748	220,846	1,284	1,192,086	3,399	2,022,345
	5,453	$7,509,027	6,819	$8,016,643	41,778	$65,463,149	56,599	$64,640,068

BRAZIL

Imports of U.S.A. Cars into Brazil are Increasing But Should Grow Faster—Sao Paulo One of Most Promising Centers for Cars and Trucks

Part II

By David Beecroft

EDITOR'S NOTE:—This is the second of a series of articles embodying the close observations of automobile and general trade conditions in Brazil made by Mr. Beecroft, Directing Editor of THE AUTOMOBILE, during a 10-weeks' trip through Argentina, Uruguay and Southern Brazil as a delegate of the United States Government and member of the Argentine Return Visit Committee. Subsequent articles will further analyze the possibilities of selling cars, trucks, and tractors in the United States of Brazil.

Diagram showing the comparative areas of Brazil and the U. S. A.

THE area of the United States of Brazil as compared with that of the United States of America is brought out in the above map, in which Brazil has been placed over the U. S. A. Both, as stated last week, approximate the 3,000,000-square-mile area, but with vastly varying populations, Brazil with 25,000,000 and U. S. A. with 105,000,000. On an average the potential buying ability of the U. S. A. per 1000 of population is much higher than Brazil.

During the last 7 years Brazil, according to the figures of her own government, has imported 10,523 automobiles and trucks. This is an average of 1503 per year. The importation of automobiles into Brazil has been very irregular, there has not been any general trend of movement. There has been a pronounced anti-climax. Two years stand out conspicuously as strong years for Brazilian imports—1912 and 1913. The high water mark of imports was in 1912 when the total of 3785 was reached. The U. S. A. received about 20 per cent of that business. Germany got nearly 40 per cent.

The following year, 1913, was a strong year with 3218 cars imported, a little lower than the previous year, but still a fairly successful one. In that year we passed Germany, but remained behind France, which had been passed by Germany the year previous.

It was in 1914 that the bottom literally fell out of the Brazilian market and it has been out ever since, except for the developing business in the State of Sao Paulo. In 1914 importations dropped to 744 cars, scarcely one-fifth of what it had been the previous year.

1915 the Worst Year

But if 1914 was a solar plexus blow the figures of 1915 showed a still worse condition. The imports fell from 744 to the low level of 214. European business stopped, excepting fifteen cars from Italy, eight from Great Britain, ten from France and three from Switzerland. The U. S. A. got the lion's share, 169 cars out of 214, but even then our business declined as compared with the previous year.

In the last fiscal year ending June 30 our exports had risen to 258 cars, a good increase over the previous year, but still a small quantity as compared with 4444 cars sold to Argentina in the same period. The tabulation on the opposite page shows year by year an analysis of Brazilian imports from different countries.

These figures give some indication of the strength of both France and Germany in the Brazilian field, and account for the preponderance of French and German cars, not only in the capital, but in other leading Brazilian cities. The highest-priced French and German cars were sold in many of the leading cities such as Rio de Janeiro, Sao Paula, Santos, Porto Allegre, Manaos, Bahia, Pernambuco and Para. Great Britain was never a contender for the Brazilian trade in the sense of France or Germany. Italy was a much greater factor than Great Britain. Belgium and Switzerland were also striving for a slice of the Brazilian trade.

The distribution of cars throughout Brazil has been much more general than is supposed. Rio has been the big consuming center, but several other places were growing as car-consuming centers when they were overtaken by the war in 1914. That stopped their importing activities. The tabulations showing how many cars were received at the different ports of entry in Brazil was compiled from the official government figures obtained in Rio last June.

Brazil's Imports of Automobiles in the Past 6 Years

NUMBER OF CARS IMPORTED FROM DIFFERENT COUNTRIES

Country	1910	1911	1912	1913	1914	1915
Germany	172	315	1,060	613	114	3
Argentina	0	0	5	...	..	...
Austria-Hungary	0	1	1	...	...	...
Belgium	9	23	120	83	35	...
United States	95	301	783	814	213	169
France	280	511	1,011	953	186	10
Great Britain	37	133	205	112	46	8
Spain	1	0	5	...	...	...
Italy	67	189	432	412	92	15
Portugal	4	6	2	...	...	...
Sweden	27	0	0	...	...	...
Switzerland	43	93	136	142	11	3
Uruguay	0	2	24	...	...	...
Others	0	0	1	89	47	6
Total	735	1,574	3,785	3,218	744	214

DISTRIBUTION OF AUTOMOBILES IMPORTED BY CITIES

Port	1910	1911	1912	1913	1914	1915
Manaos	32	31	29	24	5	0
Para	72	76	61	58	14	0
Maranhao	0	1	43	19	4	1
Ceara	4	6	36	11	4	0
Natal	1	1	1	1	0	0
Cabedello	2	3	0	0	0	0
Pernambuco	37	56	66	54	43	4
Maceio	0	3	3	18	2	4
Bahia	3	10	55	111	19	1
Victoria	0	4	0	0	0	0
Rio de Janeiro	468	994	2,117	1,345	198	8
Santos	97	296	1,121	1,318	325	166
Paranagua	0	0	21	31	0	1
S. Francisco	1	0	0	0	3	0
Joinville	1	0	0	0	0	0
Florianopolis	1	0	2	3	8	2
Rio Grande	3	19	12	14	2	1
Pelotas	1	25	30	45	25	4
Porto Allegre	9	40	151	87	37	2
Livramento	0	3	6	24	10	0
Quarahy	0	1	2	3	3	0
Uruguayana	0	1	17	36	26	0
Itaquy	1	0	2	3	0	0
Jaguarao	0	0	4	0	0	0
Corumba	2	0	0	0	2	0
Porto Velho	0	4	6	6	0	0
Itajahy	0	0	0	2	2	0
Rio Grande do Sul	0	0	0	5	0	0
S. Borja	0	0	0	0	2	0

Two horizontal columns in this table are of especial interest, that showing imports in Rio de Janeiro and the other showing imports into the Port of Santos. In 1910 Rio led Santos at a five-to-one rate; the next year the ratio was four-to-one; the next year two-to-one; and in 1913 the two ports were practically on an even keel with regard to imports.

Then in 1914 came the turning of the tables, Santos jumping ahead of Rio. The war had a more serious effect on Rio than the Santos trade. The cars imported into Santos were not used in the city, but shipped into the great state of Sao Paulo. The reason Sao Paulo was not hurt so much by the war as Rio was largely due to the coffee situation. Coffee has been well handled during the war days.

But the Sao Paulo business during war days has largely been with the farming classes in the coffee area. Cars are not selling very rapidly in the City of Sao Paulo, but quite rapidly in the country. The City of Sao Paulo is surrounded by a wonderful coffee area, which has kept trade alive.

The city of Rio has been less fortunate. It is surrounded by mountains. It is shut in by hills around its celebrated harbor. The cars it imports it sells within the city. City sales have been literally dead for three seasons and so Rio's imports have been very low.

There are some other growing automobile centers in Brazil, as the tabulation will show. Porto Allegre is one of these. It is a city of 150,000 inhabitants situated on the edge of a long bay, with business concentrated in one long street along the water front. From this avenue very steep streets radiate up into the residential section. The paved streets are in a deplorable condition, converting automobiling from a pleasure into a torture.

This is the Union passenger depot in the heart of the city of Sao Paulo. It shows the modern spirit of the city. The wide street is ideal for motor truck and motor car traffic. In the city are many other new streets of equal width, and while there are narrower streets in the business section of the city, the use of motor trucks is not hampered by them as much as might be imagined. While the city has not more than 500,000 population, it has a go-ahead spirit which is destined to make it one of the greatest in Brazil. It is destined to be the great distributing center for the entire state of Sao Paulo, and the enormous state of Matto Grosso, one of the largest states in Brazil. Sao Paulo is also developing as a distributing center for other adjacent states

The business of Porto Allegre has always been overwhelmingly in the hands of Germans, this city being the center of that section of Southern Brazil in which you find entire German-speaking communities. Naturally the city cars are exclusively Benz, N.A.G., Mercedes, and other German makes. But within the last 2 years the Hinterland, the adjacent country, has absorbed nearly 200 Fords. Other U. S. A. makers have not got started here and when they establish themselves it will have to be for the country trade.

The entire total of automobiles in this section, which in addition to Porto Allegre includes Pelotas and Rio Grande do Sul, is from 600 to 800 cars. This total shows considerably more cars in the territory than the tabulation does, which is largely due to the sale of U. S. A. cars within the last season.

This is one of the busy business streets of Sao Paulo and is an example of the Spanish type of city. The street is so narrow that one way traffic is a regulation. This makes it possible to make good speed with a motor truck or motor car. There are many streets in the heart of the city of equal width, but fortunately there are many much wider, so that the use of motor trucks is as favorable as in Boston

Other Important Ports

The other leading ports for automobile importations are Para, near the mouth of the Amazon River; Manaos, half way up the Amazon and the center of the rubber industry; Pernambuco, a seaport town, with a preponderant colored population; and Bahia, the old capital of Brazil and a city which for years was a rival of Rio de Janeiro.

Unfortunately, many of these ports will never be the automobile consuming centers that Sao Paulo is because they have not the white population and have not the fertile, well-cultivated lands. As in U. S. A. so in Brazil, the sale of motor cars will be heaviest in those agricultural sections where the man cultivating the soil is able to purchase a car.

There is, however, one respect in which Rio is a most important truck center for the entire United States of Brazil. Being the federal capital, Rio has used the government for its own benefit and naturally to the disadvantage of other cities and the twenty states. In Brazil there is no free interchange of freight and merchandise among the twenty Brazilian states. If you ship from one state into another you must pay an export tax. To draw a parallel in U. S. A., suppose you are a manufacturer in Michigan and have to ship motor trucks into New York or Illinois; you would have to pay the state government of Michigan an export tax. This export tax is used by all of the states comprising the United States of Brazil as a source of revenue.

Map of Brazil, showing location of cities which are heaviest importers of automobiles and motor trucks

This situation gives Rio a position of peculiar importance in that there is no export tax on any goods shipped from the port of Rio into any of the twenty states of the country. This makes Rio the natural place to locate headquarters for Brazilian business, particularly if you purpose covering the entire country. With headquarters in Rio there is no tax for goods shipped to the State of Sao Paulo, or to such other states as Minas, Matto Grosso, Rio Grande do Sul, etc., etc.

There is still another way in which the City of Rio de Janeiro

has fortified itself as a truck center for the country, by use of government influences. From Rio radiate the nationally-controlled railroad lines which are the big distributing channels for much of the country. Further, the government steamboat lines which operate along the entire coast are worked to the advantage of Rio and the natural disadvantage of other ambitious Brazilian centers. Rio has built some solid foundation stones to guarantee her future as a business center for the entire country, as well as being permanently fortified as the political capital of the nation.

Now let us return to the State of Sao Paulo, the best motor truck market in Brazil to-day.

Coffee Plantations a Big Field

The coffee plantations of Brazil offer the greatest field in Brazil to-day for the use of U. S. A. motor trucks. Coffee planters have the reputation of being good spenders. That characteristic seems to have been in their blood before they became coffee planters. The coffee industry is largely in the hands of natives of the state rather than being controlled by foreign capital, as is so often the case with railroads, telephone system, telegraph system, water works, trolley lines and other utilities.

One of the great objections that will be raised to the more general use of motor trucks in the coffee industry will be the argument that horse labor is very cheap as compared with motor trucks. Many planters will be able to show in figures what it costs to haul the coffee by horse as compared with motor truck. All of this is quite true, but in spite of all these men have yet to learn of the many economies of motor trucks. They are not schooled in the better use of trucks. They merely look upon the truck as a substitute for horse labor. The grade of horse used in Brazil is very inferior to that in U. S. A. and undoubtedly the planters will not be slow to see that in the long run the motor truck is a good investment rather than being an expense or an experiment.

The motor truck is not new in the coffee districts, but it is there in relatively small numbers. You see large French, English and German trucks. Generally large-capacity vehicles are used of 5 tons or higher. You frequently see these large trucks being overhauled in the garages of Sao Paulo.

The lack of good roads will be advanced as a reason for not using motor trucks in the coffee areas. It is true that roads to-day are poor, but they are not too poor to admit of truck use. Roads are easily drained.

In the coffee country there is a distinctively wet and dry season. The wet season is the summer season when the growth takes place. In the dry season there is no difficulty with roads. We were through all parts of the state in the dry season and although roads were poor there were motor cars that were averaging 20 m.p.h. for distances of over 350 miles. Roads cannot be too bad when you make such averages.

Sao Paulo Best Truck Market

The best motor truck market in the United States of Brazil is in the State of Sao Paulo, which includes the majority of the great coffee area of Brazil and also includes the City of Sao Paulo, the Chicago of Brazil, and one of the best and most enterprising business cities in all of South America. To-day this area is a better truck market than the capital city of Rio de Janeiro, which has more than twice as many trucks in operation to-day as Sao Paulo city or the entire state. Rio is not an active truck market to-day, in fact, it is a very poor truck market. It is an over-supplied market. European makers stocked Rio 4 or 5 years ago. The city was oversold on trucks and there are to-day not a few Rio dealers who have large stocks of trucks on hand. One Rio dealer admits having over forty large trucks on hand, the majority of which he has had in stock for several years. He has sold over 250 trucks of his make in the city and is naturally quite burdened in carrying his present stock, which he has not been able to move for nearly three years.

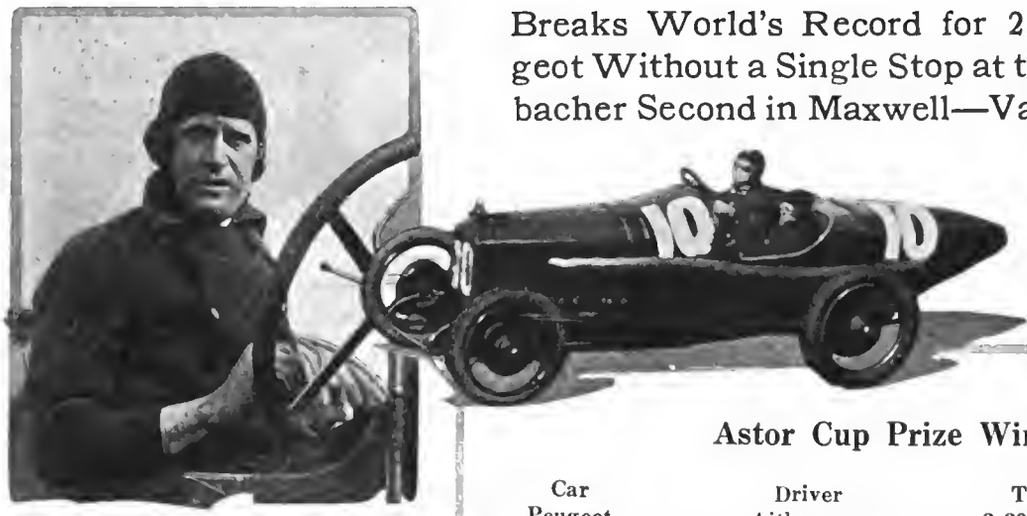
(*To be continued*)

This large viaduct near the heart of the city of Sao Paulo is an example of the enterprising spirit of the city and is indicative of the general go-ahead spirit of the state of Sao Paulo. This viaduct carries double street car lines and is amply wide for all kinds of traffic in both directions. When you find a city adding street improvements of this nature you are certain it will be a profitable motor truck market

Aitken Wins Astor Cup at 104.83

Breaks World's Record for 250 Miles in Peugeot Without a Single Stop at the Pits—Rickenbacher Second in Maxwell—Vail's Hudson Third

By Donald McLeod Lay



JOHN AITKEN
Photos by International Film Service

Astor Cup Prize Winners

Car	Driver	Time	Miles Per Hr.	Prize
Peugeot	Aitken	2:23:04.03	104.83	$10,000
Maxwell	Rickenbacher	2:24:19.54	103.90	5,000
Hudson	Vail	2:34:01.00	97.4	2,500
Delage	Lecain	2:34:42.21	97.0	1,600
Mercer	Pullen	2:37:26.00	95.2	1,300
Crawford	Klein	2:38:01.00	94.8	1,200
Delage	Devigne	2:38:31.00	94.6	1,000
Duesenberg	Mulford	2:42:02.38	92.3	900
Hoskins Spec.	Hughes	2:42:56.15	92.1	800
Duesenberg	Milton	2:45:36.90	90.6	700

SHEEPSHEAD BAY MOTOR SPEEDWAY, Sept. 30—With the delicate mechanism of his slender blue Peugeot working like a watch throughout the 250 miles of the Astor Cup race, Johnny Aitken broke the world's record for the distance here to-day in 2:23:04.03 averaging 104.83 m.p.h., without a single stop at the pits. His performance was 3:20:67 faster than the best previous time on the Sheepshead track, which was 2:26:24.7 made by Anderson in the Stutz last year.

Aitken was practically unchallenged for the race after Resta's Peugeot had succumbed to a broken intake valve at the 100-mile mark and Christiaens' speedy Sunbeam went out of the race with a broken connecting-rod on the following lap. Ralph DePalma was unable to repair a broken valve in his Peugeot in time to start.

Aitken drove a heady race, seeming to know just how far to force his car without straining it. His tires served him perfectly as is shown by his non-stop record for the race. Rickenbacher in the Maxwell, averaged 103.9 and Vail in the Hudson and LeCain's Delage both made over 97 m.p.h.

Ideal weather conditions prevailed, the day being almost identical with that on which the race was run last year. The crispness of autumn gave a tang of excitement and invigorating quality to the air. A snappy breeze drove light fleecy clouds across the blue sky and the bright sun furnished sufficient warmth to draw the sting from the atmosphere. The coolness of the day and the fact that heavy rains had fallen the day before had much to do with the small percentage of tire trouble during the race for the tires responded to these conditions by a greatly reduced tendency toward overheating.

40,000 Spectators

The stands were well filled when the thirty-one cars were lined up in rows of four for the start and streams of people were still crowding through the gates to swell the crowd to its total of 40,000. Most of those who came in automobiles were early and thousands of cars were parked within the inclosure, a goodly percentage being drawn up in the parking spaces within the oval.

In seven rows of four cars and with three in the eighth row the racers were sent off on the preliminary lap, crossing the line for a flying start at 2:31 with Christiaens' Sunbeam in the lead. The English mount of the Belgian driver was still in the van at the end of the first lap, closely followed by Resta and Aitken in their blue Peugeots, with Louis Chevrolet's Sunbeam close behind. These cars made a group slightly in advance of the rest of the field and as the race progressed they drew into the lead by a wider and wider margin, their speed averaging about 106 m.p.h., for the first few laps.

On the second lap Christiaens was still ahead but Resta had passed Aitken. On the fourth lap Chevrolet's terrific speed of 113 m.p.h. enabled him to forge to the front with

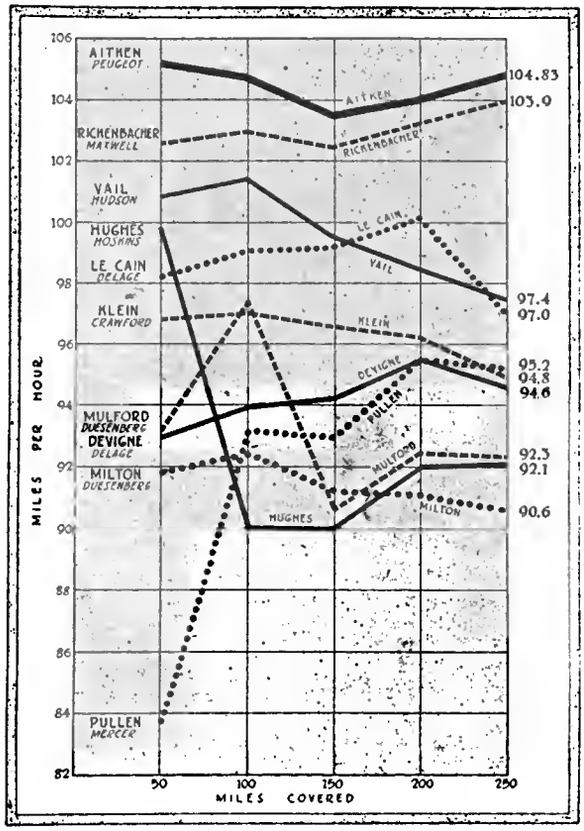
EDDIE RICKENBACHER
Second in Maxwell

IRA VAIL
Third in Hudson

Resta second and Christiaens third. For 10 miles Chevrolet and Aitken battled side by side in as pretty a duel of speed as was ever seen on the Sheepshead speedway. The Sunbeam crossed the 20-mile mark a few seconds ahead of Aitken but on the thirteenth lap Chevrolet's car gave up the battle and went to the pits with a burned-out bearing which terminated the veteran driver's hopes of victory.

After Chevrolet was eliminated Aitken held the lead with Resta second, forcing him like a veritable Nemesis, and Christiaens third, burning to avenge the withdrawal of his teammate. At 30 miles Resta swept into the lead and the spectators sent up a ringing cheer as he passed Aitken but the order was reversed five laps later when Aitken again swung into front position, Christiaens still hanging to third with bull-dog tenacity.

Passing Resta, Christiaens came into second place and for the next ten laps there was a thrilling struggle for supremacy between the dark, slender Peugeot of Aitken and the flashing nickeled Sunbeam of the Belgian. At the thirtieth lap Aitken had only a small margin of lead which he increased slightly by the time the 70-mile mark was reached, the other cars maintaining the same position.



Speed chart in miles per hour of the ten prize winners in the Astor Cup race at 50-mile intervals

Back in the field most of the cars had been lapped by the three leaders before the fortieth lap was over and there were evidences that the tremendous pace was telling as car after car dropped out at the pits, until the 100-mile mark drew near only twenty-two of the thirty-one starters were still circling the echoing speed saucer.

One of the biggest thrills of the race came in the forty-ninth lap when Resta's car was seen to falter and slow down as it sped out of the homestretch into the bank. Occupants of the stands and the bleachers rose to their feet in one great wave, pointing toward the back stretch where the Peugeot had drawn up beside the inner railing. A babel of exclamations and excited inquiries broke out and swelled in volume as the red fire truck swayed across the rough ground of the infield followed by a stream of spectators in cars and on foot. It developed that a broken intake valve had put the quietus on Resta's hope that the bad fortune which has followed him on the Sheepshead speedway would not prevail this year. In stopping, a small blaze broke out which caused an alarm of fire but driver and mechanic quickly smothered it.

As the news that Resta was out of the race spread through the stands a new cause for excitement developed when it was seen that Christiaens' Sunbeam, then in second position and battling with Aitken for the lead, had slowed up and come to a stop almost beside Resta's car on the very next lap of the track. A broken connecting-rod was responsible and after the other cars had made many laps the two unfortunates appeared around the bend leading to the homestretch pushed by drivers and mechanics in a mournful procession to the pits.

Aitken was now far in the lead and the only cars that seemed likely to challenge him for that position were the two

Time and Speed Every 50 Miles of Finishers in Astor Cup Race

Position	Car	Driver	50 MILES		100 MILES		150 MILES		200 MILES		250 MILES	
			Time	Miles per Hour	Time	Miles per Hour	Time	Miles per Hour	Time	Miles per Hour	Time	Miles per Hour
1	Peugeot	Aitken	0:28:31.15	105.15	0:57:15.00	101.7	1:26:58.00	103.5	1:55:23.00	101.0	2:23:04.03	104.83
2	Maxwell	Rickenbacher	0:29:15.00	102.6	0:58:19.00	102.9	1:27:49.00	102.4	1:56:19.00	103.2	2:24:19.54	103.90
3	Hudson	Vail	0:29:44.00	100.8	0:59:11.00	101.4	1:30:31.00	99.5	2:01:51.00	98.4	2:34:01.00	97.4
4	Delage	LeCain	0:30:34.00	98.2	1:00:31.00	99.1	1:30:53.00	99.2	1:59:52.00	100.1	2:31:42.21	97.0
5	Mercer	Pullen	0:35:51.00	83.7	1:01:25.00	93.2	1:36:48.00	92.9	2:05:43.00	95.5	2:37:26.00	95.2
6	Crawford	Klein	0:31:00.00	96.8	1:01:51.00	97.0	1:33:10.00	96.6	2:01:47.00	96.2	2:38:01.00	94.8
7	Delage	Devigne	0:32:19.00	92.9	1:03:53.00	93.9	1:35:31.00	94.2	2:05:40.00	95.5	2:38:31.00	94.6
8	Duesenberg	Mulford	0:32:13.00	93.1	1:01:33.00	97.4	1:37:43.00	90.6	2:09:51.00	92.4	2:42:02.38	92.3
9	Hoskins	Hughes	0:30:01.00	99.8	1:06:41.00	90.0	1:39:59.00	90.0	2:10:22.00	92.0	2:42:56.15	92.1
10	Duesenberg	Milton	0:32:40.00	91.8	1:01:58.00	92.4	1:38:46.00	91.2	2:11:48.00	91.1	2:45:36.90	90.6
11	Pugh*	Meyer	.....	.....	.....	.....	.....	.....	.....	.....	2:47:11.65	89.9
12	Adams*	Adams	.....	.....	.....	.....	.....	.....	.....	.....	2:55:06.07	85.8
13	Crawford*	D'Alene	.....	.....	.....	.....	.....	.....	.....	.....	3:04:01.90	81.7
14	Ogren*	Burt	.....	.....	.....	.....	.....	.....	.....	.....	3:06:20.52	80.5

*Only finish times available.

A view down the homestretch of the Sheepshead Bay speedway during the Astor Cup race, showing the grandstand crowd and the front of the pits. The police and members of the technical committee kept this space clear

Maxwells, the Hudson and the Duesenberg, which were having many fascinating speed brushes on the turns and straightaways as they fought for the privilege of passing the Peugeot. Lewis' and Galvin's Premiers and Wilcox's Peugeot had been forced to give up the race because of burned-out bearings. A broken connecting-rod had disposed of Henning's Ogren and a leaking intake was responsible for the elimination of McBride's Olsen.

After the Sunbeam had been put out of the running Richenbacher and Henderson took second and third positions and alternated in this order for a good part of the balance of the race. Mulford's Duesenberg was leading Vail in the Hudson with Milton's Duesenberg trailing.

The only accident of the day occurred on the sixty-first lap when Ruckstell's Mercer blew a tire at the top of the bank on the turn running into the homestretch and tumbled to the bottom of the slope, with driver and mechanician trapped in the seat. Ambulances, physicians, race officials and the fire truck hurried to the spot where a cloud of dust surrounded the wrecked racer. A cheer of relief went up from the spectators, all of whom had risen to their feet as the yellow car hurtled across the track, when they saw Ruckstell and his mechanic, Quicksell, crawl from beneath the overturned machine and rise to their feet. The only injuries sustained, it developed, were a few bruises by Ruckstell and a sprained shoulder by his mechanic.

Ruckstell crawling from beneath his overturned Mercer after it tumbled headlong down the steep, high incline

During this time Aitken had been increasing his lead, being nearly 2 min. ahead of the record for the distance at the 150-mile mark. Henderson's Maxwell was in second position at this stage of the race with Rickenbacher close behind fol-

Start of the Astor Cup race with thirty-one cars ready for the battle of speed. Note empty seats in stand, many spectators arriving late

Photographs by International Film Service

A lively brush. The cars are, left to right, Aitken's Peugeot; Moore's Crawford; Christiaens' Sunbeam; Klein's Crawford; Resta's Peugeot, and Henderson's Maxwell. Speed is indicated by position on bank

Resta pushing his disabled Peugeot to the pits. Christiaens was close behind him with the silenced Sunbeam

lowed by Mulford, Klein in the Crawford, Vail in the Hudson and Milton's Duesenberg. This order continued lap after lap. At the end of the eighty-fifth lap Aitken had averaged 104.1 m.p.h., Henderson's Maxwell was still second but Milton's Duesenberg had taken the third position from Rickenbacher. It was now 4:15 and a number of the spectators, evidently considering the race won by Aitken, began to leave the stand. The great majority, however, continued to watch the speeding cars with intense interest.

At 200 miles Aitken had lifted his average speed to 105.75 m.p.h. Henderson was still second having covered 196 miles while Rickenbacher and Mulford were in the same lap. Milton was in fifth position at this point with Vail sixth, LeCain seventh and Pullen eighth. Aitken's time was 1:53:25.55 for the 200 miles or nearly 3 min. ahead of the record made in last year's Astor Cup race when the distance was negotiated in 1:56:21.40.

Henderson's Maxwell went out just after the 210th mile because of engine trouble, leaving Rickenbacher to overtake Aitken. This he tried in vain to do as the Peugeot driver was safely ensconced in first position and his car was running as smoothly as at the start of the race.

Vail in the Hudson did some sensational driving, during the 6 miles following the passing of the 150-mile mark, which probably enabled him to finish in third position. He had been close behind the leaders but apparently had not tried to maintain the high speed which had characterized them. At this point, however, he deliberately set out to win a place among the cars in the van. His Hudson shot forward as though suddenly unleashed and rapidly overhauled the cars between him and the

Aitken winning the 250-mile Astor Cup race after breaking the world's record for the distance. Note how the stand has filled up since the start

Photographs by International Film Service

leaders, passing first Klein in the Crawford and then Mulford in the Duesenberg. After a bitter battle he succeeded in passing Rickenbacher, his spurt placing him in third position with only Aitken and Henderson ahead of him. By the time the 200-mile mark had been reached, however, Rickenbacher again shot ahead of Vail and settled into second place when Henderson went out at the 210th mile, with Vail third.

When the uncertainty which clouded the order of finish of the other cars had been cleared away, LeCain's Delage was found to be in fourth position with Pullen's Mercer fifth, Klein's Crawford sixth, Devigne's Delage seventh, Mulford's Duesenberg eighth, followed by Hughes' Hoskins, Milton's Duesenberg, Meyer's Pugh, Adams' Adams Special. D'Alene's Crawford and Burt's Ogren, in the order named.

Some difficulty was experienced with the scoreboard early in the race owing to the failure of the electrical apparatus but the board was put in partial operation later in the race so that the positions of the leading cars were available. As the race neared its close spectators broke away from the restraining guards and ran across the track in the path of the speeding cars, seemingly reckless risk.

A temporary diversion, which, however, might have been the cause of an accident, occurred during the first 100 miles when a number of toy balloons were seen bouncing and floating along the track in front of the grandstand, threatening to fly into the faces of the speeding drivers. Starter Wagner darted onto the track during intervals between passing of the cars and captured the roving spheres, greatly to the amusement of the spectators.

Precautions against fire at the track were very thorough, many of the cars carrying J-M and Pyrene fire extinguishers, while in addition the H. W. Johns-Manville Co. stationed a squad of fifty men equipped with its extinguishers at various points around the track.

Pit Work a Minor Factor

THE limited amount of tire changing in the Astor Cup race did not permit of much comment on the training in this direction, as practically in all cases the change went through smoothly and did not occur at a vital period in the race. In locating the cause of trouble a little uncertainty could be noticed among the drivers where mechanical failures had occurred. For instance, where one of the cars had come into the pits with engine trouble the mechanic and driver labored for some time trying to start the engine after it could be seen that every revolution of the starting crank caused a puff of steam to jet from the radiator. This plainly showed that there was a breakdown between the cylinder and the water-jacket space and the case was hopeless, but still the driver and mechanic labored on.

Eight Broken Connecting-Rods

There were forty-five stops made at the pits. Of this number nine were permanent, and there were other cars which went out that did not reach the pits. Most notable of these were Resta and Christiaens who went out on the backstretch almost simultaneously when running even and well up in the lead. Of the cars that went out, broken connecting-rods take the lead as a cause of trouble, eliminating eight.

Owing to the cool weather and the shorter distance tire troubles were comparatively few. Pullen in his Mercer car had more trouble in this direction than all the other thirty-one starters put together, as he changed five tires while no one else changed more than one, and in fact there were only three other tire changes, by Vail in the Hudson, Klein in the Crawford, and Gable, of the Erbes team. None of the tires were blown or thrown in this race, and there was a notable improvement in the manner in which the treads clung to the tire body as there was not one case of separation; whereas the principal cause of tire failure in the races of last year was the tearing off of the tread.

Oil Supply a Problem

The regulation of the oil supply continues to be the stumbling block for many drivers. Eleven times drivers drew up to the pits either to change or clean plugs. Adams, in the car bearing his own name, was the leader of the spark plug changers as he had three stops on this account. Carbureter adjustments were made by Mulford on the Deusenberg, on Chandler's Crawford and on the Ogren.

Probably the most interesting stop was made by Henning's Ogren for engine trouble, a careful inspection showed all the mechanism to be in good order. On cranking the engine, however, there was no suction through the carbureter and finally a blow-hole was located in the intake manifold. This was sealed with shellac and tape but the temporary repair could not stand the vibration and heat and consequently the car had to be withdrawn.

PIT STOPS IN THE ASTOR CUP RACE

Car	Driver	Cause of Stop	Duration of Stop
Mercer	Pullen	Right front tire	20 sec.
		Change spark plugs	4 min.
		Right rear, gas, oil	1 min. 15 sec.
		Right front tire	35 sec.
		Right front, left rear, oil	1 min. 32 sec.
Hudson	Vail	Right rear tire	20 sec.
Duesenberg	Mulford	Broken air line	9 min.
		Adjusting carbureter	2 min.
Crawford	Klein	Right front, gas	1 min. 31 sec.
Crawford	Chandler	Adjusted carbureter	30 sec.
		Adjusted carbureter	2 min.
		Repaired air line	9 min.
		Repaired air line	1 min. 30 sec.
Mercer	Ruckstell	Paper from radiator	30 sec.
		Water, gas, spark plug	13 min.
Maxwell	Henderson	Out—broken rod	
Premier	Galvin	Out—broken rod	
Delage	LeCain	Inspections	55 sec.
Dans L'Argent	Muller	Change two plugs	2 min.
		Clean plugs	4 min.
		Out—broken rod	
Peugeot	Wilcox	Out—broken rod	
Duesenberg	Buzane	Out—broken wristpin	
Premier	Lewis	Out—burned out rod	
Duesenberg	Devlin	Adjusted brakes and ignition	5 min.
		Change plugs	3 min.
Adams	Adams	Inspected plugs	1 min.
		Change two plugs	2 min.
		Change plugs	3 min.
Hoskins	Hughes	Trouble not determined	3 min.
Erbes	Gable	Slipping clutch	3 min.
		Slipping clutch	5 min.
		Consultation	30 sec.
		Plugs and inspection, gas, left rear	25 min.
Duluth	Rawlins	Engine inspection	Out of race
Crawford	Moore	Change plugs	1 min.
		Change plugs	6 min.
		Out—burned out rod	
Ogren	Henning	Leaky manifold	14 min.
		Out—leaky manifold	
Olsen	McBride	Out—burned out rod	
Olsen	Watson	Oil leak	2 min.
		Change plugs, oil leak	11 min.
		Change plugs	10 min.
Pugh	Meyer	Gasoline	1 min. 30 sec.
Ogren	Burt	Adjusted carbureter	2 min.

Preparedness Is Race's Lesson

Few Engineering Lessons Found in Analysis of Troubles —Many Old Causes of Failure Now Seem Conquered

A HIGH-SPEED racing car is always working just on the edge of failure. The reciprocating parts and the the lubrication especially are liable to fail at any instant; the factor of safety is somewhere down in the decimal points. This being so the failure of a part like a valve or connecting-rod is not to be laid at the door of its designer; the explanation why one rod in four broke and not the other three is probably to be found in some trifling difference in the homogeneity of the steel.

In the Astor Cup race nothing new transpired that is of important to engineers, the big, striking thing was the wonderful showing made by the tires. The engineering of the racing cars is just about what it was a year ago or more, the quality of the tires is ten times as good at least. Not only has their durability and sheer strength been increased, but their average of performance is much more nearly even. Loose treads seem a thing of the past. This means much for the ordinary car user in the ultimate analysis, for it means that we shall soon have tires at least twice as good as those we have to-day.

Importance of Being Ready

In the mechanical preparation for first class events there has been great improvement in the past 2 years, but there is still room for plenty more. The leading racing teams seldom lose a car except from the actual breaking of an important part. The lesser lights of the speedways usually retire by reason of something they could have prevented easily. If some part breaks it is perhaps ill luck, if some part comes loose it is surely carelessness and nothing else. The spark plug trouble has been cured entirely from the plug maker's viewpoint. It is rarely now that plugs fail except where they do so through too much oil reaching them. If they flood and soot it means that the driver did not take proper precautions in setting his lubrication system.

The running of Vail's Hudson is a paramount example of what can be attained by *work*, by making sure of everything. Some of the cars built individually by their drivers are similar monuments to the genius expressible by the taking of infinite pains. On the other hand, a job hastily assembled will almost always give trouble and will seldom stay the course. To-day any good mechanic can build himself a racing car which will win prizes. He can buy stock engines which will give all the power necessary, he can get axles and frames which are suitable for the job. Such a car is not likely to win first place in an important event, but it can be sure of finishing at a good speed, if it is got ready carefully enough. To manufacture racing cars would be impossible; to build them calls for nothing more than patience and thoroughness in detail.

It is a pity that interest in a race centers so much around the winner. For really sporting competition the struggles between the men who take places from the fifth downwards are an enthralling spectacle to watch. There will always be comparatively few cars standing right at the top of the tree, but we could build any number that would make close seconds. At the present moment a car that will average 100 m.p.h. is difficult to create, but one which will average 95 is fairly easy to build. For every car in the 100 class we could have fifty in the 95 m.p.h. bunch.

Of course it is always working upward. In a year or two we shall have the front rank cars averaging 115 miles or better, but by then the second rankers will have moved up a bit. If American speedway racing can be arranged so as to provoke keen contests between cars of approximately equal speed ability we could do without the front rank cars.

Specifications and Details of Equipment of Cars in the 250-Mile Astor Trophy Race

Car	Driver	Bore	Stroke	Disp.	Carb.	Ignition	Plugs	No. of Plugs	No. Valves	Valve Location	Tires	Wheelbase	Wheels	Pistons	Oil
Peugeot	Aitken	3.65	6.65	274	Zenith	Bosch	K L G	4	16	Head	Goodyear	105	R-W	Levett	Oilzum
Maxwell	Rickenbacher	3.75	6.75	298.2	Miller	Bosch	K L G	4	16	Head	Silvertown	106	Houk	Levett	Oilzum
Hudson*	Vail	3.50	5.00	288.6	Hudson	Delco	Rajah	6	12	Side	Silvertown	104	R-W	Levett	Veedol
Delage	LeCain	3.63	6.75	286.0	Miller	Bosch	K L G	4	16	Head	Silvertown	106	R-W	Levett	Oilzum
Mercer	Pullen	3.87	6.37	300.7	Zenith	Bosch	Rajah	8	16	Head	Silvertown	108	R-W	Aluminum	Oilzum
Crawford	Klein	3.75	6.75	298.2	Miller	Bosch	Rajah	8	16	Hor. in head	Silvertown	106	R-W	Levett	Oilzum
Delage	Devigne	3.63	6.75	286.0	Miller	Bosch	K L G	4	16	Head	Silvertown	106	R-W	Alloynum	Oilzum
Duesenberg	Mulford	3.75	6.75	298.2	Miller	Bosch	Rajah	8	16	Head	Silvertown	106	R-W	Levett	Oilzum
Hoskins	Hughes	3.75	6.75	298.2	Miller	Bosch	Rajah	8	16	Hor. in head	Silvertown	105	R-W	Aluminum	Mobiloil
Duesenberg	Milton	3.75	6.75	298.2	Miller	Bosch	Rajah	8	16	Head	Silvertown	106	R-W	Levett	Oilzum
Pugh	Meyer	3.75	6.75	298.2	Master	Bosch	Rajah	8	8	Hor. in head	Silvertown	108	Houk	Aluminum	Oilzum
Adams Sp	Adams	3.75	6.75	298.2	Master	Bosch	A. C.	8	16	Hor. in head	Silvertown	100	R-W	Aluminum	Oilzum
Crawford	D'Alene	3.75	6.75	298.2	Miller	Bosch	Rajah	8	16	Hor. in head	Silvertown	106	R-W	Levett	Oilzum
Ogren	Burt	3.75	6.75	298.2	Miller	Bosch	Rajah	8	8	Hor. in head	Silvertown	105	Houk	Levett	Castor
Dans L'Argent*	Muller	3.5	5.00	288.6	Hudson	Delco	Rajah	6	12	Side	Silvertown	103	R-W	Cast Iron	Oilzum
Maxwell	Henderson	3.75	6.75	298.2	Miller	Bosch	K L G	4	16	Head	Silvertown	106	Houk	Levett	Oilzum
Sunbeam*	Chevrolet	3.28	6.14	294.2	Claudel	Bosch	K L G	6	24	Head	Silvertown	113	R-W	Levett	Castor
Sunbeam*	Christiaens	3.28	6.14	294.2	Miller	Bosch	K L G	6	24	Head	Silvertown	113	R-W	Levett	Castor
Duesenberg	Devlin	3.75	6.75	298.2	Miller	Bosch	Rajah	8	16	Hor. in head	Silvertown	106	R-W	Levett	Mobiloil
Duesenberg	Buzane	3.75	6.75	298.2	Miller	Bosch	Rajah	8	8	Hor. in head	Silvertown	104	R-W	Levett	Oilzum
Erbes	Gable	3.63	7.19	298.3	Miller	Bosch	K L G	4	16	Head	Silvertown	98	R-W	Alloynum	Castor
Crawford	Moore	3.75	6.75	298.2	Miller	Bosch	Rajah	8	16	Hor. in head	Silvertown	106	R-W	Levett	Oilzum
Mercer	Ruckstell	3.87	6.37	300.7	Zenith	Bosch	Rajah	8	16	Head	Silvertown	108	R-W	Aluminum	Oilzum
Peugeot	Resta	3.66	6.65	275.0	Miller	Bosch	K L G	4	16	Head	Silvertown	100	R-W	Levett	Oilzum
Ogren	Henning	3.63	7.00	292.0	Miller	Bosch	Rajah	8	16	Head	Silvertown	106	Houk	Alloynum	Castor
Premier	Lewis	3.65	6.63	274.5	Miller	Bosch	K L G	4	16	Head	Goodyear	105	R-W	Levett	Oilzum
Premier	Galvin	3.65	6.63	274.5	Miller	Bosch	K L G	4	16	Head	Goodyear	105	R-W	Aluminum	Oilzum
Olsen	McBride	4.34	5.00	295.0	H & N	Bosch	Rajah	8	16	Hor. in head	Silvertown	108	R-W	Aluminum	Oilzum
Olsen	Watson	3.75	6.75	298.2	Miller	Bosch	Rajah	8	16	Head	Goodyear	108	R-W	Aluminum	Oilzum
Peugeot	Wilcox	3.65	6.65	274.0	Zenith	Bosch	K L G	4	16	Head	Goodyear	105	R-W	Levett	Oilzum
W. Duluth	Rawlings	3.75	6.75	298.2	Miller	Bosch	A. C.	8	16	Head	Silvertown	106	R-W	Levett	Mobiloil

NOTE—All cars four-cylinder, except those marked (*). All cars equipped with Hartford shock absorbers and Boyce Moto-Meter.

The Awakening of Russia

Five Factories To Produce 7500 Cars and Trucks for Government — Roads and Car Markets

The author, Nicolas Kouznetzoff, at the wheel of the first Overland car to be brought to Russia. It was taken there in 1909. The illustration gives an idea of the quality of roads in Finland, these being generally bad, sandy and rocky

¶EDITOR'S NOTE.—*Nicolas Kouznetzoff, civil engineer, of Petrograd, and president of the Technical Committee of the Automobile Club of Petrograd, is on his second visit to the U. S. A., where he has been sent to investigate the farm tractor and motor truck industry. He was here less than a year ago on his first visit when he acquainted himself with the leading automobile factories and reported to his country on the development of the industry in the U. S. A. He has been closely connected with all of the engineering and sporting phases of the automobile industry in Russia.*

ONE result of the European war upon Russia is that the country has already started to develop the manufacture of automobiles. Previous to the war little automobile manufacture was carried on in Russia, the majority of the machines coming from Germany, France, Italy and England, all of which concerns built colonial type models to meet the requirements of rough Russian roads. The war has demonstrated to Russia how necessary it is to have automobile factories, and five new factories have already been started, the government being largely responsible for this activity. According to government arrangements, these five factories must produce 7500 motor trucks and automobiles in a given time, this meaning a production of 1500 vehicles each. The minister of war has already placed orders with these five factories for all of this output.

The new car factories which have been started are as follows:

Axaj Co., Rostov-on-Don.
V. Lebedev Co. of Jaroslav.
Russian Reno Co. of Rybinsk.
Riabushinsky & Kouznetzoff Co. of Moscow.
Russo-Baltic Car Works of Moscow.

The automobiles to be manufactured by these concerns will be almost entirely of Russian make, and only a few of the necessary parts not yet manufactured in Russia are permitted to be imported, for instance, magnetos, spark plugs, ball bearings. In order to enable the above mentioned factories to attend to their orders, a number of auxiliary plants are being established in Russia for the purpose of manufacturing different automobile supplies. Every one of the above factories has adopted some foreign type of an automobile to be used as a model, with the exception of the Russo-Baltic Works, which are going to build their own type of an automobile, and which have been supplying the entire Russian market for a number of years with automobiles.

The Reno factory is going to build the French model.

Riabushinsky & Kouznetzoff are going to follow the Italian plan of Fiat.

Lebedev is going to build after the drawings of the English works of Crossley.

The Axaj works have not decided as yet what they are going to manufacture. All of the works mentioned above are erecting their buildings at present, and some of them are already beginning to equip their factories. Some of the factories have sent their representatives to America, authorizing them

Upper—White touring car with special gasoline tank for war purposes. This car goes everywhere, being a flying car for all sorts of emergencies at the front
Lower—Mobile tractor used by the Russian army in typical hauling service. It is drawing four heavy guns

Map of Russia in Europe, showing the cities which give most promise of some day becoming the leading automobile cities of the empire. The heavy lines radiating from Moscow and Petrograd indicate roads which are largely used for automobile travel at the present time. Another road connects Sebastopol and Sukhum Kale. Russia is a country of vast distances, huge forests and great plains, called steppes, large areas also being covered by impenetrable swamps. These conditions have been largely responsible for Russia's backwardness in automobile development

to order and purchase the necessary equipment for the new factories to make production possible.

Central Part Is Best Field

Russia is a country of great distances, of great agricultural areas and great forest areas. That part most favored for automobile use is in the central vicinity surrounding Moscow and in the large agricultural areas extending in all directions from the south of Moscow. When you get within 200 miles of the Black Sea the country becomes sandy and is not so favorable for motor car use.

Naturally, the cars will be used more in the large cities, which are at present well stocked with European models. Good roads radiate from the cities. From Petrograd to Moscow, 450 miles, the distance can be covered in 2 days easily. In a race it was covered in 9 hr. and 20 min., or 48 m.p.h. When touring it is customary to stop at the small town of Vishni Volotchok, which is a midway point. The country be-

tween Petrograd and Moscow is largely covered with forest.

From Petrograd to Helsingfors in Finland there is a good macadam road and the 275-mile trip can be made in 8 hr. Helsingfors has a population of 200,000 and about 3000 automobiles and trucks.

From Petrograd to Pskov, which is in the direction of Austria-Hungary, there is a good macadam road, making an 8-hr. trip between the two cities. From Pskov to Riga there is a good road. Riga was the home of the biggest Russian tire factory, Prowodnik, which soon after the outbreak of the war was moved to Moscow, where only recently the manufacture of tires has been commenced in the new factory.

Very recently an automobile test has been started from Petrograd to Archangel, the port on the White Sea. The road leads by way of Petrozavodsk on Lake Onega.

Good Roads from Moscow

More good automobile roads radiate from Moscow, which is centrally located, than from Petrograd. Leading to the south are good highways to Kiev, to Kharkov, and to Saratov.

That part of Russia lying to the north and east of Moscow is generally covered with great forests and the use of automobiles is very limited.

There are some good roads in the southern part of the country, one in particular leading from Sebastopol on the Crimea, the center of the Crimean war of 70 years ago, to the east. This road is very scenic and leads as far as Sukhum-kale on the eastern end of the Black Sea.

Perhaps the best roads in all of Russia are to be found in Poland, which is now in the hands of the Germans.

There will doubtless be a good market for motor cars among the wealthy farmers of Russia. The farming class roughly divides itself into large farmers, known as Pameshik, and the small farmer, known as Mujik, only a little over 12 per cent of the population being urban in European Russia. The former is a large landowner who can afford to buy several motor cars and many farm tractors. They have huge areas of land, some estates being as large as some of the smaller States in the U. S. A.

The Russian government has already realized the necessity of motor power on farms and has ordered twenty-three different makes of American farm tractors. These are the latest types and the Russian minister of agriculture has purchased them with the object of studying the tractor situation. Undoubtedly these will be but the forerunner of large orders of U. S. A. tractors. It is not impossible to conceive the time when factories will be started in Russia under government stimulation to build farm tractors.

To Popularize Tractors

In order to popularize tractors with Russian farmers the Russian minister of agriculture is at present planning to form ten special tractor squads, whose duty will be to demonstrate tractors to Russian farmers in different sections. Each squad will have five tractors at his disposal. In order that these demonstrations may be successful and that the tractors will be well handled, the government is organizing special classes for teaching the mechanics of tractors. It is a part of the plan to purchase 300 tractors during the coming year.

Besides agricultural tractors the ministry of war is specially interested in all kinds of tractors used for the purpose of transporting artillery loads. During the present war the tractors have proved to be invaluable and have already replaced the work done by horses in a number of branches of industry.

For the last 2 years, due to the war, Russia, being an agricultural country, is suffering a shortage of laborers and especially horses for all kinds of agricultural work. The lack of horses and of the possibility of getting them 4 years ago raised the question of finding new methods of agricultural work. The only way out of the critical situation is the introduction of tractors which will play an exceedingly important part as a substitute for horsepower.

There are about 20,000 miles of State road in Russia and approximately 475,000 miles of country road. The State roads are distributed among the various provinces as follows:

Province	Miles
Moscow	1500
Petrograd	1200
Warsaw	1100
Grodno	1000
Tiflis	1000
Ekaterinoslav	950
Volhynia	800
Piotrkow	700
Tavrichevsky	650

In all the other provinces combined there are less than 600 miles of State roads.

Russia produces annually 200,000 tons of gasoline and 1,400,000 tons of kerosene. Before the beginning of the war gasoline sold for 23 to 33 cents per gallon, depending upon the quality, but now the price ranges from 30 to 45 cents per gallon. Kerosene has also advanced in price 2 cents per gallon, selling at 10 cents now as compared with 8 cents at the time when Russia entered the war.

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189,610 Cars Registered in 58 California Counties in 6 Months

SACRAMENTO, CAL., Sept. 30—Registration of 189,610 cars and 1254 automobile dealers has been reported for the first 6 months of 1916 by the fifty-eight counties of this State, including sixty-one non-resident cars. This is the first detailed report made by the counties. The statistics, including cars, motorcycles, chauffeurs and dealers, follow:

County	Cars	Motorcycles	Chauffeurs	Car Dealers
Alameda	13,311	1,948	547	60
Alpine	12	...	...	..
Amador	352	23	17	2
Butte	1,640	241	42	12
Calaveras	318	27	17	2
Colusa	638	77	49	8
Contra Costa	1,627	353	65	10
Del Norte	117	8	8	2
El Dorado	262	16	11	3
Fresno	7,466	1,352	136	42
Glenn	693	78	15	6
Humboldt	1,432	256	178	23
Imperial	2,262	115	102	15
Inyo	342	6	6	1
Kern	4,414	566	193	20
Kings	1,383	119	13	10
Lake	268	20	27	3
Lassen	307	16	11	1
Los Angeles	61,137	8,012	3,001	350
Madera	539	101	34	4
Marin	1,028	109	81	7
Mariposa	133	4	34	..
Mendocino	796	51	29	8
Merced	1,106	181	17	15
Modoc	302	13	18	5
Mono	17	...	1	..
Monterey	1,418	199	87	12
Napa	984	143	70	13
Nevada	396	33	13	1
Orange	5,410	917	129	35
Placer	759	79	42	6
Plumas	216	12	13	1
Riverside	3,251	706	111	23
Sacramento	5,372	819	350	32
San Benito	520	92	29	6
San Bernardino	5,215	1,114	192	43
San Diego	7,544	965	491	70
San Francisco	20,457	1,826	2,675	115
San Joaquin	4,494	849	131	34
San Luis Obispo	1,267	121	72	12
San Mateo	1,686	288	143	8
Santa Barbara	3,157	328	266	31
Santa Clara	6,186	1,227	183	40
Santa Cruz	1,404	182	42	20
Shasta	497	62	9	5
Sierra	80	4	7	2
Siskiyou	756	42	28	5
Solano	1,268	208	72	12
Sonoma	2,976	347	110	29
Stanislaus	2,965	447	52	25
Sutter	497	58	11	1
Tehama	641	121	17	..
Trinity	57	3	9	3
Tulare	3,780	602	42	26
Tuolumne	447	22	13	3
Ventura	2,098	184	57	17
Yolo	1,299	179	32	8
Yuba	550	64	35	3
Outside	61	6	2	..
Total	189,610	25,935	10,191	1,254

Above — A White Red Cross ambulance in the service of the Russian army drawn up in company with two White touring cars and several Opels used by officers. The White touring cars are to the left of the ambulance

Above—A line-up of automobiles requisitioned by the Russian army authorities for war service. They are a heterogeneous lot, comprising everything from light touring car chassis to heavy motor trucks. Most of them, however, are medium weight chassis. All have been fitted with army bodies

Above — A Delaunay-Belleville touring car mounted on a freight car on its way to the front for service with the Russian army

Right — An armored car which was one of several captured by the Russians from the Germans. Note the steel wheels and heavy armor plating, the latter protecting both rear wheels. A machine gun is carried in the revolving turret

Engineers To Specify Ideal Truck

S. A. E. Committee Drafting Specifications for Nominal 1½-Ton Truck Making for Ideal Without Regard to Current Practice of Manufacturers—Specification Will Be Submitted for Criticism to All Interested

By A. Ludlow Clayden
Chairman S. A. E. Standards Committee

THERE are two ways an army can buy trucks. One is to draft a specification which covers a few essentials but is not so rigid that it will not permit the purchase of existing trucks. This is good for war time or when there is a hurry call for vehicles.

The other, and the better way, is to get an ideal specification with close definition on everything that affects interchangeability and with latitude on non-essentials only. To say to the industry "this is what an army truck should be, and if you like to build a truck on these lines you will have no changes to make if an army order is out for bids."

This was done by Great Britain some years ago. A committee of engineers was appointed and they specified certain parts very accurately. Many different truck makers started building trucks which fitted the specification, trucks different in many respects yet as one in some vital points. War proved that the British scheme did not go far enough in some ways, and that some of the things insisted upon were not important. The scheme will be revised after the war. Meanwhile the S. A. E. through its truck standards division and its members generally is drafting a specification which might be entitled "the American engineers ideal army truck."

Ideal Army Truck

A recent meeting or two held to discuss an army specification showed that the building up of an ideal specification would be a long job. It also showed that a specification drawn so widely as to admit many standard trucks as now built was of little use. It was for this reason that the society took up the task of making an ideal specification. It is impossible to say to what use the specification may be put. It may never be used or it may be used extensively. The immediate object of the society is to have the truck engineers of America go on record as to what they think an army truck should be. As to what parts of the design need rigid specification and what parts can be left to the individual manufacturer.

To get a start H. D. Church, chairman of the truck standards division and chief engineer of the truck department of the Packard Motor Car Co. drafted his idea of a specification; which is noteworthy in that many of its provisions call for things which are not Packard practice. This specification was, on Sept. 28, discussed by the truck standards committee and some changes were made here and there.

There are to be many more meetings. While the committee are working they will enlist the help of the whole industry. They will seek criticism and advice from any truck man who will study the specification carefully and write a letter or come to a meeting.

One thing is to be remembered above all others. Nobody who has begun work on this specification has any axe to grind. The specification will not fit any existing truck. If anyone wants ultimately to build one to fit it they will have to start from the ground up.

The following pages contain the specification as put up for criticism after the first meeting of the truck standards division. Before the society feel that agreement is close enough to call it a really ideal specification it will no doubt be altered in many respects from what it is now. *At present it is to be regarded only as a groundwork, as a foundation upon which the specification for the ideal army truck can be built.*

Tentative Standard Specifications for 1½-Ton Capacity Gasoline Military Motor Trucks

1. The number of trucks required will be stated in the "Instructions to Bidders," issued by the Purchasing Quartermaster. The prices quoted will be f.o.b. factory, and the truck must be complete in every respect, and in proper operating condition.

2. *Manufacturers:* Each bidder must submit a complete list of manufacturers and location of factories furnishing any part, either finished or unfinished, assembly, or accessory, which is used in the construction of the trucks, and not made in the factory where the trucks are constructed. This shall not be construed as including bar or sheet stock or structural material. If this information is not given, the proposal may be rejected, or in case the proposal is accepted, the Quartermaster Corps reserves the right to name the manufacturer and select the material, apparatus, parts, or accessories, and no others will be substituted for those named.

3. *Employment of Convict Labor:* In the performance of work herein specified the contractor shall not, directly or indirectly, employ any person undergoing sentence of imprisonment at hard labor, which may have been imposed by a court of any State, territory, or municipality having jurisdiction, nor permit such employment of any person furnishing labor or material to said contractor in fulfillment of this agreement.

4. *Patents:* The contractor shall for all time secure to the government the free and undisputed right to use any and all patented articles used in the work, and shall defend at his own expense any and all suits for infringement of any patent or patents, and in case of adverse claims under patents, the contractor shall pay all awards.

5. *Interchangeability of Parts:* All parts of trucks must be constructed to definite standard dimensions, and proper tolerances, so that any part of same may be replaced and properly fitted and adjusted without requiring additional tool work or machine work on the parts.

6. *Materials:* A complete list of all materials used in the construction of the various parts of the truck must be given,

together with the chemical composition, and physical properties of same.

7. *Drawings and Data:* Each bidder will be required to submit complete dimensioned detail and assembly drawings, showing the size and construction of every part of the truck. These drawings must show the shop limits on all parts, and a reference number or letter referred to the list of materials, physical properties, and heat treatment, which list will also be submitted with the proposal. The drawings must be arranged in proper order for filing, and provided with a suitable index which will enable any individual drawing to be readily located. The drawings and data above referred to will not be opened publicly with the proposals, but will be considered confidential. The drawings and data may be submitted direct to the Quartermaster General, Washington, D. C., and should be referred to in each proposal which is submitted.

8. If the drawings and data herein required are on file in the office of the Quartermaster General, they need not again be submitted with the proposal. If any major changes have been made in the construction of the truck, materials used, or methods of heat treatment since the drawings and data were submitted, details of those changes should be submitted with the proposal.

Service Station Data

9. *Service Stations:* Complete information regarding the location of all service stations, the floor area of each station, and the number of men employed in each service station, should be submitted with the proposal.

10. *Departure from Specification Requirements:* In case the vehicle on which proposal is submitted does not comply with these specifications, in every particular, the bidder must state definitely in what particulars the vehicle which he proposed to furnish does not comply with specification requirements.

11. *Guarantee:* Each bidder will be required to guarantee his vehicle or vehicles against defects in material or workmanship for a period of one year. This guarantee shall include the delivery of the defective part or parts to any point in the United States. After the installation of the new part, the defective part will be returned to the manufacturer if he so requests. The manufacturer will pay the transportation charges on all returned parts.

12. *Load Capacity:* The normal load capacity above the chassis, including body, shall be 4480 lb. The maximum load capacity above the chassis, including body, shall be 5080 lb.

14 M.P.H. Maximum Speed

13. *Road Speed:* The maximum road speed shall be 14 m.p.h., obtained by maximum motor piston speed on high gear of 1100 ft. per min., limited by governor.

14. *Engine:* Engine shall be located in front, under a hood, and shall be of the four-cylinder vertical type, with a piston displacement of not less than 300 cu. in.

Mechanically operated interchangeable poppet valves are to be used. Valve stems and springs are to be completely enclosed by dust and oil-proof covers which must be readily removable.

Crankshaft must have not less than three main bearings.

Circulating Lubrication

Lubrication must be circulatory, with at least 2 gal. capacity in the oil pan. There shall be pressure feed from the pump to the main crankshaft bearings. If splash is used for connecting-rod lower end bearings, it must be so controlled that the amount of lubrication is not affected by any grade up to 25 per cent, or by a certain transverse inclination. Spray lubrication for other parts of the engine will be acceptable. A screen shall be fitted on the inlet side of the oil pump of a design which will not require cleaning more often than once in each 1000 miles of vehicle operation. A screen must be provided between the crankcase oil-filler and the oil pan, and provision must be made to prevent its ready removal or intentional injury. A settling basin with drain must be provided in the oil pan, and the oil pump inlet must be above level of same.

Ignition by high tension magneto, with battery ignition for starting.

Magnetos must be gear-driven, made to S. A. E. standards, and must be interchangeable in every respect, including mounting. Magnetos must be arranged for *clockwise* rotation and be properly protected from water. For interchangeable magneto specifications see S. A. E. Data Sheet 36, Vol. I.

Timing Marked on Flywheel

To enable the timing of the valves and ignition to be readily set, the flywheel is to be clearly marked for the opening and closing of both inlet and exhaust valves, and for the magneto setting on full retard, and a suitable pointer is to be provided with which the flywheel marks can be aligned when timing the engine.

All ignition wiring must be protected from water and oil and mounted in such a way as to prevent chafing.

Engine must be mounted on a three-point suspension.

Oil pan must be removable without disturbing any of the main bearings or the clutch housing.

Carbureter must be so designed as to properly handle gasoline of the following specifications: (Not settled.) The carbureter must be provided with a readily removable wire mesh gauze strainer in a sediment pocket under the float chamber, and sediment pocket must be provided with a drain cock of the snap-lock type.

Provision must be made to keep dust out of the carbureter air intakes, crankcase breather and oil filler.

Provision must be made to prevent oil leaks at any point in the engine.

To prevent mud and water being spattered up into the carbureter or ignition apparatus, some form of protection must be fitted between the sides of the crankcase and the frame, either in the form of cast webs on the crankcase, or rigidly mounted metal pans extending from the frame sides to the main barrel of the crankcase. Full engine shields extending clear across the frame will not be accepted.

15. *Cooling System:* Water cooling must be used, with forced circulation by centrifugal pump, which must be of a design to permit thermo-syphon circulation in event of pump failure.

Radiator must be of the vertical individually finned tube type, with detachable upper and lower tanks. All radiators must be interchangeable and constructed as per drawing. Radiators must be flexibly mounted, to prevent strains from any frame distortion.

Cooling Water Drain

A drain-cock which will drain all the water from the entire cooling system must be fitted in a location where a bucket can be readily placed directly beneath the drain. This drain-cock must have a clear bore of at least ⅜ in., and must be fitted with a spring-snap lock to hold it in the closed position.

All suction hose connections must be provided with means to prevent collapsing.

Belt-driven fan shall be used, with a 28-deg. endless V belt of 1¼ in. width, and means of belt adjustment must be provided.

A radiator guard must be furnished, in accordance with drawing.

16. *Hood:* Hood with water-proof top must be fitted. Hood must be of a type which can be completely removed or opened up wide for engine inspection or adjustment.

Hood must be supported independently of the radiator.

Folding Starting Crank

17. *Starting-Crank:* Starting-crank must be arranged to fold up when not in use, in such a location that it will not be damaged by minor collisions. Detachable starting-cranks will not be accepted.

18. *Clutch:* Clutch must be of dry disk or dry plate type, with either a spring adjustment, or a spring sufficiently long to automatically compensate for wear on disk surfaces.

The steel clutch disks must be properly hardened.

All thrusts must be self-contained when clutch is engaged.

Clutch release must be fitted with ball bearings, with adequate provision for lubrication.

A large clutch brake must be fitted, and the entire clutch and release bearing must be enclosed in a dust-proof housing.

Plain clutch thrust-bearings will not be accepted.

19. *Front Universal Joint Shaft:* If universally jointed shaft is used between clutch and transmission, it must be equipped with two universal joints. Either the metal to metal or fabric disk type of joint will be accepted. In either type, provision must be made to prevent the shaft from whipping loose in event of joint failure. If the joints are of the metal to metal type, they must be thoroughly enclosed, and provision made to obtain lubricant.

Sliding Gear Transmission

20. *Transmission:* Transmission must be of the sliding gear type, with four speeds forward and one reverse, the various gear ratios to come within the following percentage limits:

High speed.....100%
Third speed.....
Second speed..... } Await suggestions
Low speed.....

Reverse: As low as or lower than low speed.

Transmission shaft pilot bearings must be either on ball or roller bearings, as plain bearings at this point will not be accepted.

Transmission must be so mounted as to be unaffected by chassis frame distortion.

Provision must be made to prevent oil leaks at any point.

Sufficient lubricant must be carried for 300 hr. operation without renewal or replenishment.

21. *Propeller-Shaft:* The propeller-shaft must be fitted with two universal joints and a slip joint. The fabric disk type of universal joint will not be acceptable.

Universal joints and slip joint must be completely enclosed, and provision must be made for retaining lubricant.

At the front end of the propeller-shaft, provision must be made to prevent shaft from whipping loose in event of failure of the front universal joint.

Hotchkiss Drive Banned

22. *Connection Between Rear Axle and Frame:* The driving connection between the rear axle and the frame may be of the type using radius-rods and torque-arm, or radius-rods only, with the springs taking the torque.

The Hotchkiss drive, transmitting both torque and thrust through the rear springs, will not be accepted.

23. *Rear Axle:* The rear axle may be of the worm gear type, or a double reduction gear type with the reduction gearing in a central housing.

The rear axle design throughout must be such as to entirely house all the driving mechanism, and provision must be made to prevent any escape of lubricant.

Sufficient lubricant must be carried in the axle housing for 300 hr. of service without renewal or replenishment.

The differential must be of a type which will drive one rear wheel when the other wheel loses traction.

24. *Front Axle:* The front axle must be a steel forging.

Plain or ball bearings will not be acceptable for the front wheels.

Positive stops must be provided to limit maximum steering angle of front wheels, which must be sufficient to give a minimum turning radius, measured to outside of front wheel track, not to exceed 28 ft.

Steering-knuckle tie-rod must be located behind the front axle. (Many opinions wanted on this.)

25. *Wheels:* All wheels shall be of cast steel and interchangeable, although not necessarily identical as to design. Standardized dimensions which will be required are shown on drawing.

36 by 4 Tires

Wheels shall be of the proper size to take 36 by 4 in. single front tires and 36 by 4 in. dual rear tires.

26. *Tires:* Solid tires must be used—36 by 4 in. single front and 36 by 4 in. dual rear, S. A. E. standards, of makes either approved by or specified by the War Department.

27. *Tread:* Front, 56-57-in. center to center front tires. Rear, 56-57-in. center to center between dual rear tires.

28. *Springs:* Front and rear springs must be half-elliptic.

Springs shall be equipped with suitable rebound clips, and the second leaf from the top shall be wrapped around the spring eyes to give assistance to the top plate on rebound.

Springs with shrunk-on center bands will not be accepted.

Rubber or spring buffers must be fitted front and rear to cushion blow of frame on axle or spring center under maximum spring deflection.

11 to 13 Ft. Wheelbase

29. *Wheel Base:* Wheel base must not be less than 11 ft. nor more than 13 ft.

30. *Frame Length:* Frame length back of driver's seat available for body, 10 ft. 5 in.

31. *Load Distribution:* Load distribution arranged to carry between 80 and 95 per cent of load above chassis on the rear tires.

32. *Control:* Control levers, including gearshift lever, brake hand lever, clutch pedal, brake pedal, accelerator pedal and spark and throttle hand levers, must be in accord with S. A. E. standards.

Flanges must be fitted on the clutch and brake pedals to prevent the driver's feet from slipping off.

The pressure on the clutch pedal pad necessary to disengage the clutch should not be more than 90 lb. nor less than 70 lb.

33. *Steering Gear:* The steering gear may be of the screw and nut or the worm and wheel type.

The ratio of movement between the steering hand wheel and the front road wheels shall be such that for 360 deg. travel of the steering hand wheel, the road wheels will move not to exceed 30 deg. about the steering knuckle pivot. (Many opinions wanted on this.)

Throughout the steering gear, including all steering connection joints, adequate provision must be made for lubrication, and all steering connection joints must be protected by leather boots.

Electric Lighting

34. *Electric Lighting Equipment:* Current for electric lighting must be furnished from a 6-volt 100-amp. hr. storage battery and gear- or chain-driven generator on engine.

All wiring must be enclosed in metal conduits.

The following lamp equipment will be required:

Side-lamps—combination oil and electric, with 15 candlepower bulbs.

Tail-lamp—combination oil and electric, with 2 candlepower bulbs.

Side- and tail-lamps and side-lamp brackets must be interchangeable, as per drawing.

One swivel electric searchlight with 8 in. lens and 21 candlepower bulb, mounted on dash.

An electric instrument lamp with 2 candlepower bulb must be furnished, and also an 8 candlepower inspection lamp with 15 ft. removable socket cord.

35. *Road Clearance:* The following minimum road clearances must be maintained:

Under center of front axle, 9¾ in.

Under center of rear axle, 9¾ in.

Under flywheel housing or flywheel, 13 in.

36. *Brakes:* Two independent sets of double acting brakes must be equipped, either both or rear wheels or with one set on rear wheels and the other on transmission line back of transmission.

Brake Adjustments

Brake adjustments must be readily accessible, and must be adjustable without the use of wrenches or special tools.

All brake clevises, pins, connections and threaded joints must be subjected to

a rust-proofing process on their wearing surfaces.

The design must be such that the application of rear wheel brakes is not affected by relative movement between the frame and the axle.

37. *Gasoline System:* The gasoline tank must be made of drawn sheet steel with welded joints and thoroughly tinned inside and out. Soldered joints will not be acceptable.

Interchangeable Gasoline Tanks

Gasoline tanks must be of 30 gal. capacity and be interchangeable, as per drawing.

Tanks must be fitted with partitions to give two 5-gal. reserve compartments, and must be equipped with a two-way cock for the reserve compartments, combined with a shut-off outlet.

Gasoline tank must be located inside seat body, and mounting devices must be attached to seat body by means of bolts.

Pressure-feed of the gasoline is required, pressure to be supplied by engine driven pump arranged to maintain from 2 to 3 lb. pressure. An auxiliary fuel hand-pump is to be furnished, mounted on the dash. (Many opinions wanted on this.)

The fuel pipe from the tank to the carbureter is to be not less than ⅜ in. outside diameter, and all fuel and pressure pipes are to be properly clipped at suitable intervals, to prevent vibration and chafing.

All fuel and pressure piping is to be of copper, thoroughly annealed.

All fuel and pressure pipe connections are to be S. A. E. standard fittings.

38. *Driver's Seat:* Dimensions of driver's seat shall be in accordance with drawing.

The seat cushion must be covered with genuine leather and be fitted with suitable cushion springs.

Arm rests and seat back must be covered with genuine leather and padded with genuine hair.

The distance between the back of the dash and front of the seat cushion on all trucks must be 25 in.

39. *Dash and Floor Boards:* Dash and floor boards must be approximately the same overall width as seat body.

40. *Driver's Top:* Cape or buggy type of top must be furnished, as per drawing, and covered with first-class 12 oz. water-proof canvas.

A suitable boot or storm apron must be furnished, made of 12 oz. water-proof canvas.

Road Sprags Required

41. *Sprags:* Road sprags must be fitted. These sprags must be of the triangular type and fitted with restraining chains and lifting device, as per drawing.

42. *Towing Hooks:* Towing hooks as shown on drawing, must be attached by rivets or bolts to all four corners of the frame.

43. *Body Holding-Down Devices:* Chassis design must be such that body holding-down devices, as shown on drawing, can be used.

44. *Paint:* Chassis shall be supplied painted with three coats of lead and oil, olive drab color, of the following composition:

6 lb. white lead ground in linseed oil.
1 lb. raw umber.
1 pt. turpentine.
½ pt. Japan drier.
1 qt. linseed oil.

Spare Parts

45. *Spare Parts:* The following spare parts must be furnished with each truck:

4 spark plugs with gaskets.
12 extra sparkplug gaskets.
3 exhaust valves.
3 valve springs.
2 fan belts.
1 assortment of cotter pins, containing not less than 1 doz. of each size used on truck.
1 assortment of lock washers containing 1 doz. washers of each size used on truck.
1 set of radiator hose clamps.
1 length each of all rubber water hose connections.
1 radiator drain cock.
1 box of plain hexagon nuts, to include not less than six of each size on truck.
1 box of assorted castellated hexagon nuts, to include not less than six of each size on truck.
1 box of valve grinding compound, to contain two grades.
1 roll, 1 ft. by 2 ft., of 1/32 in. thick gasket material.
10 ft. secondary or high tension cable.
5 ft. primary or low tension cable.
1 metal box containing one set of electric light bulbs used.
1 box containing 1 set electric lighting system fuses.

Tool Requirements

46. *Tools:* Each truck must be furnished with the following tool equipment:

1 set of open end wrenches to fit all nuts on truck.
1 magneto wrench.
1 3 in. blade screw driver.
1 6 in. blade screw driver.
1 drop-forged all steel 12 in. adjustable wrench.
1 pair of 8 in. combination pliers.
1 valve lifting tool.
1 6 lb. pinch bar 42 in. long.
1 6 in. bastard file.
1 8 in. flat mill-cut file.
1 combination oil- and grease-gun with special tips to fit wheel hub, universal joints and other points requiring oil or grease in quantities.
1 socket-wrench for carbureter nozzle.
1 4000-lb. capacity jack and handle.
1 5-lb. can of soft cup grease.

47. *Extra Oil and Water Supply:* Each truck shall be equipped with a cylindrical drawn steel welded tank with two compartments, one to carry 2 gal. of engine lubricating oil, and the other to carry 8 gal. of water, as shown on drawing, tank to be thoroughly tinned inside and outside and to be fitted with two faucets having ¾ in. through hole, snap spring lock plugs with square ends for use of wrench. No faucet handles to be fitted. This tank must be permanently and rigidly attached to the chassis.

48. *Tests:* Any manufacturer's model of truck designed for military purposes must satisfactorily undergo the following tests, which will be conducted by the War Department. All tests hereinafter specified will be made under a load of 5080 lbs. above the chassis, distributed as specified in paragraph 31.

Ability and Economy

49. *Ability:* On hard roads of 25 to 40 lb. per ton resistance to tractive effort, the fully loaded truck must climb, on high gear, a 5 per cent grade, and on low gear, a 25 per cent grade. Under the same road conditions, the fully loaded truck must be able to start from a standstill in low gear on a 25 per cent grade.

50. *Fuel and Oil Consumption:* On level hard roads of 25 to 40 lb. per ton resistance to tractive effort, the fully loaded truck must average, on straight away running, 9 miles per gal. of gasoline, according to spec. in par. 14, and 200 miles per gal. of engine lubricating oil.

51. *Cooling Ability:* The cooling system must have capacity as follows: At sea level and in an atmospheric temperature of 80 deg. Fahr. and with an initial water temperature of 150 deg. Fahr. the cooling system must be adequate to permit the engine to operate under maximum torque developed at between 600 and 700 r. p. m. in low gear, for a period of thirty minutes before the cooling water reaches the boiling point.

52. *Brake Performance:* Each set of brakes must be powerful enough to slide the rear wheels in either direction on a hard road of 25 to 40 lbs. per ton resistance to tractive effort. At least one set of brakes must be capable of handling the fully loaded truck at a maximum speed of 14 m. p. h. on a descent of 4 miles, averaging 8 per cent grade, without firing the brake linings.

53. *General Road Test:* In addition to the above tests, all military models submitted will be required to undergo a 2000 mile road test, with regular enlisted drivers, carrying a maximum load of 5080 lb. above the chassis, over give and take roads, embodying severe operating conditions.

Early Armored Car Raids Audacious

Cars Taken from Transport Column and Fitted with Steel Plating Constituted First Types Used by British Army in France—Cover Retreats Well—Make Raids at Night

By Granville Pollock

[EDITOR'S NOTE: *For over a year Granville Pollock, of Buffalo, N. Y., was connected with an anti-aircraft corps on the western front in the present war. He had direct charge of the Pierce-Arrow trucks used to carry anti-aircraft guns, as well as other trucks needed for various uses in the corps. Mr. Pollock lived in an atmosphere surcharged with armored car matters and had a good opportunity to observe the practical working out of different types of armored cars, especially as used by the British army.*]

CONSIDERING the rapidity with which events followed one another at the commencement of the Great War, it was only to be expected that many small actions and incidents would occur that, due to the general excitement prevalent almost everywhere at the time, would pass unnoticed, or at least be quickly forgotten.

Yet some of these side issues, so to speak, had a most important influence on the whole military situation, though their full value will in all probability not appear until the end of the war, when the records of both sides may permit of a comparison of values.

In particular does this apply to the events in the northwestern part of Belgium and that part of France known as Flanders, following the fall of Antwerp and up to the Battle of the Yser. For in this short space of time, the actions of a few daring individuals led by an extraordinarily bold and resourceful commander, did more to keep that part of the country and the channel ports clear of the Uhlan patrols and other German detachments than is generally known, or shown in military records; and incidentally, the first occasion on which British forces had used armored cars in Europe.

Fight Way Out of Antwerp

It is usually recalled that Great Britain assisted in the defense of Antwerp with a naval division and an armored train known as "H. M. S. Churchill," and an aero squadron. This squadron was one of the few complete units to get clear of that fortress, the planes flying and the motor cars that comprised the transport fighting their way through the encircling German lines and proceeding west to the port of Dunkerque, where a permanent base was formed, from which they afterward conducted innumerable scouting expeditions and raids into territory more or less occupied by enemy detachments, harassing fairly large units and often totally destroying smaller ones, and numerous patrols.

Armor for Transport Chassis

The cars used in this work were taken from the transport column, and a preference seems to have been given to the Rolls-Royce, as its speed and quietness were two very important features in this class of fighting.

With the assistance of a large shipbuilding yard in Dunkerque, they were fitted with gun mountings to support two or more Lewis or Maxim guns, and a few sections of mild steel sheeting as used in ship work, of about 10 mm. thickness, were bolted over a few places where protection was most essential, such as the radiator, the gas tank and the engine. Even this was but scant protection from a rifle bullet when fired from anything like close range, but it was the best that could be had at that time, though on other occasions they were under point-blank running fire with less protection than this, and managed to get off with few casualties.

For their defense, however, they relied principally on taking the enemy by surprise; a short, sharp engagement, and if unsuccessful, a quick get-away, where their superior speed would soon take them out of range.

Short Night Trips

At first, their movements were limited to short night trips along the roads leading to towns or villages known to have been recently occupied by advance patrols of enemy detachments that were gradually spreading over that part of the country, and when a favorable position was reached—usually a cross road or a wide place in the road with trees or shrubbery that afforded concealment—the cars would be turned around in the direction of home, all lights extinguished, and with engines throttled, all would be in readiness for the first enemy that appeared.

These operations were almost always led by Commander Sampson in person, and never was there any shortage of volunteers to drive the cars or handle the guns, though all realized that the risks were tremendous and the odds never in their favor, as seldom indeed were there less than ten riders in these patrols, and with ditches on each side of the road, a trained man on horseback was decidedly apt to have the advantage in maneuvering.

However, as previously stated, the very audacity of these raids made them a success, and the seriousness with which they were felt by the Germans is best illustrated by the large reward that the Kaiser offered for the head of Commander Sampson, or his capture.

So adroit did these men become in this sort of work that it was not unusual for them to have one or more engagements the same night, while as many as three distinct encounters before sunrise have been recorded. The villagers near their headquarters became accustomed to seeing piles of saddles, rifles, lances and other equipment, and occasionally a string of horses, that was the result of their night's work.

Covering the Retreat

While most of these operations took place in the vicinity of the coast, they made frequent trips far to the south, the most spectacular one being the occupation of the town of Douai, in the face of the advance of Von Kluck's flanking force that was then proceeding north, where Commander Sampson took charge of the few remaining French forces in the town and skillfully conducted their retreat, he, with the cars, remaining behind to the last and barely escaping capture, having to actually fight their way through the advancing line of skirmishers.

It must have made a great picture with these cars tearing

madly along the road, several of them old London omnibus chassis fitted up for the purpose, the enemy's cavalry skirmishers having dismounted and advancing on foot through the woods in an endeavor to head them off, while the flashes of the machine guns and rifles from the cars, showing against the dusk of the evening, gave a spectacular quality to the scene.

On the other hand, it clearly shows that if a few determined men in motor cars, indifferently armed and poorly armored, can operate with such success against field troops for so long a time, what might have been the result had it been possible, in the early part of the war, before trench fighting commenced, to place several brigades of properly organized and trained armored cars, mounting light artillery, to conduct a series of such raids on an enemy's flank.

About the time these cars were armored, the first attempt was made to adapt artillery so as to operate it in connection with them, not by mounting a field piece on the car itself, as they were not built sufficiently strong to permit this, but in replacing the gun carriage with an automobile type of axle, with wire wheels mounting dual pneumatic tires, and the whole towed behind one of the armored cars.

Credit Due Captain Wilding

Credit for this is principally due to Captain Wilding, the well-remembered tennis player, who was so popular in the United States just before the war; and with it, he did excellent work in advanced positions that would have been impossible to reach except for this type of carriage. In fact, in his case, it worked too well, for so annoying did it become to the Germans that they made special efforts to get him, using their heaviest artillery lavishly, which is quite a compliment in its way. They finally succeeded in dropping a coal-box—a 42-cm. shell—onto the top of the dugout in which he and some others had taken shelter when they had first started to shell him.

National's Factory Hospital

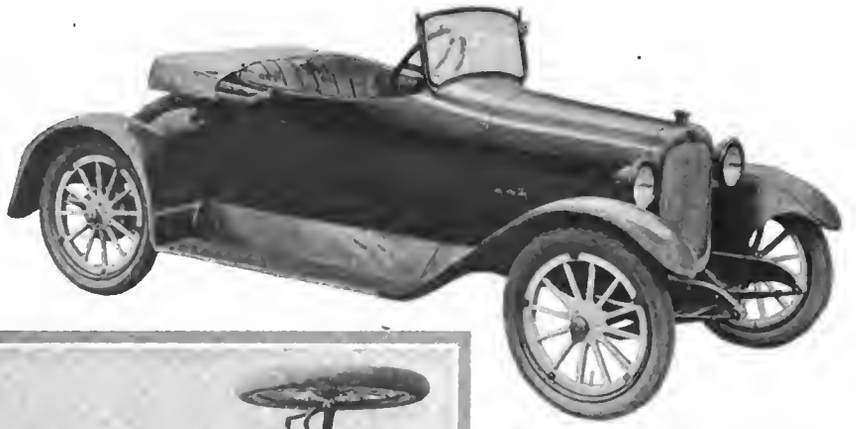
ONE of the most recent developments of the safety first movement which has been inaugurated at the factory of the National Motor Vehicle Co., Indianapolis, Ind., is the installation and equipment of the small but complete hospital shown in the accompanying illustration. This department is located on the second floor of the most central building of the company's plant and is in charge of a trained attendant who is ready at all times to render intelligent relief and first aid service to employees who have been taken ill or injured in an accident.

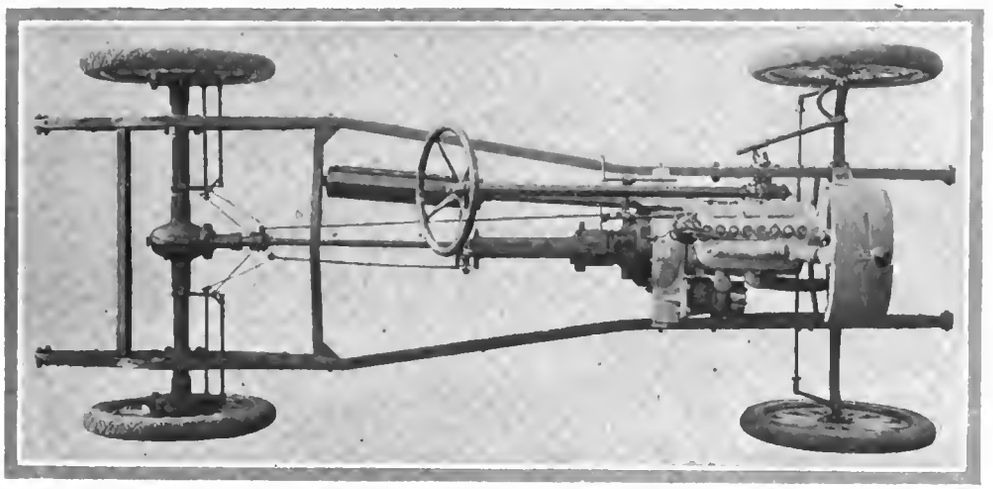
3-Ton F-W-D Truck Hauls 26-Ton Load

The illustration shows a 3-ton truck built by the Four Wheel Drive Auto Co., Clintonville, Wis., hauling a dozen trailers each of which carries 1½ cu. yd. of crushed rock. The truck straddles the narrow-gage track on which the trailers run. According to the Hanlon & Oakes Co., contractors, Sioux City, Ia., fifty teams and trucks were unable to do the work which this truck does at a daily cost of $17. The material is used for the construction of a concrete highway and the truck pulled it up a 5 per cent grade

Low Seats in Maibohm Roadster

$695 Sporting Roadster Is Low Hung with Rakish Lines—Engine High-Speed Four Carefully Balanced





Great simplicity characterizes the chassis lines of the Maibohm, while the body is quite distinctive. Colors are optional and complete equipment is included for $695

THE Maibohm car built by the Maibohm Motors Co., Racine, Wis., has rather an unusual series of characteristics. Briefly the makers have aimed to produce a roadster of low price which gives a combination of speedy performance, smart appearance and comfortable seating. It is a very low-built car with low seats having extra heavy upholstery, so that the passengers sit well within the body despite the rakish exterior. For the convenience of the driver a large range of adjustment is provided on the pedals, and the gearshift and brake levers are bent back so as to come within easy reach.

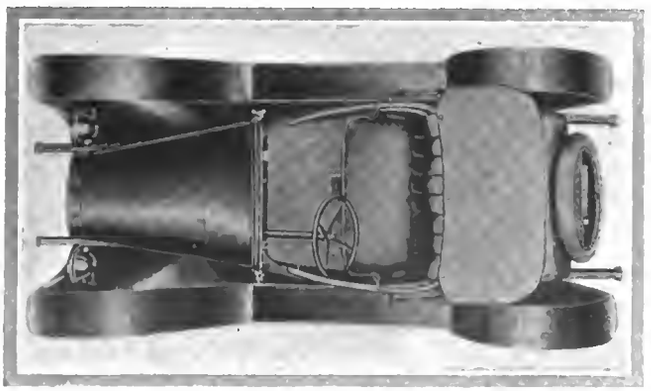
Features Careful Balance

The engine dimensions are 3⅛ in. bore by 4 in. stroke and it is an L-head type having the cylinders and crankcase all in one iron casting. To reduce vibration as much as possible the crankshaft is 2¼ in. diameter and the piston and connecting rod assemblies are carefully balanced and selected in sets of accurately even weight.

Lubrication is cared for by a cam-operated, plunger pump which sends a pressure supply to each of the main bearings and also fills dip troughs under the connecting rods. The oil pan is pressed steel and is provided with a level gage. Rather special pains have been taken to place the oil filler where it is readily accessible, and the illustration of the right side of the engine shows the size and position of the filling cap clearly. This same view also shows the location of the 12-volt Disco motor-generator which is driven by a silent chain from a sprocket mounted on the crankshaft just back of the main bearing at the flywheel end.

The manifolding is unusual, since the exhaust and intake are cared for by a single casting. This insures the supply of adequate heat to the gas and keeps warm the whole of the Zenith carbureter which bolts direct to the manifold. There are no internal passages cored within the cylinder casting of the engine.

For ignition there is an Atwater Kent Unisparker with automatic advance, mounted upon a vertical shaft that is driven from the rear end of the camshaft; this allowing the use of very short ignition leads. Cooling operates on the convection or thermo-syphon system without a pump, and it should be noticed that the tall, narrow radiator is especially well suited to this form of cooling.



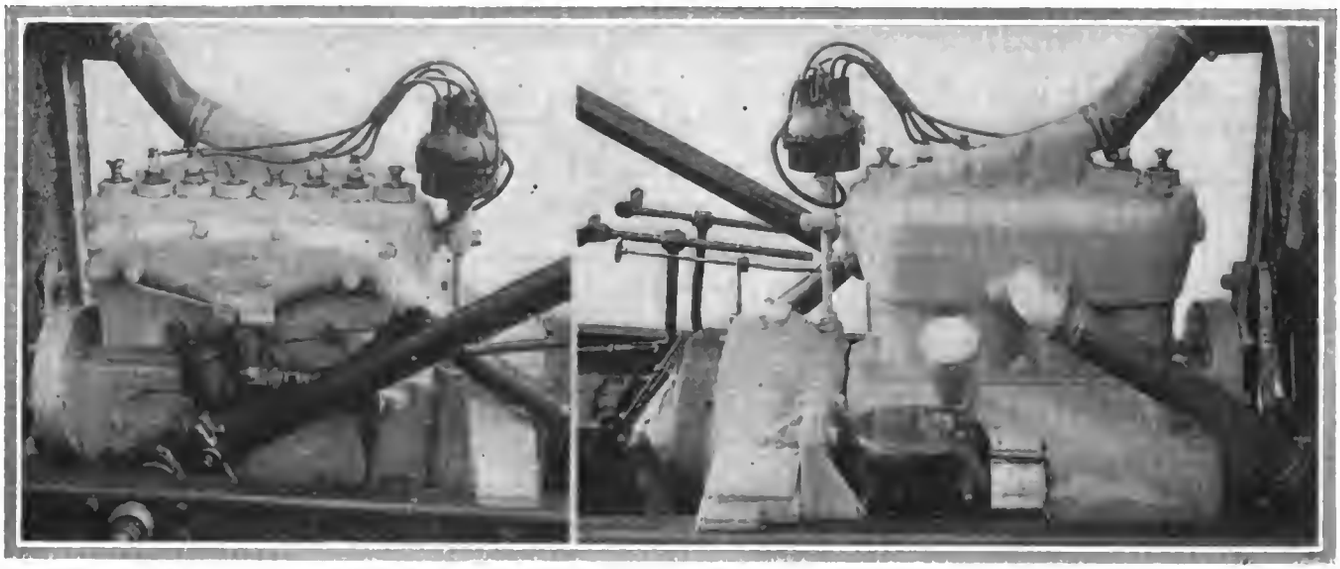
This plan view gives some idea of the seat width

Extension Carries Levers

In unit with the engine is a dry-disk clutch with three plates, and this connects to a three-speed gearset. Naturally the gearset comes just beneath the dashboard, so a special casting is bolted to the rear end of the transmission, stretching back to the seat line. On the end of this casting the gear and brake levers are mounted, the arrangement being shown in the plan view of the chassis.

Hotchkiss Drive Used

There is nothing unconventional about the axles, that at the rear being three-quarter floating. The 46 by 1¾-in. rear springs take both drive and torque. The frame layout is rather unusual, having all four springs mounted beneath it



Left—Shows the combined intake and exhaust manifold used on the Maibohn engine. Right—The electric unit

and none outside. It is 3 in. deep of ⅛-in. stock and is well kicked up over the rear axle. The wheelbase is 105 in. and the tires 30 by 3½-in. on either wood or wire wheels.

That special care was taken in designing the seat has already been mentioned, but there is another particular body feature, this being the provision of an extra large baggage compartment below the rear deck. This baggage case has a large door, closing flush and fitted with a Yale lock. The windshield is mounted with a rake and the one piece top folds down flat so that it accentuates the body lines. Optional colors are obtainable, an almost unheard of thing on a car costing only $695.

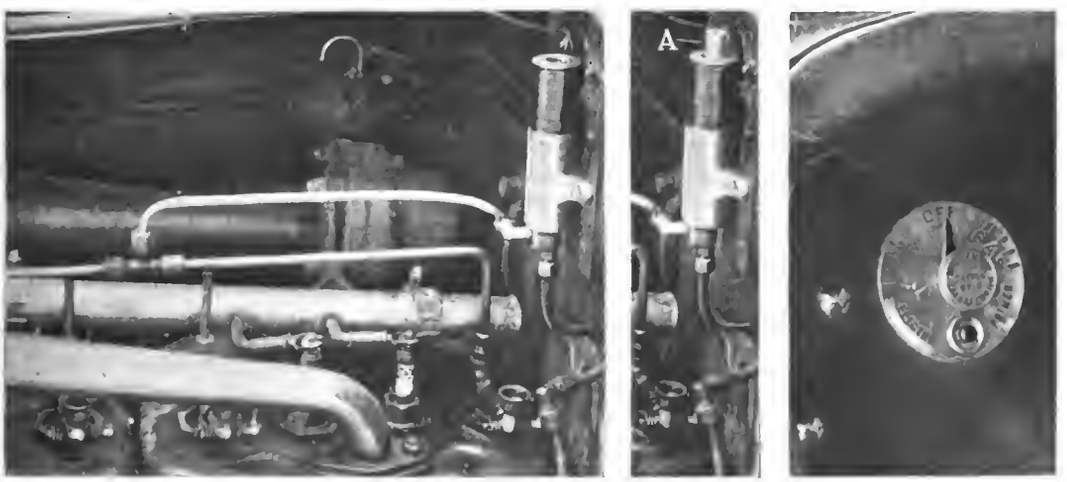
McCormick Primer Is Electrically Operated

THE McCormick Laboratories of Dayton, Ohio, have secured patents on a very accurate device which measures a precise quantity of gasoline which it transfers into a pipe whence it reaches the cylinders successively during the suction stroke.

Beginning at the cylinders there is a small check valve screwed into a valve cap or other convenient place, and these check valves are all joined to a tube running along the cylinder top. The valves open during the suction stroke, but are kept closed as long as there is any pressure within the cylinder. From the middle of the standpipe connecting the check valve a second pipe runs to an electrically-operated pump mounted on the dashboard. This pump has a suction line connected to the main gasoline supply somewhere near the carbureter and the plunger is lifted by a solenoid when current is switched on. On the cowlboard there is a dial with a button controlling a cock on the supply side of the pump and beneath this turn button there is a knob which sends current around the pump solenoid when depressed.

To operate the primer the knurled button is turned to the right and the electric button depressed for an instant. Sending current through the solenoid lifts the plunger, and as soon as the electric button is released the plunger falls, driving gasoline down to the check valves above each cylinder. The starter pedal is then operated and the engine sucks in charges of gas as it revolves. As long as the finger on the cowl dial is kept on the right-hand side the suction will continue to draw gasoline through the little check valves direct from the main supply line, so it is possible to run the engine indefinitely without the carbureter coming into action. As soon, however, as the engine starts it is usually possible to turn off the supply to the primer by bringing the pointer on the cowl to the off position. The same instrument can also be used for supplying additional air. By turning the pointer to the left instead of to the right, the check valves are put in communication with the atmosphere instead of with the gasoline, so that on each suction stroke a small quantity of air is drawn direct into each cylinder.

The device renders it possible to prime directly into the cylinders and eliminates the necessity for soiling the hands by lifting the hood.



Left—McCormick primer which combines an auxiliary air supply. Plunger is in normal position. At A it is at top of suction stroke. Right—Knurled knob and pointer gas and air control. Electric pushbutton is at bottom of dial

The Rostrum

Preventing Valve Stems from Sticking

EDITOR THE AUTOMOBILE:—I have a Chandler 15 and am having trouble with sticking valve stems. Every 1500 to 2000 miles carbon has to be burned out, valves ground and valve stems cleaned and some of them straightened. I am using a high grade medium oil. The repair man says piston rings are not at fault.

Would new valve stems be advisable? Can you suggest a cure? The car has been run 15,000 miles.

Needham, Mass. F. J. R.

—It would be advisable to try relieving the valve stems making them 1/64 of an inch smaller in diameter for a distance of 1¼ in. downward from underneath the head. This should give more room for any carbon accumulation and ought to prevent the valves from sticking.

It might possibly be advisable to try relieving two or three of the valves and see whether this makes those particular valves perform satisfactorily, without relieving all the lot.

If you have to have carbon burned out every 1500 to 2000 miles it is difficult to believe that you are not getting too much oil into the cylinders. Some of the patented rings are very successful in reducing the amount of oil that reaches the cylinder head and I think you would be well advised to try at least one patent ring on each piston.

Wants Data on Hudson Super-Six

Editor THE AUTOMOBILE:—What is the timing of the 1917 Hudson Super-six?

2—What is the lift of the valves and the angle of valve seat?

3—Is the cylinder offset to reduce piston thrust?

4—What is the diameter and length of connecting-rod bearing?

5—What is the timing of the 1916 Marmon?

Trenton, N. J. P. F. H.

—The valve timing of the 1917 Hudson Super-six is as follows: Inlet valve opens 7 deg. after top dead center. Inlet valve closes 42 deg. after lower dead center. Exhaust opens 55 deg. before lower center; exhaust closes 8 deg. after top center.

2—The lift of the inlet valve is 0.3125 in.; the lift of the exhaust valve is 0.3250 in. and the angle of the valve seat is 45 deg.

3—The cylinder is not offset to reduce piston thrust.

4—The diameter of the lower end of connecting-rod bearing is 2.250 in. and its length is 1.989 in.

5—The timing of the 1916 Marmon is as follows: Exhaust closes 12 deg. past top center; inlet opens 19 deg. past top center; exhaust opens 45 deg. before bottom center; intake closes 35 deg. past bottom center.

Gear Ratio on Packard Twin Six

Editor THE AUTOMOBILE:—Kindly furnish me with gear ratio and firing order of the Packard twin six.

Des Moines, Iowa. J. D. E.

—The standard gear ratio of the Packard twin six in high is 4.36 to 1. The firing order in each block is 1, 4, 2, 6, 3, 5, the impulses alternating between the two cylinder blocks. Numbering the cylinders in succession, beginning with number one at the front of each block, the firing order would be 1R, 6L, 4R, 3L, 2R, 5L, 6R, 1L, 3R, 4L, 5R, 2L, the R and L designating the right and left cylinder blocks.

Racing Compressions Are Variable

Editor THE AUTOMOBILE:—What compression is used in the Peugeot, Delage, Duesenberg, Mercer and Stutz racing cars? Please give compression for both 1914 and 1915 Stutz cars.

2—What compression is used in the Packard, Cadillac, Hudson, Franklin and Biddle stock cars?

3—I have seen the statement that for a given sized combustion chamber the compression increases as the motor speed increases. Will you kindly explain this?

Riverton, N. J. R. R. W.

—The compressions used in the racing cars you mention are not available. As a matter of fact, the best compression for racing is usually found by trial and it is liable to vary from time to time. The normal compression for a racing car is about 90 lb. gage.

2—The compression used in the cars you mention is as follows:

Packard—Between 75 and 80 lb.
Cadillac—85 lb.
Hudson—Between 75 and 85 lb. at 100 r.p.m.
Franklin—About 70 lb.
Biddle—70 lb.

3—You have this the wrong way around. The gage compression will be greatest when the engine is running slowly because then the piston is able to draw in a full charge through the valve. When the engine is running fast the wire-drawing action of the valve cuts down the total volume of the charge and the compression is correspondingly reduced. With most engines there is one speed depending upon the valve timing at which maximum compression is registered.

Revamping a 1910 Velie for Speed

Editor THE AUTOMOBILE:—I have read with interest your answer in the Aug. 31 issue of THE AUTOMOBILE to R. W., who is rebuilding a Haynes model T for speed.

It happens that I am the proud owner of a 1910 model four-cylinder Velie 4½ by 5¼. Owing to the fact that No. 4 cylinder has become scored decreasing the power output of that cylinder so that on a hard pull the uneven flow of power is noticeable, I am figuring on having all cylinders bored out and new pistons made so that even amount of power will be obtained from each cylinder. I am not an expert mechanic or automobile engineer, and so probably do not understand all that might be implied from your answer to R. W., but it does seem to me that with this engine working with gas-tight cylinders as it should when rebored and fitted with new pistons and rings (hot air connection to carbureter) that I should get results from it to compare favorably with an engine of 1916 design. Of course I know that 1916 engines are designed with smaller bore, and designed to run at much higher number of revolutions per minute, and are geared for

higher number of revolutions in comparison with car speed, but it seems to me that I should get as much efficiency out of this 1910 engine as I would from a 1916 engine of the same volumetric capacity per rear wheel revolution at speeds of from 10 to 30 m.p.h. Understand, I do not care for high speed performance from this engine as I am satisfied with ordinary touring speeds.

Would it be advisable to crown the new pistons at all? I notice the old pistons are flat. The cylinder heads are integral with the cylinders, and presume they could easily stand the higher compression; however, if this would result in higher explosive pressures, the crankshaft bearings might not be designed to take care of that and I believe that the engine would not run as smoothly at low speeds.

Is there anything that you would advise in connection with reboring and fitting new pistons to obtain more satisfactory service from this engine?

Buffalo, N. Y. L. S.

—You would probably get very good results by boring out cylinders and having new pistons made as you suggest. It would not, however, be wise to crown the pistons, as you will have trouble with pre-ignition and rapid carbon formation if you raise the compression. You could get new pistons partly finished from the Velie Motor Vehicle Co., Inc., Moline, Ill., and your local repairman could finish these to the exact size to suit the rebored cylinders.

While rebuilding the engine make sure that the valve seats have not been ground down so that the valve head sits in a little pocket. It might be advisable to have a light cut taken on each valve seat. See also that the valve stems are a good fit in the guides and not worn, particularly the inlet valve stems. If these wear too small air is sucked up and this disturbs the proper functioning of the carbureter.

While the engine is torn down examine the oil pump carefully and if the gears are worn on the sides, so that they are not a close fit sideways in the case, the latter should be faced down so that the pump cover will be brought closer to the gears. This will increase the amount of oil pumped.

Changing Overland 69 Oiling Inadvisable

Editor THE AUTOMOBILE:—The new oiling systems are giving so many more miles per gallon of oil on practically the same make of engines, could the old mechanical oilers, such as is on Overland 69-T 1913 cars be adjusted to give more miles per gallon of oil without danger of ruining the engine? The new oiling systems are splash systems in one sense of the word and the old mechanical systems merely feed oil into the crankcase, which in turn is splashed on to the cylinder walls, so what is the difference?

2—Would you advise putting a new carbureter on such cars as 1913 model mentioned above, that is, would a new carbureter use less gas per mile than the old one that came out of the car?

3—Can you suggest any other changes that would likely show a saving in gas?

4—What firms make an inclosed body to fit this car?

5—From Greenville, S. C., to Jacksonville, Fla., which is the best route, via Atlanta, Macon, Valdosta, or via Columbia, Augusta, Savannah, and about what is the mileage each way?

Inman, S. C. C. G. F.

—The model 69 cars were all equipped with a mechanical force feed oiler with lines directed to the cylinders, timing gears and the rear crankshaft bearing, the intention being to lubricate the above-mentioned parts, while, of course, the connecting-rods, wristpins and main crankshaft bearings were all lubricated in the usual way by splash. It is very true that by making certain adjustments to the oiler it can be adjusted so as to keep a sufficient quantity of oil in the motor oil base to properly lubricate the motor. However, this would not be advisable inasmuch as the oil directed to the cylinders would no doubt cause excessive accumulation of carbon, and consequent fouling of the spark plugs at occasional intervals.

Thus, it would probably not be advisable to make any changes in the lubricating system. If the engine is properly lubricated and in good condition, adjustments should be readily made that would not require over 1 gal. of oil for each 350 to 400 miles of car running. However, if the car has seen constant service since the year 1913, no doubt parts of the lubricator are worn, and this naturally decreases the oil mileage.

2—Probably you could obtain better mileage with a new carbureter. You would be best advised to take this matter up with the maker of the carbureter now fitted to the car who will know whether one of his later models will give you better results.

3—Only that you take care and see the transmission and wheel bearings are properly fitted and lubricated so that there is no unnecessary friction.

4—The manufacturers of the chassis have no special closed body which would suit you and your best plan would be to inquire of your local dealer. It is, however, doubtful whether it would be worth while to have a closed body built for a 1913 car as it might cost as much as buying a new car with a closed stock body.

5—The best way from Greenville to Jacksonville is as follows: To Athens, 102 miles; to Macon, 97; to Waycross 174; to Jacksonville 81 miles, making a total of 454 miles.

No Formula for Dynamometer Power

Editor THE AUTOMOBILE:—Kindly publish complete formula for calculating the horsepower from a fan dynamometer and an example of its application.

Detroit, Mich. W. L.

—There is no formula which can be relied upon for calculating the horsepower of a fan dynamometer. The reason is that as the fan's speed increases it begins to beat out a hollow in the air and the resistance, therefore, drops below what it would be theoretically. This effect is known as cavitation. It is similar to the action of a gear cutting out a hollow in soft grease. The only way in which the power absorbed by any given fan can be ascertained is by driving it at different speeds with an electric dynamometer and actually measuring the horsepower absorbed.

Removing Tar from Car Body

Editor THE AUTOMOBILE:—What is the best method of removing tar or Tarvia from my car? I recently had to drive twice a day for 2 weeks over a road freshly covered with it. The chassis is absolutely covered and the body not much better.

Westmount, P. Q., Canada. A. E. J.

—Soap and water used promptly will generally remove tar or Tarvia. It can also be softened by the application of butter or oleomargarine without damage to the varnish.

Another good solvent is cocoa butter, which is used in the theatrical profession for removing grease paint. This can be purchased in some drug stores and is a harmless solvent for all kinds of oil and grease as well as tar.

Wants Differential and Transmission Assembly

Editor THE AUTOMOBILE:—Are there any concerns making a transmission and differential assembly that is interchangeable with the one used on a 1912 Flanders 20 model? If so, please give list.

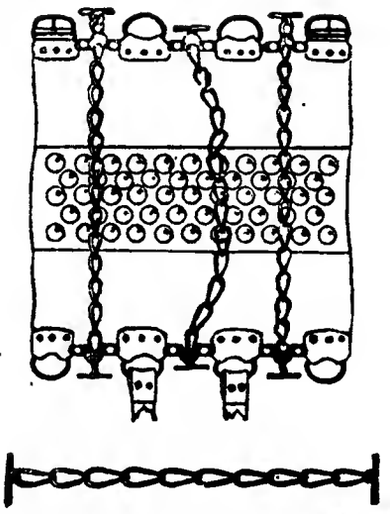
Burlington, Vt. H. L. W.

—THE AUTOMOBILE has no record of any concern making such an assembly as you require.

ACCESSORIES

Anti-Skid Shoe

THIS shoe is made of two-ply leather reinforced up the middle with an extra strip which is studded with rivets having heads about ⅛ in. thick. The chains that cross the reinforced part of the shoe, as shown in the accompanying illustration, are made of heavy wire of high tensile strength. The shoe can be used as a blow-out patch; it acts as a preventive of blow-outs when strapped to the weakest spot on the tire; it gives traction when the wheels are stuck in the mud and the manufacturer states that it cannot injure the tire. The shoe is held on the tire by 1-in. chrome leather straps lacing through rings and the strap and buckle adjustments render it possible to draw up the shoe very tightly. Since the straps are attached to the boot the shoe cannot be lost. When the shoe is used for a blow-out patch the anti-skid chains are easily withdrawn by slipping a small ring through the brace and their replacement is just as simple. With non-skid chains the 3 by 3½-in. size sells for $2.50; 4 by 4½-in., $2.75; and 5 by 5½-in., $3. Chains, including end rings, list at 25 cents for set of three in the 3 by 3½-in. size, 35 cents in the 4 by 4½-in., and 45 cents per set in 5 by 5½.—Auto Anti-Skid Shoe Mfg. Co., 31 Nassau Street, New York City.



Above—Anti-Skid shoe designed to act as a blow-out patch, to give traction and to prevent skidding. Below—One of the chains, which are easily detached

Sebring Tire

This seven-ply tire is impregnated with pure gum rubber and has a non-skid tread. The gum friction coat is built between the fabric and the tread and is said to promote easy riding and to require a low tractive effort. Straight side tires are offered and are applicable to any type of rim. The tires are retained on the rim by nineteen strands of piano wire. The Ford type tire is the only exception to this form of rim and is a regular clincher. —Sebring Tire and Rubber Co., Sebring, Ohio.

Section of Sebring Efficiency tire tread, showing wires that retain the tire on the rim

Johnson's Carbon Remover

This liquid carbon remover is easy to use, the spark plugs being removed and four tablespoonfuls poured into each cylinder. After 2 or 3 hours, or preferably after leaving the liquid standing over night, the engine is started, blowing the loosened carbon out through the exhaust. The remover softens the carbon and detaches it from the cylinder walls, etc., without in any way harming the engine. It sells for 50 cents per half pint, 85 cents per pint and $1.50 per quart.

Johnson's Blac-Lac is a dressing for tops, leather cushions, side curtains, tire covers and trunks. It is also useful for touching up other parts of the car, one coat being said to give a rich black finish to the parts mentioned, or to fenders, rims, running boards, radiators, lamps, etc. It is applied with a brush, being in liquid form, and is said to act as a preservative of leather, etc. It does not come off on the hands or clothing, according to the manufacturer, who also produces Johnson's Prepared Wax and Johnson's Cleaner for car bodies. The Blac-Lac sells for 40 cents per half pint, 65 cents per pint and $1.10 per quart.—S. C. Johnson & Son, Racine, Wis.

Trump Jack

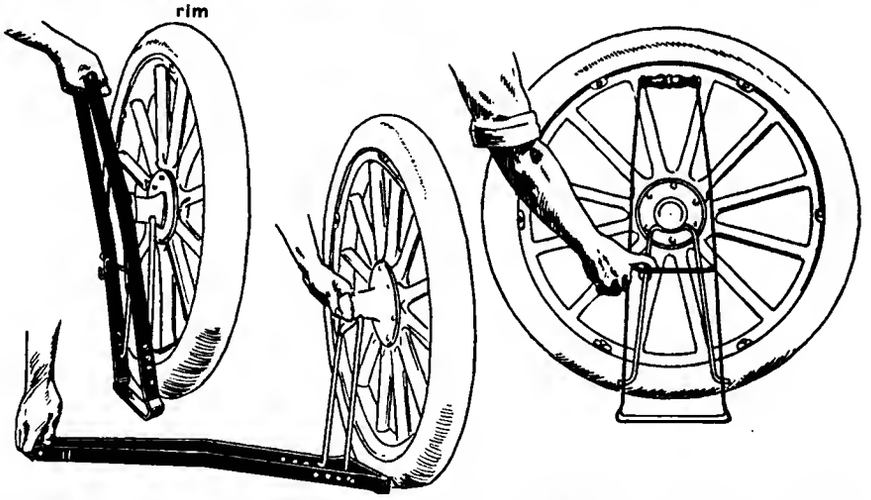
The car may be readily lifted from the floor by means of Trump jacks. A compound lever caught beneath the hub lifts the wheel free from the floor and locks it in the raised position. The strain on the tires is thus relieved and the tires are removed from contact with an oily floor. The height of the jacks may be adjusted and it is said that each jack will support 5000 lb. Price, per set of four, $5.—Trump Products Co., Garland Bldg., Chicago, Ill.

Lewis Pneumatic Grease Gun

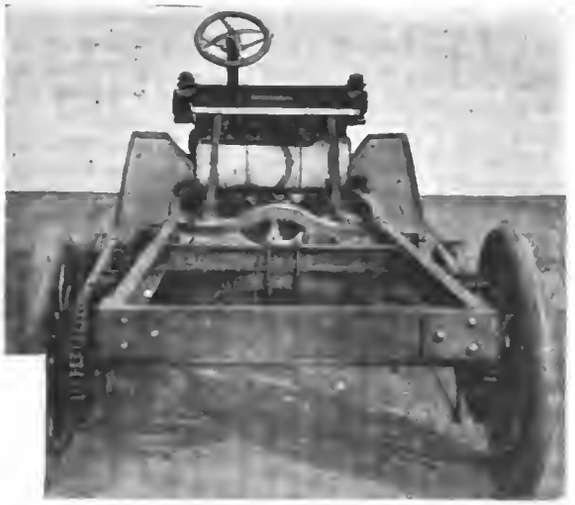
This gun is designed to handle lubricants of all consistencies from the hardest cup grease to the hardest cylinder oil, and may be used for filling or emptying gear boxes, differentials, etc. It is double acting and self filling. It is 2 in. in diameter and 18 in. long and is operated by compressed air at pressures of 50 lb. or more. There are two nozzles, one for fluids and the other for heavy greases. Price, $10.—Lewis Pneumatic Grease Gun, Chicago, Ill.

U-Can-C Rain Shield

The U-can-C rain shield placed on the market last season has been improved by the use of somewhat larger vacuum cups made from rubber compound. Each cup is provided with a shank that facil-



Trump jacks are useful as tire savers since they lift the car from the floor, thus not only relieving the tires of its weight but also keeping the rubber from contact with the oil on the floor, which is frequently a cause of deterioration of the rubber



Franklin Convertor for Ford chassis

itates its application and removal from the windshield. When in place before the driver's seat, the shield serves to keep the glass free of moisture and water by the aid of a rubber sealing strip. The use of the larger cups, says the manufacturer, causes cups to adhere rigidly even in a strong wind, or when applied to a dry glass. They may be rolled up and packed away in a tube 3 by 11 in. They are made for all cars. Amber shields sell at $2 each; clear shields at $1.50.—Frey Mfg. Co., 1326 Michigan Avenue, Chicago, Ill.

Apco Ford Breather Pipe

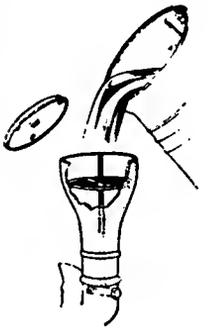
This breather pipe for the crankcase of Ford cars is an upright pipe, containing a fine screen, is secured to the oil intake by a hooked bolt that fastens around the timer retaining bolt. The installation is said to make the renewing of the oil supply an easy matter and to prevent the oil from spraying from the crankcase. The cover is easily removed or replaced, and the screen prevents the entrance of foreign elements. Price, 50 cents.—Auto Parts Co., Providence, R. I.

Glare-Off Lights

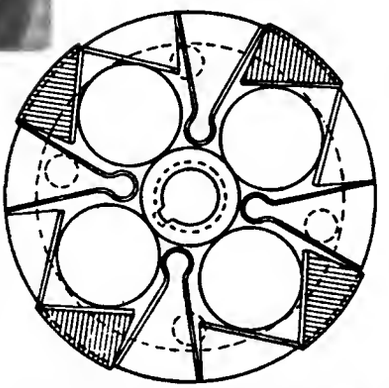
An ornamental metal shield covers the upper portion of the headlight lens and causing the light rays to be concentrated on the road. The ascending rays are reflected by the polished surface of the shield, thrown back onto the reflector of the lamp and thence onto the road in a manner that does not blind the oncoming driver. The face of the shield carries either a club monogram or any ornamental design desired. Price, $1 per pair.—Glare-Off Co., 1777 Broadway, New York City.

Automatic Spark Advance

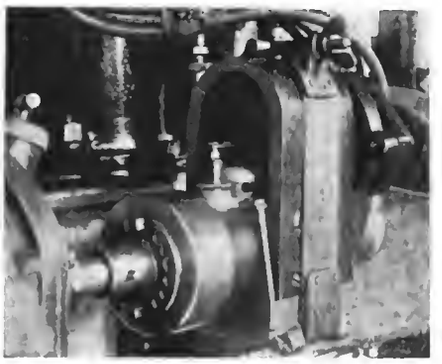
The spark is automatically advanced by the centrifugal action of four balls, driving and driven members of the coupling being constructed so that there are four V-shaped compartments in each one of which there is a ball. One side of the compartment is part of the driving member, and the other part of the driven. As the speed increases the centrifugal force throws the balls outward, and forces the sides of the V's apart, thus advancing the spark. It is said that it may be installed in place of the usual coupling between the pump and magneto and will fit any standard magneto.—Automatic Spark Advance Co., Monadnock Bldg., San Francisco, Cal.



Apco breather pipe for Ford cars, designed to facilitate renewal of the oil supply in the crankcase



Cross section of the governor on the Automatic Spark Advance. The centrifugal force of the balls in the V-slots advances the spark



Automatic Spark Advance as attached to a magneto

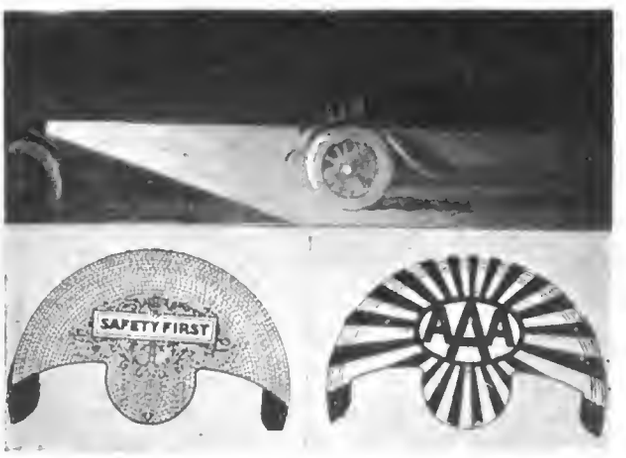
Franklin Convertor for Ford

Converting the Ford into a 1-ton truck without damage to the chassis, permitting it to be converted back again into a passenger car, is the function of this construction. The rear axle becomes a jackshaft and is bolted onto the new channel frame by means of a special casting. A special bell-sprocket that telescopes over the brake drum carries the chain that drives the truck wheels, and permits the use of standard gauge. The change requires only the removal of the rear wheels, rear spring and radius rods and the bolting on of the convertor. It is claimed that no skilled labor or special tools are required to make the change. Price, model A2, $345; model A3, with motor governor and jackshaft brake, $400.—Franklin 2-Way Convertor Co., Herald Bldg., Chicago, Ill.

Oxy-Ignitor Spark Plug

The Oxy-Ignitor plug replaces the O-G, the patent papers and exclusive manufacturing rights of the latter having been purchased by the maker of the new plug. Minor improvements have been made and the plug has been subjected to severe tests. The porcelain is inclosed by the shell and the central electrode terminates in four points, one or all sparking at the same time. The plug may be taken apart easily and all parts are replaceable. Each plug carries a guarantee to be sootless and to last during the life of the engine. —Oxygenerator Co., 1919 South Michigan Avenue, Chicago, Ill.

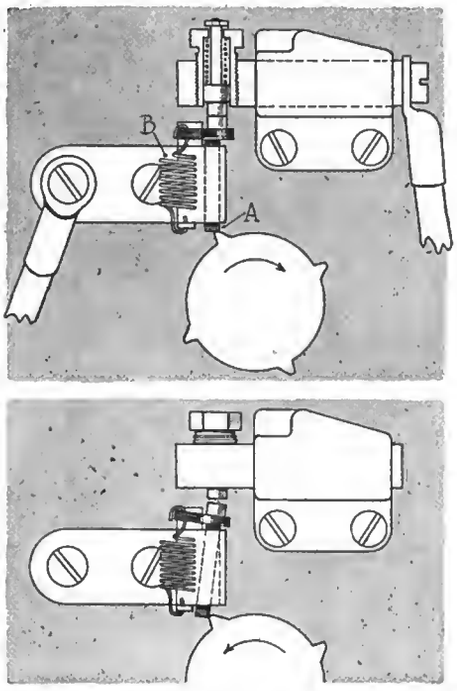
Oxy-Ignitor spark plug



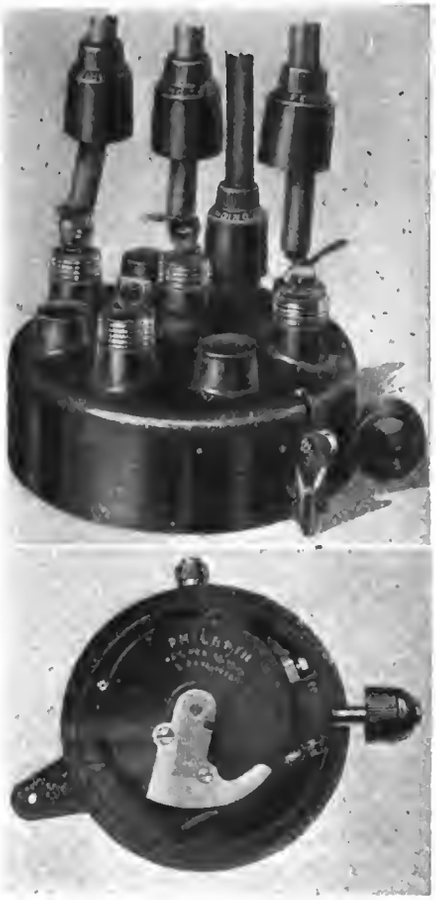
Glare-Off headlight regulators for concentrating the rays on the road

Philbrin Battery Ignition

New Duplex System Gives Alternative Forms of Spark Production—Includes Novel High-Speed Breaker and Follow-Up Spark System



Full size sketch of Philbrin cam and contact action. Upper shows the cam lifting the contacts and closing the circuit. Lower indicates the way the trigger folds back should the cam turn around in the wrong direction



Above—Twelve cylinder unit with coil mounted on the side. Right — The construction of the distributer terminals which give a very secure grip on the wires and view of the long sector suitable for a four-cylinder distributer

PRODUCED by a man who has been in the battery ignition business for a good many years, the Philbrin duplex battery ignition has many unique points. It is made by the Philips-Brinton Co., Kennett Square, Pa., who are just ready to supply in quantities. As its name implies it is a system including two alternative methods of producing the spark, and either of these methods can be used with storage battery or dry cells. The two methods of spark production are called, by the makers, the main system and the secondary system, and as they operate on quite different principles they can best be considered separately.

The distinctive feature of the main system is the constructive detail of the contact breaker. This is small, very strong, gives a square contact between the points and a very quick break which is claimed to have less lag than any other type. In the sketch above the principal parts of the contact breaker are shown on a magnified scale. The upper contact is set in an adjustable socket backed by a strong coil spring. The lower contract is secured to the end of a hardened steel trigger *A* which can be lifted from beneath by the cam point. To follow the action imagine the cam rotating clockwise. The point of the cam will catch the foot of the trigger and lift it till the points are in contact. The spring above the upper point determines the firmness of the contact obtained.

Lag Almost Eliminated

As soon as the tip of the cam reaches the edge of the trigger, all support is removed and the small coil spring *B* causes the trigger to fly back with practically no lag whatever the speed. This quickness is due to the very light weight of the trigger and to the rapidity of action obtainable from a coil spring.

Now, it is easy to make a rapid action cam with a square drop like this, but precaution has to be taken to prevent the trigger from being broken off should the engine reverse its proper direction of rotation. To guard against this possibility of damage, the trigger slides in a groove as seen in the sketch, but this groove is open behind the trigger which is held in its working position by the spring. Thus, if the direction of rotation is reversed, the trigger merely moves back out of the way as if it were hinged at the top.

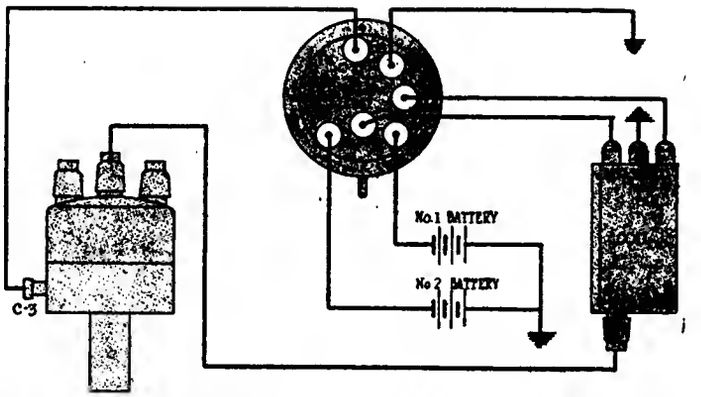
The cam points are so designed that they give a duration of contact equivalent to 3½ deg. of movement which is sufficient to permit the current to saturate the condenser at speeds of the cam sufficient to fire a 12-cylinder engine at 5000 r.p.m. There is only one adjustment, this being the closeness of the contact points which should be about 25-30/1000 in., apart when broken. When the points wear down the need for adjustment will become apparent through the engine refusing to run at maximum speed; when this is noticed a fraction of a turn of the nut back of the upper contact will restore the original speed range.

The condenser for the main ignition is contained within the breaker box, and the coil is either combined with the distributer unit or is separate. The switch selects either storage battery or dry cells in the usual way.

For spark advance the Philbrin has no automatic mechanism this being said to be needless because of the absence of lag in the breaker. A lever is provided for hand advance and is made in two forms; one moves the whole distributer and another moves the cam without affecting the external parts.

In connection with this "main" system there is a distrib-

uter which is also part of the secondary system. It is mounted above the breaker box and is of the non-contacting type, where the high tension spark leaps a small air gap. Inside the distributer head are a number of brass studs corresponding to the number of cylinders, and above the breaker cam there is a Bakelite disk carrying a brass sector which conveys the high tension discharge to each of the spark piug leads in turn. It will be noticed that this sector is very long, being only a little shorter than the circular distance between any two of the fixed studs in the distributer head, this meaning that the front edge of the sector is within 7/32 in. of the stud ahead of it while its hind end is still level with the edge of the stud behind. The reason for this great length of sector is made plain by the description of the secondary system.



Wiring diagram of Philbrin duplex ignition system

No Breaker for Secondary

The secondary system uses no part of the breaker mechanism. Within the switch assembly that attaches to the cowl board, is a special form of vibrator, consuming little current and operating at a vibratory speed of from four to five times that of the old-fashioned coil vibrator. There is a very peculiar thing in connection with this vibrator, this being that it requires no adjustment, in fact the manufacturers disclaim all guarantee if the adjustment is altered within the lift of the contact points. The latter are large, and will wear a very long time, and it is stated that the action is not affected in any way by such wear as can occur up to the very last limit.

Two Switch Controls

Looking at the outside of the switch box it wili be seen that there are two controls. The lever gives the "off" when in the middle position and can be turned right and left to pick up the storage battery or the dry cells. Above it and to the left is a knob moving on a ratchet. This gives a series of positions marked *M* and *S* meaning main and secondary ignition. When the pointer is opposite any of the *M* marks the breaker is working and the engine being fired on the single spark system, but when the pointer shows an *S*, it means that the contact breaker is cut out altogether and a continuous current is flowing through the vibrator all the time the switch is on.

Continuous Stream of Sparks

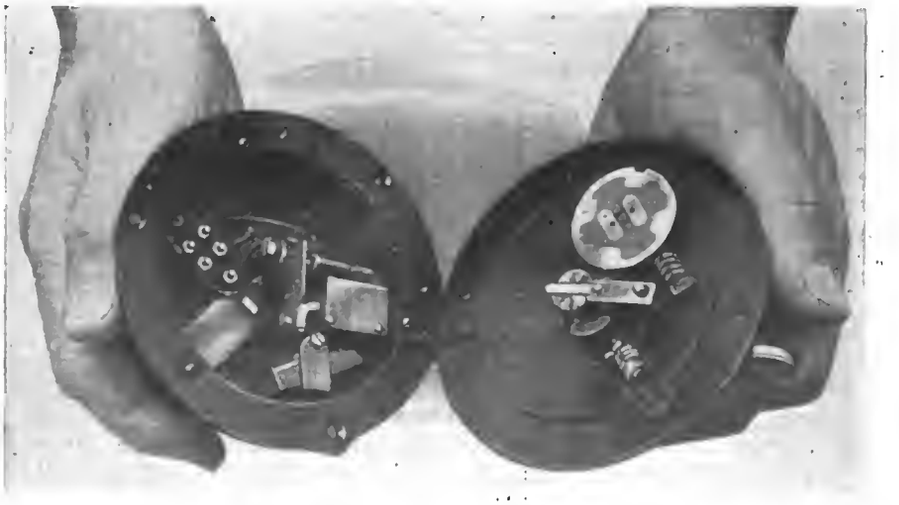
The vibrator is in circuit with the primary of the coii, so a steady stream of sparks is being sent to the distributer, and this is the reason for the long distributer sector. As the distributer turns it will continue to supply sparks to any one of the plugs during the whole time the sector takes to pass the stud in the distributer head. As the piston descends on the firing stroke the resistance at the spark plug points drops, so when the front end of the sector is approaching the next stud, there is no risk of a long thin spark jumping out ahead of the sector, the next spark plug will not get a spark at all till the sector is close enough to insure a good fat discharge.

Prevents Fouling of Plug Points

Naturaliy such a sort of ignition is very effective, particularly if the carbureter is not working well or if the engine is very cold, and it is also claimed that the continuous spark prevents oil from collecting on the plug points. The discharge is said not to injure the points because its intensity is never great enough to do them any harm, increased speed has no effect on the nature of the spark; there is no flame produced. As to the current consumed this is about one ampere, or similar in amount to that taken by a cowl board lamp bulb, much less than that consumed by a headlamp of ordinary size and power.

Current Reversed Constantly

It will be seen in the view of the switch cover that there are a series of *M* and *S* positions controlled by the ratchet knob. Their purpose is to reverse the direction of the current flow at each click of the ratchet and so equalize the wear on the contact points of both main and secondary systems. In the center of the main switch lever there is a lock operated by a key, and the cover of the switch cannot be removed even by taking out the screws as long as the lever is locked in the off position.


Left—Switch cover as it appears on cowiboard. Right—inside of switch showing the vibrator employed for the secondary ignition and the details of the selecting and reversing switch which gives either main or secondary ignition and reversee the direction of the current with each click of the ratchet

Cleveland—Rising City in the Industry

Part II

Over Eighty Manufacturers of Parts Produce in Cleveland Factories 70 to 75 Per Cent of the Automobile Parts Used in the Middle West

CLEVELAND, O., Oct. 3—According to the 1914 government census, Cleveland leads all other cities in the production of automobile parts which are assembled in other cities into complete cars. At present over eighty manufacturers of automobile parts are located in Cleveland, and the Cleveland Chamber of Commerce, which has been very active of late in inducing automobile industries to locate in Cleveland, has estimated that from 70 to 75 per cent of the automobile parts used in the Middle West manufacturing section are manufactured in the Cleveland district. These include drop forgings, sheet aluminum, sheet steel, frames, bearings, leather, paints, varnishes, etc. To these might be added various accessories, such as batteries, spark plugs, lamps, etc.

In its new campaign to increase its automobile manufacturing position, Cleveland, through its Chamber of Commerce, has announced that it does not covet Detroit's leadership as being the first automobile manufacturing city, but rather has in mind a much wider diversity of industries. The aim is to make the Cleveland district a unit within itself, capable of supplying its own needs in a manufacturing way, without being dependent on other cities.

To Attract Factories

With this end in view, the Chamber of Commerce is working to attract factories producing all varieties of automobile parts, and is at present looking for manufacturers of bodies, sheet metal parts, and additional frame makers. All of these are produced in Cleveland, but greater output is required.

In its work of securing factories for the city, the local chamber has never offered and declares it never will offer, any material inducements to industries seeking a location in Cleveland. There has been formed in the city, however, a Cleveland Industrial Development Co., with an initial capital of $500,000, which interests itself in the financing of new factories, such as automobiles, parts and accessories.

Cleveland has many arguments which are advanced as potential reasons for automobile parts, and accessory factories locating there. It is a large primary and secondary steel city. Iron, ore, and coal can be assembled here cheaper than in any other district in the North. It is a good city for working men, more than 25 per cent of Cleveland's present inhabitants owning their own homes. There is a 3-cent carfare covering the entire city.

A Large Railroad Center

This city offers exceptional shipping facilities in that over 350,000 sq. miles of country are served directly by the railroads radiating from this zone. This is practically 10 per cent of the total area of the U. S. A. Seven trunk lines enter the city, these including New York Central, Pennsylvania, Big Four, Nickel Plate, Erie, B. & O. and Wheeling & Lake Erie. The city is immediately served by the Cleveland Short Line Railway, a part of the New York Central. This belt line is 19 miles long and connects all railroads entering the city. There are thirty-nine freight stations within the city's switching limits and twenty-two passenger stations. In addition there are six electric interurban systems radiating from the city through Northern Ohio. Most of these carry freight.

Last week several of the Cleveland factories which are engaged in the automobile industry were referred to with the object of showing their growth during the past season. There are many others in the city, some of which refuse to make public figures showing the growth of the industry, and others from whom it has not been possible to get the information to date.

Columbia Axle Expands

The Columbia Axle Co., established 3 years ago, has increased its business four-fold during the past year, and now has capacity for 75,000 axles per year. Over 450 men are employed, and 50,000 sq. ft. of floor space used. New additions are planned to add 5000 sq. ft. of floorspace for rough stock and receiving department. These will be ready in 30 days. Besides manufacturing front and rear axles for several passenger car makers this concern manufactures truck axles for several concerns.

Reflex Business Gains 25%

During the past year the Reflex Ignition Co. has increased its business 25 per cent and doubled its manufacturing space. Over $20,000 worth of new machinery has been added for its spark plug manufacture. Its capacity is 3000 plugs per day. The factory has been working overtime 3 hr. per day since July.

Torbensen Boosts Production

The Torbensen Gear & Axle Co. has during tbe year added 60,000 sq. ft. of floorspace to its own manufacturing facilities and is employing 200 men. Over $100,000 worth of new machinery has been installed. In 1915 approximately 1900 Torbensen axles were produced and sold to motor truck manufacturers. By the end of 1916, a total of 11,000 will have been produced and sold. For 1917 the production figure is 25,000. In addition to its own manufacturing facilities the company has had to contract with another Cleveland concern for manufacture of many axles.

Hydraulic Pressed Steel Rushed

The Hydraulic Pressed Steel Co. has increased its business 15 per cent during the past year. In that time it has erected five new buildings as follows: A forge plant 360 by 80 ft.; an automobile frame plant 560 by 80 ft.; a receiving building 120 by 60 ft.; a power plant 80 by 40 ft., and a pump house 160 by 40 ft. Over $400,000 worth of new machinery has been installed. The company now employs 1200 men, has a capacity of 1500 automobile frames per day, and two-thirds of its entire factory has been working at night since 1914. This factory is still another example of the great activity of Cleveland plants that are not much in the public eye so far as automobiles are concerned, but which manufacture many parts entering into cars made in many different cities.

—

Michigan Has 143,550 Cars

LANSING, MICH., Sept. 30—State records show that on Sept. 1, 143,550 automobiles were registered in Michigan, or 25 per cent more during the first 9 months of 1916 than during 12 months in 1915, when the total was 114,845. Of the 143,550 cars there were 10,196 commercial vehicles.

In Wayne County, in which Detroit is located, there are 41,375 of the 143,550 cars, or 10,348 more than were registered in 11 months last year. It is estimated by officials that the total registration for the year will be between 155,000 and 160,000 cars.

The Automobile

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Mismanaged Racing

THE finest speedway in the world situated within the greatest city in the world deserves the best management in the world. Judging by the general handling of the Astor Cup race it has got something much nearer the other end of the scale.

During the race a driver on pulling up at the pits complained of spectators standing *on the track* opposite the bleachers. When the winner pulled up at the pits a crowd of thousands swarmed the fences and blocked the pits, spreading out to the boards, where thirteen cars were still running at nearly one hundred miles an hour.

The Vanderbilt Cup race was abandoned because of the deaths it caused, but the danger to spectators on a road course is a tiny trifle compared to their danger on a speedway. Every race manager knows that the public in moments of excitement must be protected against itself, so when the custom of huge crowds is sought huge precautions should be taken. To get enough track guards to police the New York speedway as it should be policed is quite easy. Indianapolis with a far larger crowd to care for has never had any difficulty, though it is much harder to get an adequate staff there than in New York.

Then, again, the drivers who enter an event like last Saturday's have *some* rights. If the management care nothing for the public they ought at least to protect their entrants from the smash up which only good fortune can avoid with spectators on the track. The drivers also have a right to expect that the times will be given out accurately and quickly.

The mismanagement of the Astor Cup race was thorough. Letting the crowd on the track was the biggest sin, but the timing was bad, and even the detail handling of the crowd was poor. In parts of the grandstand the attendants did not know the numbering system and could not show people their seats, and the second gate for pedestrians was not opened till more than an hour after the appointed time.

It is this sort of thing that kills speedways and kills public interest in racing.

The newspapers express wonder at the small size of the crowd, the owners of the track are naturally disappointed that they could not fill the grandstand nor get the patronage of a fifth of the people who could easily see a race on foot.

Tires

WHAT is the biggest item in the cost of motoring? Tires, because they wear out so fast.

American racing, culminating in the Astor Cup, has shown how to multiply tire life by ten. The racing tires which carried nearly every car in the race right through without changing a shoe are not yet tires of commerce, but they soon will be. The racing tire of today is the touring tire of tomorrow; so the time is in sight when tires will become much less troublesome than they are now.

Remembering the tire stops in the races of two years ago it seems incredible that so much improvement could be made in so short a time. Certainly the board speedway is kind to tires, also no doubt the cool air temperature on Astor Cup day was a help, but despite this the tire showing was a marvel.

That the winner could run right through at so high a speed is astonishing, but it would be far less pregnant with meaning were it not for the paucity of trouble on other cars. One example may be luck; a high average all around is proof positive that luck had nothing to do with it. Racing has contributed much to the betterment of the everyday car. The contribution from the American seasons of 1915 and 1916 is one of the most far reaching in its effect that the history of racing can show.

Obtaining Ideals

THE effort of the S. A. E. to prepare an ideal military truck specification is one of the most praiseworthy things the society has ever attempted. No engineer is ever able to build his ideal machine because of all kinds of limitations, but he has usually a very good idea as to what that ideal is. In preparing the military truck specification, the S. A. E. members will be untrammeled. They have not to consider price, nor their factory equipment, nor the ideas of their sales department; nothing troubles them except determining what they really think is *best* for the specially arduous conditions of military service.

Metz Has Balanced Crankshaft

1917 Model Reduced to $545—Engine Parts Lighter—Body Improved

NEW YORK CITY, Oct. 1—The 1917 Metz will have a balanced crankshaft and will sell at $545, f.o.b. factory, a reduction of $55. The reciprocating parts of the engine have also been lightened. Body lines have been improved and a new ventilating hood has been provided with nickel-plated clamps. The new car has metal hood sills. The metal-covered windshield board has all been enameled. The steering column brackets have been improved and an electric dash light has been placed on the instrument board. Pockets have been placed in the tonneau board.

The standard wheel color is vermillion, with an option of white or purple blue. Either wire or artillery wheels may be had. Demountable rims are not furnished as standard equipment. The front guards are made to curve gracefully over the wheels and blend into the body sides by the use of a steel apron that protects the occupants of the car from road and wheel splash.

—

Commerce Enlarges and Adds Model

DETROIT, MICH., Sept. 27—Stockholders of the Commerce Motor Car Co. have sanctioned an increase of the capital stock from $200,000 to $400,000. A 1-ton model has been brought out by the Commerce company and 3000 of these trucks are scheduled to be made during the next 12 months. The chassis with driver's seat will sell at $1,175. In addition to the 1-ton truck there will be made 1800 ¾-ton trucks. The increase in business of the company has made it necessary to enlarge the plant and an addition 60 by 250 ft. is now being built.

—

Cotta Transmission Expanding

ROCKFORD, ILL., Oct. 2—The Cotta Transmission Co. has purchased 100,000 sq. ft. of land, upon which a factory of the monitor type will be erected. The present plant is to be abandoned. The change is made necessary by increased business and the necessity for enlarged quarters. The new plant will be ready Nov. 12 and will have 27,000 sq. ft. of floor space. At present the company is employing 100 men. The new plant will employ twice this number.

—

Agrimotor Will Design Tractors

LA CROSSE, WIS., Oct. 2—The Agrimotor Engineering Co., La Crosse, Wis., has been organized by C. W. Levis, for many years sales manager of the La Crosse Plow Co., to engage in the design of tractors, farm implements and accessory lines. Levis has been elected president and manager of the new concern, which will make a specialty of marketing both patented and unpatented implements or parts and serve as agents for patentees and attorneys. In its agency capacity the company will endeavor to arrange for the manufacture of implements or attachments which have merit. A competent force of engineers, designers and draftsmen has been procured.

—

Chandler Starts New Assembly Building

CLEVELAND, OHIO, Sept. 30—Further expansion in the manufacturing facilities of the Chandler Motor Car Co. is marked by the beginning of construction of one new general assembly building 60 ft. wide, 500 ft. long and four stories high, and the addition of three stories to the 60 by 160 ft. service building erected earlier this season. With the completion of these two new buildings the Chandler company will have on its factory site five manufacturing buildings.

The new buildings will be ready for occupancy in time to help take care of the production of next year's series of Chandler sixes, a contemplated production of 25,000 cars.

The Chandler company also has purchased a large piece of property directly across East 131st Street from the main factory buildings, and on this property will, next spring, erect a building to be devoted exclusively to the handling of export shipments, installation of special foreign equipment, boxing cars ready for delivery to steamships, etc.

The comfort of Chandler employees has been borne in mind by the company in its extended building plans. One floor of the big service building will be devoted to a restaurant. Included also in the plans permitted by the new building is an emergency hospital in which a trained nurse will be on duty during factory hours and in which the company physician will make his headquarters.

—

Michigan Foundry to Be Doubled

ST. JOSEPH, MICH., Sept. 26—The Michigan Malleable Foundry Co. is to be practically doubled. A building, 100 by 300 ft., is now under way and contracts have been let for a further addition, 60 by 80 ft.

—

Rumely To Make All-Steel Tractor

LAPORTE, IND., Oct. 2—The Advance-Rumley Co. is experimenting in the manufacture of an all-steel tractor. Heretofore considerable wood has gone into the construction of tractor bodies. Recently the possibility of manufacturing an all-steel tractor gained headway in the Rumely office.

Belgian Engineers Arrive

Kelecom and Perrier, of Fabrique Nationale, Here to Visit Car Plants

NEW YORK CITY, Sept. 28—Two of the leading engineers, one of Belgium's largest motor car, motorcycle and ammunition factories, arrived in this country this week for the purpose of making manufacturing investigations and doing engineering work here. Both were engineers in Fabrique Nationale, the large factory at Liege which previous to the war manufactured F. N. motor cars, motorcycles, etc. Paul Kelecom was engineer of the motorcycle department of the factory for 12 years, and for 6 years previous was in the automobile industry. Julian Perrier has been connected with the engineering department of the F. N. factory since 1905, in charge of the development of automobile motors and motor car design. For 9 years he has been specially engaged in engineering research and laboratory work.

The F. N. factory was closed on Aug. 3, 1914, and since that date has been practically deserted. Over $1,300,000 worth of machinery has been removed from the factory by the Germans and taken to Germany. The factory is now used as a field repair depot by the Teutons. Previous to the war the F. N. factory was building 1200 automobiles a year and upward of 4000 motorcycles. In addition to this there were a great many small firearms manufactured. Over 4000 men were employed. Since the outbreak of the war Messrs. Kelecom and Perrier have been engaged in the organization of the Belgian military motor transport system. Both gentlemen expect to make a tour of the U. S. A. automobile factories.

—

Three-Plow Tractor Sells at $500

HAMILTON, OHIO, Oct. 2—J. A. Vail is president of the Vail-Rentschler Tractor Co., which will produce a three-plow machine to sell at $500 to $600. Other officers of the company, which has been capitalized at $100,000, are: Secretary, Sam S. Vail; vice-president, C. B. Wing; chief engineer, E. O. Powers; field agent, L. F. Kerner. J. A. Vail, E. O. Powers and L. F. Kerner were connected with the Fairbanks-Morse Co.

—

Kerosene Carbureter to Be Made in Des Moines

DES MOINES, IOWA, Sept. 30—A carbureter attachment which can be fitted to any car and which will permit the use of kerosene will be manufactured by a Des Moines company, capitalized at

$250,000, which has applied to the Secretary of State for a charter and which will be known as the Trotter Kerosene Carbureter Co. Directors of the company are: H. S. Butler, vice-president of the Iowa National Bank; D. F. Witter, vice-president of the Iowa Loan & Trust Co.; John Gilchrist, George Phillips, George Trotter, G. A. Huffman, and W. Hartley.

It is claimed for the device that it can be used for either gasoline or kerosene, and that it will increase the gasoline mileage by one-half, while securing from kerosene the same mileage as for gasoline without the attachment. The factory is to be erected here and a force of seventy-five will be employed.

Dechant Heads Case Advertising

RACINE, WIS., Oct. 2—George A. Dechant, Harrisburg, Pa., has been appointed advertising manager of the J. I. Case T. M. Co., Racine, Wis., to fill the vacancy caused by the resignation of Bertholf M. Pettit, who has joined the staff of the Curtis Publishing Co., Philadelphia.

Harding Takes Up New Detroit Job

DETROIT, MICH., Oct. 2—J. V. Harding, who was formerly the Detroit factory representative for the Goodyear Tire & Rubber Co., has left the field to become the general manager of the Neville More Room Steering Wheel Co.

New Departure to Double Output

30,000 to 35,000 Bearings a Day Will Be Made by July 1

BRISTOL, CONN., Oct. 3—The New Departure Mfg. Co., of this city played the role of host to its 2700 bearing workmen last Saturday when it staged an old-fashioned barbecue dinner of grilled lamb and all that goes with it. The dinner was one of the most pretentious ever held in New England by an automobile concern. It required eighty spring lambs which were stretched on skewers over a trench 328 ft. long filled with burning charcoal, to serve the 2700. In addition 11,000 ears of corn were needed and 30 bushels of potatoes. To make it a New England occasion all the bakeries in the vicinity were working on New England pumpkin pies. One of the outstanding features of the affair was the orderly precision in which the whole program was carried out, there not being any disorder from start to finish of the day's activities.

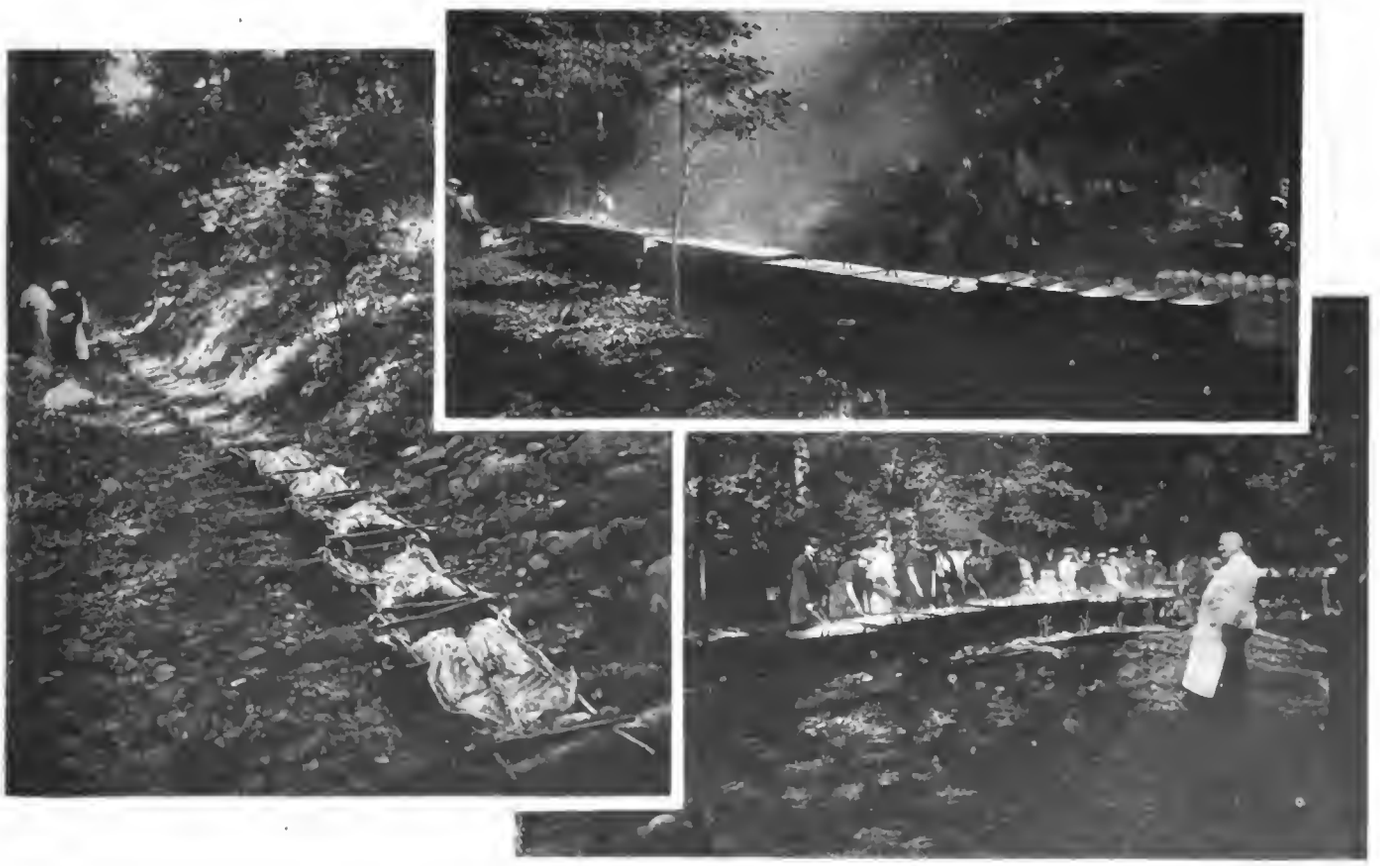
The New Departure company is making giant strides in the manufacture of its double and single row ball bearings. Its manufacturing capacity to-day is 21,000 bearings per day. This was the average production for each day of last week. The output is double what it was a year ago. It is planned to have the present output doubled by July 1 when there will be capacity for 30,000 to 35,000 bearings per day. By July 1, 4500 men will be employed.

To care for this rapid factory expansion twenty-three acres of land were purchased in this city last June. On it 102 homes for workmen's families have been completed. To care for single men the local hotel was purchased and accommodates 200.

The factory additions at present under way, are: One new four-story building, 60 by 450 ft., is one-half complete. It will be used for the manufacture of steel balls.

A contract has been let for another building 100 by 600 ft. part one-story and part three-story. It will be used for automatic work, press work, receiving and shipping. It will have two railroad sidings 950 ft. long.

At present the company is operating two factories, one in this city and the other in Hartford, Conn., where small bearings, such as required for magnetos, are manufactured. The New Departure started manufacturing double-row bearings 6 years ago, and single-row types 3 years ago. At present its output is equally divided between the two.



Scenes at the old-fashioned barbecue dinner given by the New Departure Mfg. Co., Bristol, Conn., to its 2700 bearing workmen last week. The dinner consisted of eighty spring lambs with all accessories, including stacks of New England pumpkin pies, 11,000 ears of corn and 80 bushels of potatoes

Union Products Co. Formed

$200,000 Company To Make Parts and Accessories in Rockford

ROCKFORD, ILL., Sept. 29—The Union Products Co. has been organized here with $200,000 capital and will manufacture, among other automobile parts and accessories, a piston ring patented as No. 1,195,279, by D. D. Shierk. Exclusive manufacturing licenses have been obtained by the company on six issued patents and four that are pending covering the manufacture of wire wheels.

Officers of the new company are: President and general manager, A. H. Martin, formerly vice-president and sales manager of the Burd High Compression Ring Co.; vice-president, M. R. Harned; secretary, H. F. Norris; chief engineer, W. E. Williams, consulting engineer of the American steel Foundries.

Plans for a factory have been completed and the work is being rushed on special machinery for the company.

—

Peerless Truck Order Increased to 100 Per Week

CLEVELAND, OHIO, Sept. 27—The order for motor trucks recently given to the Peerless Truck & Motor Corp., has been increased from sixty a week to 100 a week. Additions to the plant have made the increased output possible.

The new order comes through Gaston, Williams & Wigmore, Inc. If necessary the Long Island plant can be diverted from present work to fulfill the order.

—

Autocar Issues $1,250,000 in Bonds

NEW YORK CITY, Oct. 1—The Autocar Co., Ardmore, Pa., has issued $1,250,000 first mortgage 5 per cent serial bonds, dated Oct. 1 and maturing from April 1, 1917, to Oct. 1, 1921, in instalments of $125,000 each. The capital stock of the company is $2,000,000. The bonds are secured by a first closed mortgage on all the company's property, whose replacement value is in excess of $1,400,000.

For the last 2 years and 8 months, net profits of the company after depreciation have averaged $500,000 per annum, after making ample allowances for depreciation. This is equivalent to eight times the interest requirements on the new bond issue.

—

Stability Marks Material Prices

NEW YORK CITY, Oct. 3—Automobile material prices last week were featured by a steady market. There were few changes and those changes that did take place were for the most part unimportant.

The only important change was that of Pennsylvania crude oil, which rose 10 to $2.40 a barrel. Conditions in the oil field, however, are quiet despite the stir created by the oil advance. Demand for gasoline throughout the country continues strong with few changes occurring. New York gasoline continues unchanged at 22 cents a gallon.

—

Marathon Tire Increases Capital to $1,000,000

CUYAHOGA FALLS, Oct. 2—At the annual stockholders' meeting of the Marathon Tire & Rubber Co., this city, held Sept. 27, it was voted to increase the capital stock from $500,000 to $1,000,000.

—

BeSaw Capital Now $220,000

AKRON, OHIO, Sept. 30—The BeSaw Tire & Rubber Co. has increased its capital from $150,000 to $220,000.

—

Alford Becomes Nash Comptroller

DETROIT, MICH., Oct. 3—W. H. Alford has resigned as comptroller of the General Motor Corp., to take a similar position with the Nash Motor Car Co., Kenosha, Wis., effective Oct. 2.

—

Dividends Declared

Locomobile Co. of America; quarterly of 1¾ per cent on preferred, payable Oct. 2 to holders of record at close of business Sept. 30.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.61	.61	.61	.61	.61	.61	...
Antimony, lb.	.11	.11¼	.11¼	.11¼	.11¼	.11	...
Beams and Channels, 100 lb.	2.76	2.77	2.77	2.77	2.77	2.77	+ .01
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl.	10.50	10.48	10.45	10.41	10.42	10.71	+ .21
Fish Oil, Menhaden, Brown, gal.	.58	.58	.58	.58	.58	.58	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.08	1.08	1.08	1.08	1.08	1.08	...
Lead, 100 lb.	7.25	7.25	7.25	7.25	7.25	7.25	...
Linseed Oil, gal.	.73	.74	.75	.75	.75	.81	+ .06
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.30	2.40	2.40	2.40	2.40	2.40	+ .10
Rapeseed Oil, refined, gal.	.90	.90	.90	.90	.90	.90	...
Rubber, Fine Up-River, Para, lb.	.72	.72	.72	.72	.72	.72	...
Rubber, Ceylon, First Latex, lb.	.60	.60	.60	.60	.60	.60	...
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	39.00	39.11	39.30	39.40	39.50	39.50	+ .50
Tire Scrap, lb.	.05¾	.06	.06	.06	.06	.06	+ 00¼

$2,000,000 Truck Line

Co. Formed To Operate 104 Vehicles Between N. Y. and N. J. Cities

NEW YORK CITY, Sept. 30—The New York and New Jersey Express Co. has been organized to do a general haulage business by motor trucks between this city and New Jersey points within a radius of 20 miles. The project is the outgrowth of the great increase of manufacturing in nearby cities, including Newark and Elizabeth, whose outlet for export has been limited by railroad congestion. The company plans to put into operation 104 heavy trucks, contracts having been signed for hauling 55,000 tons of goods per month.

The company has $2,000,000, 7 per cent preferred stock fully paid up and 10,000 shares of common without par value. The company's offices are at 309 Broadway.

—

Kilborn Is Liberty Sales Manager

DETROIT, MICH., Oct. 2—E. J. Kilborn, who for the past 2½ years has been the manager of the Oakland Motor Co.'s Chicago wholesale branch, has been appointed general sales manager of the Liberty Motor Car Co. He is taking immediate charge of his new duties.

A. W. Franklin has been appointed Eastern representative and Nicholas Hall and D. C. Reeves have been made Southwestern representatives of the company.

—

Weston Stays with U. S. Tire

NEW YORK CITY, Oct. 1—J. C. Weston will remain with the U. S. Tire Co., instead of going to the Mitchell Motors Co., Racine, in the capacity of vice-president in charge of sales. Mr. Weston will assume the newly created position of director of sales, thus abolishing the post of sales manager formerly held by him. O. S. Tweedy has become general branch sales manager, having direct charge of all branches.

—

Couzens Heads Detroit Police

DETROIT, MICH., Sept. 28—James Couzens, who was one of the men who started the Ford Motor Co., and who resigned as its vice-president and general manager in 1915, has been appointed police commissioner of Detroit. He fills the vacancy of the former chief who resigned suddenly.

—

Swinehart Tire Business Increases 20%

AKRON, OHIO, Sept. 28—Reports submitted by Swinehart officials showed an increase of more than 20 per cent in the

volume of business. Net sales were reported to the annual meeting yesterday, as exceeding $1,680,000, and according to T. F. Walsh, president, the business was never on a sounder basis. The factory is now turning out 500 tires a day.

The directors organized yesterday afternoon and will meet early next week to declare a quarterly dividend of 1½ per cent.

The following were elected directors: B. A. Polsky, Fred Snyder, W. M. Weldon, Charles Currie, T. E. Barry, Dr. E. L. Mather, T. F. Walsh, F. S. Long and R. E. May. Officers were re-elected.

—

New Overland Stock All Subscribed

NEW YORK CITY, Sept. 30—The $15,000,000 common stock of the Willys-Overland Co., Toledo, Ohio, which was offered to stockholders a few weeks ago for subscription of $44 a share was entirely taken up by the old shareholders, so that there will be none of the stock offered to the general public. The shares were subscribed for in proportion of one to each lot of five shares of common held, the exchange being on a share-for-share basis in respect to holders of preferred stock.

—

Hydraulic Pressed Steel Redeems Preferred

CLEVELAND, OHIO, Sept. 28—The Hydraulic Pressed Steel Co. is notifying preferred shareholders of its intention to redeem the present preferred issue at 102½ on Oct. 1.

Security Prices Rise

—

General Motors and Springfield Body Feature Market Activities

NEW YORK CITY, Oct. 3—Speculation in automobile and accessory issues last week was partly responsible for higher prices. Automobile securities have joined in the general rise of prices. At the present time interest rates are low and people are buying stocks both for speculation and investment purposes.

Last week Willys-Overland, General Motors, and Springfield Body common stock were in large demand. Willys-Overland, however, did not come up to expectations, as it was expected to rise to at least 48. Springfield Body rose 14 points to 96. The board of directors of that company has authorized the sale of 2250 shares of preferred stock to all stockholders, common and preferred, as of record, Oct. 9. These stockholders are granted the privilege of subscribing to the extent of 10 per cent of their holdings at $110 per share, plus accrued dividend from Oct. 1 to date of subscription.

General Motors made a large gain for the week, closing yesterday at 720, just 20 points higher than last week, Packard common rose 25 points to 175.

Several of the tire issues were strong though Firestone, which has featured the Akron exchange with its high price, dropped 40 points. Goodyear featured the market activities with a 25-point rise. Goodrich common rose 2 points; Portage common and preferred went up 10 points each; and U. S. Rubber common and preferred went up 2¼ and ¾ points, respectively.

The Detroit prices were fairly steady with gains ranging from a fraction to 12 points. Packard common featured the activities with a 12-point rise.

—

White Sued for $1,500,000

NEW YORK CITY, Oct. 3—Alleging that he had a contract with the White Co., made prior to the outbreak of the European War, giving him the exclusive right to sell White trucks in Russia, M. S. Friede, prominent in Russian-American trade, has filed a suit in this city for damages and commission aggregating $1,500,000 against that company, which, he states, violated the contract by permitting others to deal in its interest with Russians.

—

Hall Joins Pathfinder Co.

INDIANAPOLIS, IND., Oct. 2—D. K. Hall last week was appointed director of service of the Pathfinder Co. He had been head of the complaint department of E. C. Atkins & Co., saw manufacturers, Indianapolis, for 20 years.

—

Chemists Discuss Alcohol as Fuel

NEW YORK CITY, Sept. 29—Alcohol as a possible substitute for gasoline, and its increased industrial value were discussed by chemists attending the National Ex-

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co.	..	..	64	65½	— ½
J. I. Case T. M. Co. pfd.	79	83	83	86	+1
Chalmers Motor Co. com.	140	146	145	155	..
Chalmers Motor Co. pfd.	98	102	95	99	—1
*Chandler Motor Car Co.	..	..	105	106	..
Chevrolet Motor Co.	..	..	198	201	—6
Fisher Body Corp.	..	..	40½	42	..
Fisk Rubber Co. com.	..	..	97	106	—3
Fisk Rubber Co. 1st pfd.	..	..	110	117	..
Fisk Rubber Co. 2d pfd.	..	..	100	110	..
Firestone Tire & Rubber Co. com.	560	..	1110	1150	—40
Firestone Tire & Rubber Co. pfd.	112	..	110	112	..
*General Motors Co. com.	348	352	720	759	+20
*General Motors Co. pfd.	111	113	126½	127	+2½
*B. F. Goodrich Co. com.	77	79	74¼	75¼	+2
*B. F. Goodrich Co. pfd.	109	111	113½	114	+1½
Goodyear Tire & Rubber Co. com.	335	345	295	300	+25
Goodyear Tire & Rubber Co. pfd.	109	110	106¾	107½	+ ¼
Grant Motor Car Corp.	..	..	9	11	+1
Hupp Motor Car Corp. com.	..	..	5½	6½	— ½
Hupp Motor Car Corp. pfd.	..	..	..	95	..
International Motor Co. com.	29	30	5	10	..
International Motor Co. pfd.	58	63	18	21	+3
*Kelly-Springfield Tire Co. com.	220	227	81½	81¾	—1½
*Kelly-Springfield Tire Co. 1st pfd.	89	91	98	100	..
*Lee Rubber & Tire Corp.	..	..	45¾	46	..
*Maxwell Motor Co. com.	53	55	93	93½	—3
*Maxwell Motor Co. 1st pfd.	92	93	87¾	88	+ ¼
*Maxwell Motor Co. 2d pfd.	44	45	57	58	—1
Miller Rubber Co. com.	198	202	250	265	..
Miller Rubber Co. pfd.	109	110	104	106	..
Packard Motor Car Co. com.	126	130	175	185	+25
Packard Motor Car Co. pfd.	100	..	97	102	+2
Paige-Detroit Motor Car Co.	..	..	33½	34½	+1½
Peerless Truck & Motor Corp.	..	..	24½	25½	—1½
Portage Rubber Co. com.	54	56	170	180	+10
Portage Rubber Co. pfd.	92	94	170	180	+10
Regal Motor Car Co. pfd.	..	..	17	22	—1
Reo Motor Truck Co.	18	†19	..	..	..
Rec Motor Car Co.	34½	†..	45¼	45¾	+ ¾
Saxon Motor Car Corp.	..	..	79¼	80¼	—2¾
Springfield Body Corp. com.	..	..	96	100	+14
Springfield Body Corp. pfd.	..	..	125	135	+5
Standard Motor Construction Co.	..	..	6½	7	..
Stewart Warner Speed. Corp. com.	76	78	112	114	— ½
Stewart Warner Speed. Corp. pfd.	106	..	..	..	..
*Studebaker Corp. com.	140	141½	132	132½	+1½
*Studebaker Corp. pfd.	109	110	109½	111	+1½
Swinehart Tire & Rubber Co.	87	90	90	96	..
United Motors Corp.	..	..	66	66¼	—1¼
*U. S. Rubber Co. com.	54	55½	61¼	61¾	+2½
*U. S. Rubber Co. pfd.	106	107½	113¾	113¾	+ ¾
White Motor Co.	110	..	54¾	55½	+ ½
*Willys-Overland Co. com.	223	225	46	46½	+ ½
*Willys-Overland Co. pfd.	108	110	103½	103¾	+ ⅛

*At close Oct. 2, 1916. Listed New York Stock Exchange. †Ex-dividend.
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co.	..	..	41	44	+2
Chalmers Motor Co. com.	139	..	..	145	..
Chalmers Motor Co. pfd.	97½	102½	..	102	..
Continental Motor Co. com.	295	..	36	37	—2½
Continental Motor Co. pfd.	83½	..	9½	10½	..
Ford Motor Co. of Canada	1500	..	325	345	+5
General Motors Co. com.	345	355	700	780	..
General Motors Co. pfd.	111	112½	124½	129	+ ½
Maxwell Motor Co. com.	53	55	92	95	+1
Maxwell Motor Co. 1st pfd.	90½	93	86½	89½	+ ½
Maxwell Motor Co. 2d pfd.	44½	47	56	59	..
Packard Motor Car Co. com.	126	..	180	185	+12
Packard Motor Car Co. pfd.	100	..	100	101½	..
Paige Detroit Motor Car Co.	..	445	36	37½	+3¼
W. K. Prudden Co.	21	..	..	51½	..
Reo Motor Car Co.	35½	..	45½	46	+ ¾
Studebaker Corp. com.	140	143½	131½	134	+1½
Studebaker Corp. pfd.	106	110	107	..	..
C. M. Hall Lamp Co.	..	..	27	30	+ ½

INACTIVE STOCKS

Atlas Drop Forge Co.	..	29	..	33	..
Kelsey Wheel Co.	205	..	55	60	..
Regal Motor Car Co. pfd.	..	21	18	..	..

position of Chemical Industries in this city.

According to Dr. A. D. Little of Boston, the only fuel in sight which promises to take the place or hold down the price of gasoline is alcohol. Dr. Little declared that alcohol is the best fuel for internal combustion engines, as benzol, which had been suggested as a substitute for gasoline, is not sufficiently plentiful to keep the large number of automobiles in this country going for two days. Kerosene, he added, was out of the question.

From 1912 to 1915 the production of completely denatured and specially denatured alcohol rose from 8,000,000 gal. to 14,000,000 gal. a year.

Alcohol is being made from sawdust, according to A. H. Comey, chemist at the Du Pont Powder Co.'s laboratory, who states that it is a great commercial success and will grow accordingly.

Dr. Little stated that in the yellow pine district alone there is enough material wasted to make 600,000 gal. of alcohol a day.

Industry Gains 153% in 5 Years

1909 - 1914 Value of Products $632,831,000—Gain $383,629,000

WASHINGTON, D. C., Oct. 2—The large growth of the automobile industry in the 5-year period from 1909 to 1914, is indicated by an increase of 153.9 per cent in the value of its products, according to the Census Bureau of the Department of Commerce.

The value of those products in 1914 was $632,831,000, an increase of $383,629,000 over 1909. In 1914 there were 300 establishments engaged primarily in the manufacture of automobiles. They employed 91,997 persons, had an invested capital of $312,876,000, paid $84,901,000 in salaries and wages during the year and produced vehicles to the value of $503,230,000.

In addition, there were thirty-three establishments engaged in other lines of manufacturing which produced automobiles to the value of $6,636,920.

Adding the value of bodies and parts produced by 971 companies making this their principal business and 434 other establishments producing them as a side line, brings the total value of automobile products for that year to $649,982,990, an increase of 155 per cent over the value of production of $254,447,346 in 1909.

The greatest increase shown by the industry in the 5 years was in salaries paid, which increased 295 per cent, from $9,479,000 to $37,526,000.

The average value of production per employee increased from $2,920 to $4,336 in the respective census years.

The second largest increase was in value of materials purchased for the manufacture of cars, bodies and parts. This grew from $131,646,000 in 1909 to $356,208,000 in 1914, an increase of 170 per cent.

August Exports Total $10,068,538 in Value

(*Continued from page* 557)

valued at $772,257 and 18,884 passenger cars, valued at $16,612,060, together with parts to the value of $4,107,545, were shipped to various foreign countries. These figures look puny beside the statistics for the past 2 years.

Seven hundred and eighty-nine cars, valued at $1,963,526, were shipped to Russia in August last, while during the 8 months' period of this year the number was 2182 and the value $5,955,120. Russia did not figure in the export returns last year.

France's contribution to American automobile manufacturers in August last was the purchase of 398 cars, valued at $1,147,602, which is a big gain over the figures for the same month of 1915, when the purchases amounted to 196 cars, valued at $661,972. Likewise, during the 8 months' period the shipments to France increased from 4464 cars, valued at $11,209,798, in 1915, to 6053 cars, valued at $15,005,294, in 1916.

The big decline is to be noted in the figures for the United Kingdom. In August, 1915, there were 2290 cars shipped to the United Kingdom, the value of which was $3,530,831, while in August last the number had decreased to 294 and the value to $534,359. During the 8 months' period the exports fell from 16,784 cars, valued at $25,528,943, in 1915, to 6575 cars, valued at $10,392,259, in 1916.

There were no shipments to Germany during August of this year, or during the 8 months' period of 1916, but during the 8 months of 1915 there were four cars valued at $2,800 exported to Kaiser Wilhelm's domain.

Our trade with Canada shows a large increase during the periods under consideration, the exports having grown from 721 cars, valued at $480,677, in August, 1915, to 860 cars, valued at $750,361, in August last, and from 4682 cars, valued at $3,673,203, to 9476 cars, valued at $6,777,656, during the 8 months' periods.

In August a year ago there were 274 cars, valued at $149,319, shipped to various South American countries, while during the 8 months of that year the number was 1486 cars and the value $793,037. Herewith are the figures for South American countries, listed separately, for the same periods of this year: Argentina, 145 cars, valued at $86,470, in August, and 3798 cars, valued at $1,863,625, during the 8 months. Brazil, 29 cars, valued at $14,715, in August, and 280 cars, valued at $184,447 during the 8 months. Chile, 151 cars, valued at $85,355, and 702 cars, valued at $446,788; Venezuela, 25 cars, valued at $19,648, and 386 cars, valued at $240,982. All other South American countries, 42 cars, valued at $32,383, and 609 cars, valued at $367,759. These figures prove conclusively that South America is a field for American-built cars.

Growth of Automobile Industry from 1909 to 1914

	Census				Per Cent of Increase,		Per Cent of Increase,
	1914						
	Automobiles	Automobile Bodies and Parts	Total	1909	1909–1914	1904	1904-1909
Number of establishments*	300	971	1,271	743	71.1	178	317
Persons engaged in manufacture:	91,997	53,954	145,951	85,359	71.0	.....	...
Proprietors and firm members	60	700	760	405	87.7	.....	...
Salaried employees	12,630	5,469	18,099	9,233	96.0	1,181	682
Wage earners (average number)	79,307	47,785	127,092	75,721	67.8	12,049	528
Primary horsepower	104,983	68,701	173,684	75,550	129.9	10,109	647
Capital	$312,876,000	$94,854,000	$407,730,000	$173,837,000	134.5	.....	...
Services:	84,901,000	54,552,000	139,453,000	58,173,000	139.7	.....	...
Salaries	17,966,000	19,560,000	37,526,000	9,479,000	295.9	$1,257,000	654
Wages	66,935,000	34,992,000	101,927,000	48,694,000	109.3	7,159,000	580
Materials	292,598,000	63,610,000	356,208,000	131,646,000	170.6	.....	...
Value of products	503,230,000	129,601,000	632,831,000	249,202,000	153.9	30,034,000	730
Value added by manufacture (value of products less cost of materials)	210,632,000	65,991,000	276,623,000	117,556,000	135.3	16,883,000	596

*In addition, in 1914, 33 establishments primarily engaged in other lines of manufacture, produced automobiles to the value of $6,636,920, and 434 establishments of this character manufactured automobile bodies and parts to the value of $10,515,070; in 1909, similar establishments produced automobiles valued at $830,080 and automobile bodies and parts valued at $4,415,266.

Speedways Ban Sunday Races

Eight Championship Events of 100 Miles or Over with $100 a Mile Prizes

NEW YORK CITY, Oct. 2—Practically all of the speedways were represented at a joint meeting of the contest board at the American Automobile Association in this city to-day, when changes in the racing rules for 1917 were discussed and other necessary changes for 1917 racing recommended.

All speedways were agreed that the contest board should not sanction Sunday racing on speedways. Indianapolis, represented by J. N. Allison, was particularly strong on this ruling, due to the postponed race on the Chicago speedway being held on a Sunday, which caused the withdrawal of the Indianapolis team. David S. Reid, representing the Chicago speedway, voted for the new rule.

It was decided that eight 1917 championship events be held, one on each speedway. These championships are to be at a minimum of 100 miles, but may be at 250, 300, 350 or 500, according to the desires of the different speedways. It was voted to have a minimum cash prize at the rate of $100 per mile of race. This would make the prize for a 500-mile race $50,000; for a 250-mile race, $25,000, and for a 300-mile race, $30,000.

The eight championship events scheduled for 1917 are:

May 30	Indianapolis
June 9	Chicago
July 4	Omaha
July 14	Des Moines
July 28	Tacoma
Sept. 3	Cincinnati
Sept. 15	Providence
Sept. 29	New York

In addition to this schedule of championship events which are only to be held on speedways, 1917 dates for other speedway races were arranged for as follows:

May 19	New York Metropolitan
June 23	Cincinnati
Aug. 4	Kansas City
Oct. 6	Kansas City
Oct. 13	Chicago
Oct. 27	New York

It is expected that early next year two other speedways will be completed, namely, Philadelphia and Uniontown. Dates will have to be awarded for these as necessary.

The feeling was general that all drivers who qualify and start in 1917 races should receive some financial assistance, and it was decided to allow $100 transportation expenses to all cars qualifying and starting. Should a car finish in the money this amount would be deducted from the cash winnings of the car. If the car does not finish in the money the $100 will be awarded. In case of particularly long trips, such as Chicago to Tacoma, a total allowance of $150 per car may be made.

No 1917 championships will be held outside of the speedways as mentioned. This year the Grand Prize and Vanderbilt Cup races will be included in the championship events. It was decided to allow the first 300-cu.-in. car finishing in each of these 1916 road events to receive championship points the same as if they won the event. In other words, the first 300-cu.-in. car to finish will receive 800 points, the second 420, the third 220, etc.

Drivers will be better protected in 1917, in regard to receiving prize money, than they were this year. At Minneapolis and Sioux City drivers were required to compromise and did not get their full cash allowance. For 1917 cash prizes must be posted 2 weeks before the day of the race. This protects every driver and he will not be put to the expense of shipping his car to a speedway, because he will know before he has to ship if the money is posted or not.

New Starting Rules

While the drivers have been given every assistance under the new schedule, there are a few rules which they will have to observe. One of these is that every driver must be at the starting line 1 hr. before the start of the race. Violation will mean a cash penalty.

Pit supplies for racing cars must be in the pits at least 3 hr. before the start of the race.

Eddie Rickenbacker recommended that on speedways like New York and Chicago forty cars be permitted to start instead of thirty-two. It is expected that the contest board will revise its rules accordingly.

The drivers winning positions in the 1916 championships will receive permanent racing numbers for their cars in 1917 according to the positions in which they finished in the 1916 championships. Thus the driver finishing first in the 1916 championship will have No. 1 for his car during the entire racing season. He will also be given No. 1 driver's registration. The driver finishing second will be given No. 2 racing number for his car and also No. 2 driver's registration. This rule was strongly urged by the drivers.

To Boost Championship Fund

In order to swell the championship fund for 1917 the different speedways have agreed to pay to the contest board $10 for each car entered in a championship event. This money will all go to the 1917 championship fund.

Among those speedways represented at the meeting were: Indianapolis, J. M. Allison and L. E. Myers; New York, Harry Harkness and E. Thompson; Chicago, David E. Reid and Edward Heinze; Cincinnati, H. S. Lehman; Uniontown, C. W. Johnson; Des Moines, L. C. Dunn; Omaha, J. W. McShane.

Aitken Leads for Championship

Astor Cup Victory Lifts His Score to 2520 Points—Resta Second

NEW YORK CITY, Oct. 2—Johnny Aitken, of the Indianapolis speedway racing team, now leads the list in the 1916 racing championships. Aitken was running third previous to the Astor Cup race Saturday, but by winning this race he gained 800 points and so took first position away from Dario Resta, who was leading with 2400 points. Aitken now has 2520 points to his credit.

The order of championship standing is:

J. Aitken	2,520	Le Cain	120
Dario Resta	2,400	B. Oldfield	80
E. Rickenbacker	1,990	O. Taft	75
Ralph De Palma	1,790	E. Pullen	70
D'Alene	1,120	O. Haibe	60
Milton	690	N. Stringer	55
Mulford	620	G. Adams	55
Christiaens	540	Earl Cooper	55
Henderson	517	H. Wilcox	40
Vail	440	W. Chandler	40
D. Lewis	380	P. Watson	35
F. Galvin	340	M. Sorensen	35
J. Devigne	320	C. Johnson	30
H. Hughes	275	J. Gable	30
G. Buzane	210	Devene	30
E. O'Donnell	185	F. McCarthy	25
C. J. Devlin	140	W. J. Muller	20
A. A. Klein	125		

Uniontown's 1⅛-Mile Speedway to Open Thanksgiving Day

NEW YORK CITY, Oct. 3—The new Uniontown, Pa., 1⅛ mile board speedway, which has been erected by C. W. Johnson, a Uniontown capitalist, will be opened on Thanksgiving Day for the local meet. The speedway is a regulation board type, designed and built by Jack Prince of bicycle fame.

Speedway Heads Meet and Discuss Permanent Organization

NEW YORK CITY, Oct. 3—Steps toward a permanent organization of the different motor speedways were taken here to-day when representatives of Indianapolis, New York, Chicago and Cincinnati speedways discussed tentative plans for the scope of such an organization. To-day's meeting adjourned to meet in Chicago on Saturday, Oct. 14, when a charter for such an organization will be adopted.

The committee in charge consists of L. E. Myers, Indianapolis; David A. Reid, Chicago; E. Thompson, New York, and H. Lehman, Cincinnati. These four are taking the old Indianapolis charter for such an organization, and re-arranging it to meet present conditions. R. Kennerdell, chairman of the Contest Board, A.A.A., will meet with the committee in Chicago.

31 Grand American Entries

CHICAGO, ILL., Oct. 4—The management of the Chicago speedway has announced thirty-one entries for the Grand

American automobile race, Oct. 14. This is for 250 miles and is limited to 300-cu.-in. cars, being an A. A. A. championship event.

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Aprahamion Sails for Orient

NEW YORK CITY, Oct. 4—A. Aprahamion sails Saturday for Africa, China and other points in the Far East, where he will represent several automobile and accessory companies, among which are: Mitchell Motors, Federal Tire, Cox Brass, New Departure, Standard Woven Fabric, Champion and Keyless Auto Lock. Mr. Aprahamion recently returned from South America.

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Hupmobile Tour Progressing Westward

DETROIT, MICH., Oct. 2—The capital-to-capital Hupmobile left Minneapolis on its way westward, with Pierre, S. D., for its next destination. From Pierre it goes to Seattle, Wash. The car turned the 5000-mile mark between Des Moines and Minneapolis exactly on the thirtieth day of its trip, Sept. 28. On that same day the crew encountered the first rainstorm and drove in mud to the hubs.

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New Traffic Plan for New York

NEW YORK CITY, Sept. 30—Isles of safety are now put at the intersections of Fifth Avenue with 43rd, 46th and each alternate cross street as far north as 59th to help solve the night traffic problem due to the increased vehicle travel caused by the street car strike. These isles of safety render it possible to withdraw traffic policemen from these points.

—

Eastman Heads Philadelphia Packard

PHILADELPHIA, PA., Sept. 30—Lee J. Eastman, manager of the Philadelphia branch of the Packard Motor Car Co., was elected president by the directors at a recent meeting in Detroit, succeeding Edwin B. Jackson, who is now president of the New York branch.

Harkness Trophy Race Oct. 28

—

100-Mile Event Will Carry $10,000 Prize Money—Marks Close of 1916 Season

NEW YORK CITY, Sept. 30—The 100-mile race for the Harkness trophy will be held at the Sheepshead Bay Speedway Oct. 28. It will also carry $10,000 prize money. The Harkness trophy race is looked upon as the final speedway event of the year and is expected to bring together all the drivers who have won places in the big races of the season.

The first Harkness trophy race last year was won by Dario Resta in his Peugeot in 56:55:71 or at 105.39 m.p.h.

—

Silver Takes Dort in New York

NEW YORK CITY, Sept. 30—C. T. Silver has closed a contract with the Dort Motor Car Co., Flint, Mich., by which he will represent the Dort car in the New York territory.

—

Oakland Branch Managers in 3-Day Conference at Plant

PONTIAC, MICH., Sept. 30—The 3-day annual meeting of the branch managers, distributers and salesmen of the Oakland Motor Car Co., ended to-day. It was the most enthusiastic gathering of Oakland salesmen ever held, marking the most successful year in the history of the company.

Oakland officials, branch managers and distributers took part in the many business sessions at which all matters concerning the 1917 Oakland policies as to cars, service, sales, etc., were discussed. The visitors also spent considerable time in the shops.

A banquet was tendered to the visiting Oakland men by the officials of the Oakland Motor Car Co., at the Hotel Statler, Detroit, Sept. 29. Among those who informally addressed the distributers and salesmen were Fred W. Warner, now president of the company; C. B. Voorhis, now vice-president; J. T. Shaw, treasurer of the General Motors Co.; W. L. Day of the General Motors Truck Co.; H. H. Rice, personal representative of W. C. Durant; Carl M. Green and W. C. Durant, who came unexpectedly.

—

Takes Over N. Y. Saxon Factory Branch

NEW YORK CITY, Oct. 1—Distribution of the Saxon in this city and surrounding territory, formerly in the hands of a factory branch, has been taken over by the Saxon Motor Car Corp., recently organized. G. S. Morrow is president.

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Newman Resumes Former Position

DETROIT, MICH., Oct. 4—Harry Newman, who recently resigned the presidency of Harry Newman, Inc., Chicago and Milwaukee Chalmers distributers, has again taken his old position.

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Lancia Adopts H. & N. Carbureter

NEW YORK CITY, Sept. 30—The Lancia Co. has adopted the H. & N. carbureter as standard equipment, the type used being of special design for this car.

—

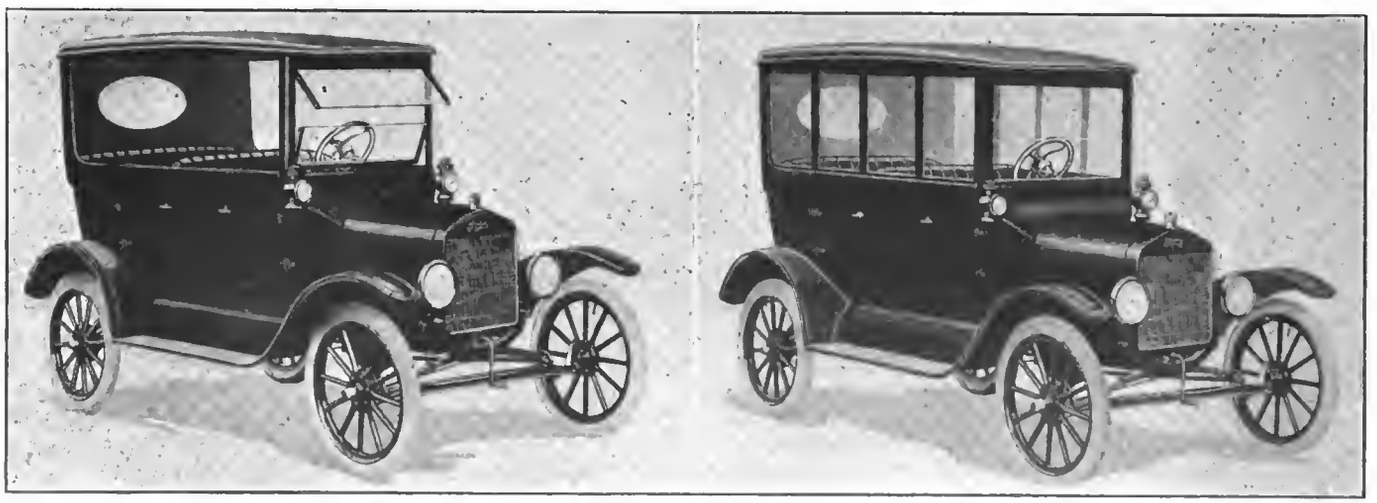
Lexington-Howard Rayfield Equipped

CONNERSVILLE, IND., Oct. 3—The Lexington-Howard Co., this city, has added the Rayfield carbureter as standard equipment.

—

Senator Morgan to Sell Saxons

NEW YORK CITY, Oct. 4—W. J. Morgan, familiarly known as "Senator," and pioneer in automobile beach races in Florida, has organized the Morgan-Farr Motor Co., Inc., Newark, N. J., to sell Saxon cars.



The Motor Products Co., Indianapolis, Ind., has commenced manufacture of the convertible sedan top for Ford cars illustrated above. It is easily attached in the first instance, and the windows can afterward be removed quickly in fair weather or replaced for bad conditions. It is supplied for $125. This is the first of a series that will be put on the market; tops of similar design for Chevrolets, Overlands, Maxwells, etc., will be added shortly

Factory Miscellany

Brown Heat Department Completed—The Brown Co., Syracuse, N. Y. has been completed. Four oil-burning furnaces have been installed with a capacity of sixteen large pots per furnace, or 1200 to 1600 bolts per heat, each furnace. Three heats every 24 hr. can be successfully run, or 3600 to 4800 pieces for each furnace in a complete day.

Bulldog Plant for Plymouth—Adelbert Work, of Chicago, head of a company manufacturing Bulldog shock absorbers and other accessories, has announced plans for removing the plant from Chicago to Plymouth, Ind., as soon as a factory building can be erected. Ground for the plant has been purchased. The plant will be 38 by 38 feet.

Patent Ring Plant—The Ford-Davis Mfg. Co., St. Louis, has selected 2642 Locust Street as the location for the new factory and will manufacture the Ga-Saver piston rings, of which Jack Ford and T. D. Davis, the active members of the firm, are inventors.

American Tire Fabric Company Builds—The American Tire Fabric Company, New Bedford, Mass., will start work soon on a 76 by 194-ft. two-story factory.

1250 Men Erecting Goodyear Buildings—The Goodyear Tire & Rubber Co., Akron, Ohio, is employing 1250 men in the erection of its new buildings. Goodyear building operations now include more room for the office force as well as the factory workers. Within a year the company expects to be employing 20,000 men, making Goodyear products.

Boone Tire to Build in Belvidere—The Boone Tire & Rubber Co. has secured an option on ten lots in Belvidere, Ill., on which it will erect a plant in two units, the first of which will be housed in a building 60 by 120 ft., in which machinery will be installed for manufacturing fifty tires a day. Immediately upon the completion of this unit two additional buildings will be erected. The complete plant will have a capacity of from 150 to 200 tires per 10-hr. day.

1000 Sets of Hayes Wheels in Day—The Hayes Wheel Company recently built 1000 sets of Ford wheels in one day at its Anderson, Ind., plant. The 4000 wheels were produced by the regular force of 300 men running day turn. A night shift of 300 employes is to be added so that the required capacity of 2000 sets of Ford wheels daily may be reached.

Cadillac Truck Plant Completed—The foundation work and the first floor of the new plant of the Cadillac Auto Truck Company, Cadillac, Mich., is completed. The structure is two stories high, 100 by 180 ft. It will be occupied Nov. 15.

Mitchell Rushed—The demand of the Mitchell Motors Company on the Mitchell Wagon Company, both of Racine, Wis., for automobile bodies, has necessitated the wagon company increasing its working force as well as the provision of additional room for the automobile body department.

Budd Company Adds—The Edward G. Budd Manufacturing Company, Philadelphia, Pa., maker of steel automobile bodies, etc., has awarded a contract for the electrical equipment for its recent plant additions at an estimated cost of $20,000.

Spokane Lumber Company Makes Bodies—The Robbins Lumber Company, Spokane, Wash., is planning a four-story addition to its plant at 1218 Railroad Avenue, where it manufactures bodies for automobiles. The addition will be 16 by 30 ft., of concrete and brick.

Advance Felt Moves—The Advance Felt Specialty & Cutting Co., Chicago, has moved into its new quarters at 318-322 South Jefferson Street. This is the second move for the company within the last eighteen months, due entirely to the rapid growth of the business. The new building is of the "daylight" type, two stories with full concrete basement, brick construction with sprinkler system, equipped throughout with specially designed machinery for the cutting, striping and punching of felt cloth, rubber, and analogous materials. The Advance people specialize in the manufacture of felt parts for automobiles, motors, transmissions, axles, etc.

The Automobile Calendar

ASSOCIATIONS

Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.
Oct. 2-7—Kansas City, Mo., Dealers' Show, American Royal Live Stock Show; Kansas City M. C. Dealers' Assn.
Oct. 13—Flint, Mich., Fall Meeting National Assn. of Automobile Accessory Jobbers.
Dec. 2-9—Electricians' Country-wide Celebration.
Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11. S. A. E. day. Annual Banquet, Hotel Biltmore. Special performance Ziegfeld's Midnight Follies.

CONTESTS

Oct. 7—Omaha Speedway Race.
Oct. 7-14—Troy, N. Y., Show, Motor Mart Bldg.
Oct. 14—Chicago Speedway Race.
Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Oct. 21—Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.
Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.
Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race, Arizona State Fair.

1917

April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23—Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 14—Des Moines, Iowa. Speedway Race, Championship.
July 28—Tacoma, Wash., Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15—Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race, Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13—Chicago Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Oct. 6-11—St. Louis, Mo., Open Week, Dealers' Assn.
Oct. 9—Kansas City, Mo., Fourth Annual Trade and Booster Tours, Kansas City Motor Car Dealers' Assn.
Oct. 14-21—Pittsburgh, Pa., Thirteenth Annual Show, Motor Square Garden. Automobile Dealers' Assn. of Pittsburgh.
Oct. 14-21—Dallas, Texas, Show, State Fair.
Nov.—Providence, R. I., Show, Rhode Island Automobile Dealers' Assn.
Dec. 2-9—Springfield, Mass., Show, Auditorium. H. W. Stacey, Mgr.
Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City: Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 13-20—Montreal, Que., Show. Montreal Automobile Trade Assn.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb.—Minneapolis, Minn., Show, National Lamp Co. Factory.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 26-March 3—Omaha, Neb., Show: Auditorium, Omaha Automobile Show Assn.
March 3-10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

TRACTOR

Oct 14-29—Dallas, Tex., Demonstration, Texas State Fair.

The Week in the Industry

Twin City News — The Chevrolet Motor Co. and the Bearings Service Co., Minneapolis, will occupy a new building on Harmon Place near Hennepin Avenue.

The St. Paul Chandler Co. has been formed to sell Chandlers and R. W. Pantel will be sales manager.

The Overland Co. has shipped from the factory branch in St. Paul forty-two carloads of stock cars to Vladivostock, Russia, for use of the government. The shipment, 126 machines, valued at $150,000, left recently for Seattle.

Washington Items — George Farnsworth, Seattle, Wash., has opened salesrooms at Broadway and Pine Street, where he will distribute Abbott-Detroit machines for the territory of Washington, Oregon and northern Idaho.

The Stegeman motor truck has entered the Northwest field, the F. H. Barshar Motor Co. having secured the distribution, with headquarters in Seattle.

M. C. Davies has secured the exclusive agency in Tacoma and Pierce County for the Velie line.

R. A. Mueller and L. W. Harkins have withdrawn from the Universal Motor Co. in Tacoma, and have formed the Mueller-Harkins Motor Co. to distribute Buick cars and G. M. C. trucks in Pierce County.

The Chevrolet Northwest Co. has opened a branch in Tacoma with a complete line of parts and accessories, with A. J. Smith as director of sales.

Ohio News Items—The Central Auto Vehicle Co., Columbus, has taken the central Ohio agency for the Grant, formerly held by the Miller-Main Garage.

Harry Ensign has purchased the interest of his brother, Bert Ensign, in the Ensign Motor Co., Springfield, agent for the Cadillac and Cole.

The Dobyns Motor Car Co., Hilliard, has taken the agency for the Chalmers, covering all of the counties of Union, Madison and Delaware. Branch salesrooms will be opened in London, Marysville, Delaware and Plain City.

Geddes with Scripps-Booth — B. F. Geddes has been appointed sales representative in the Middle West for Scripps-Booth Co. He was formerly with the Grant and Maxwell companies.

Niekirk with Galion Truck Co.—J. D. Niekirk, foreman at the plant of the Sommer Motor Co., Bucyrus, Ohio, has resigned to become shop superintendent of the Galion Dynamic Motor Truck Co.

Willis Joins Singleton-Hunting Co.—P. P. Willis has joined the Singleton-Hunting Co., Cleveland, Ohio, advertising agent, as vice-president and manager of production. James P. Hunting becomes treasurer and continues in charge of merchandising. These changes were rendered necessary by the increasing automobile accessory business of the company.

Rennard Joins Ross — Ben Rennard has been appointed special sales representative for the Ross Automobile Co., Detroit. He has been with the Locomobile, Chalmers and Chandler organizations.

Zadek Goes to Temple Co.—James L. Zadek, superintendent of the police department shops, Chicago, Ill., has resigned to take charge of the testing and assembling departments of the Temple Mfg. Co., 54th and 22d Streets. The Temple company makes gasoline engines and machine tools.

Diver to Design Cole Bodies.—B. M. Diver, body designer and engineer, has become connected with the Cole Motor Car Co., Indianapolis, Ind. Mr. Diver's special work is in connection with the present Cole-Springfield bodies and he will devote his attention to other bodies now contemplated.

Gilbreath Detroit Club Mgr.—William Sydnor Gilbreath has resigned as traveling secretary of the Dixie Highway Association to become manager of the new Detroit Automobile Club. Mr. Gilbreath has been one of the best-known figures in the development of through routes in America, having been associated with Carl Fisher in the early days of the Lincoln Highway, and after the preliminary work on that was done carrying forward similar work for the Dixie Highway Association.

Williams with Chanslor & Lyon.—Harrie R. Williams has resigned as accessory sales manager of the Gibson Co., Indiana Overland distributer, to become vice-president and general manager of the Chanslor & Lyon Co., San Francisco, accessory dealer and distributer. He will be succeeded by E. C. Kurman, manager of the Gibson Co.'s branch at Logansport, Ind.

$600,000 Chevrolet Co. in Texas.—The Chevrolet Motor Co. of Fort Worth, Tex., was chartered this week with a capital stock of $600,000. Incorporators are W. C. Stripling, Sam Davidson and B. C. Bradford of Fort Worth and W. C. Durant of New York.

Johnson, Tractor Expert, Sails for Russia.—Nelson Johnson, tractor expert for the Emerson-Brantingham Co., Rockford, Ill., sailed this week for Vladivostock, Russia, to line up business for delivery after the war. Johnson has spent several years in Spain, Argentina and Mexico, selling tractors, and will remain in Russia for a year or more, being similarly engaged.

Gibson and Hammerton Resign.—Lester H. Gibson, formerly general manager of the Gibson-Hollister Mfg. Co., Boston, Mass., and Alfred J. Hammerton, formerly superintendent, have resigned to become connected with the Higginson-Gibson Mfg. Company, Inc. This concern makes automobile electric lamp connectors and other accessories.

Chandler's N. Y. Office Moved—W. S. M. Mead, vice-president of the Chandler Motor Car Co., Cleveland, Ohio, and in charge of exports, has moved his offices from the Brady-Murray Motors Co., Chandler distributer in New York City, to 1790 Broadway.

Picard Moves—A. J. Picard & Co., New York City, accessory dealer, has outgrown the present quarters at 1720 Broadway, and will build a five-story building at Sixty-first Street to be finished around Jan. 1.

Ryall Joins Poertner—J. B. Ryall, prominent in automobile racing a few years ago, has been appointed manager of the Poertner Motor Car Co.'s truck department, New York City.

Gewinner Resigns—J. K. Gewinner has resigned as president and general manager of the Johnson-Gewinner Company, Atlanta, Ga., accessory dealer.

Bulask Joins Frisco Company—H. C. Bulask has joined the Hartmann Motor Sales Agency, San Francisco, in the capacity of wholesale manager for the Elgin Six. This company also handles the Lozier and Paige.

Philadelphia Items — The Pratt & Moser Motor Co., Fifty-seventh and Chestnut Streets, has opened a showroom and service station at 833 North Broad Street, and will handle the Pilot and Elcar automobiles.

The L. S. Bowers Co., 245-47 North Broad Street, agent for the Cole and Grant cars, has opened a used-car department across the street, at 256.

The W. Clark Grieb Co., Briscoe agent in this territory, has moved to its new salesroom and service station, 851 North Broad Street.

Gaulke Joins Heil—W. H. Gaulke has resigned from the A. B. and B. Specialty Company to join the Heil Company, Milwaukee, Wis., in charge of the automobile gasoline tanks and specialties.

The AUTOMOBILE

Vol. XXXV
No. 15

NEW YORK, OCTOBER 12, 1916

Ten cents a copy
Three dollars a year

Stewart V-Ray Spark Plug

An Instant Success and A Continuing One

Inquiries and orders are pouring in—and in answer the new Stewart V-Ray Spark Plugs are being shipped out in larger quantities every day.

The demand is steadily growing.

Car owners who formerly clamored in vain for V-Rays will now be able to get them.

And dealers who formerly had to offer customers inferior plugs because of the limited V-Ray production are once more displaying V-Rays on their counters.

The demand for this famous quality plug is already large and growing.

And V-Ray production will keep up with it.

Wise dealers are getting in on the ground floor. Wire today.

"It will pay you to see that the car you own is equipped with Stewart Products"

Stewart-Warner Speedometer Corporation

Chicago, Ill., U. S. A.

The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, OCTOBER 12, 1916—CHICAGO NO. 15

Form Eastern Motors Syndicate

Organization To Plan High-Grade Car To Be Built by Eastern Motors, Inc.

HARTFORD, CONN., Oct. 10—The Eastern Motors Syndicate has been organized and financed in this city for the purpose of designing and preparing all details of a proposed high grade automobile. This new car will incorporate many refinements that will appeal to the most fastidious. The manufacture of the car will be taken over by the Eastern Motors, Inc., which will be organized for purposes of manufacture and sale, the development, however, resting with the Eastern Motors Syndicate.

The Eastern Motors Syndicate has at present an option on two plans and a final selection of a factory location is expected to be made in the near future. Allen Shelden, chairman of the Eastern Motors Syndicate, has the organization work in charge, and has developed plans of co-operation with dealers in connection with merchandising of product.

Others connected with the organization are: Willis D. Upson, Waterbury, Conn., as treasurer. He is a man familiar with the automobile industry. L. S. Hubbard, Bridgeport, Conn., is secretary; and is manager of a large business in that city. F. A. Law, formerly chief engineer of the Pope Mfg. Co., and more recently connected with Selden, Brewster and Gaston, Williams & Wigmore, is chief engineer.

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Webster Heads Racine Rubber

RACINE, WIS., Oct. 9—Stuart Webster has been elected president of the Racine Rubber Co., Racine, Wis., manufacturer of tires and tubes, to fill the vacancy caused by the resignation of H. L. McClaren, who recently resigned as president of this company and also of the Mitchell Motor Corp., Racine, the ownership of which is closely allied with the tire company. Mr. Webster was one of the original officers of the tire company, which was first established in March, 1910.

He first held the position of treasurer, but in 1915 he was elected vice-president and general manager. This position has been turned over to Louis T. Vance, who has been factory manager since 1911. H. C. Severance remains as secretary and general sales manager. The office of treasurer is combined with that of president.

The Racine Rubber Co. is now doing a business amounting to $5,000,000 annually and employs from 900 to 1000 men. The daily output exceeds 1500 tires and the same number of tubes.

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Hudson 1917 Price $175 Higher

NEW YORK CITY, Oct. 10—On Dec. 1, the Hudson Motor Car Co. will advance the price of its various models by $175. On May 9 last, the company raised its prices $100 on its various models, due to the very greatly increased cost of materials.

The new price on the phaeton model and the two-passenger will be $1,650, while the four-passenger roadster type will sell for $1,700; the cabriolet at $1,950 and the sedan at $2,175.

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Chalmers to Raise Prices $70

DETROIT, MICH., Oct. 9—The Chalmers Motor Co. announces an increase in the price of several of its models. The seven-passenger touring car now selling for $1,280 will be increased to $1,350; the sedan selling at present for $1,760 will cost $1,850; the town car and limousine will raise in price from $2,480 to $2,550. The increase in price becomes effective on Dec. 1.

Perfection-Stanweld Merger?

Negotiations Now Under Way May Mean Consolidation of Cleveland Firms

CLEVELAND, OHIO, Oct. 7—A merger of the Perfection Spring Co. and the Standard Welding Co., both of this city, may shortly be completed. The consolidation has been approved by the boards of directors of both companies and now awaits the ratification of the stockholders.

The combination would result in one of the strongest factors in the industry, producing among other parts and accessories, automobile springs, heaters and rims.

The capital stock of the Perfection Spring Co. is $2,500,000 authorized, which is divided into $1,000,000 preferred and $1,500,000 common; $1,250,000 of common stock has been issued.

The capital stock of the Standard Welding Co. is $2,225,000 of which $2,206,800 is outstanding all of which is one class.

Holders in both companies will be given the privilege of converting their securities into those of the new corporation. This company will have an authorized stock of $25,000,000 common stock and $10,000,000 7 per cent cumulative stock preferred. Borton & Borton, a Cleveland investment house, will underwrite the stock to be issued. The two companies have combined total assets of $10,000,000.

The Perfection Spring Co. which manufactures automobile springs and at present supplies more than thirty large automobile makers of this country, employs between 1700 and 1800 men. It commenced business 10 years ago in

(*Continued on Page* 636)

4000 Wintons for Next Year

$1,500,000 New Capital Will Be Used to Enlarge Production Facilities

CLEVELAND, OHIO, Oct. 7—Following the sale of $1,500,000 7 per cent cumulative preferred stock to Borton & Borton, as reported in THE AUTOMOBILE last week, the Winton Co. will enlarge its production facilities with the new capital thus provided. For the past 12 months orders have been filled from 6 weeks to 6 months later than specified and, while the company intends no change in its policy of limited production, more flexibility was necessary.

Up to 1916 the Winton Co. built between 1200 and 1300 cars a year, but during the past 12 months over 2000 cars have been sold and production for the coming year is estimated at 4000. The company's production of gas and oil engines of the Diesel type has also increased and a part of the new capital will be devoted to the engine factory.

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McCornack Is Hudson Sales Manager

DETROIT, MICH., Oct. 5—O. H. McCornack, who for the past 6½ years has been the purchasing agent for the Hudson Motor Car Co., has been appointed to succeed E. C. Morse, who recently resigned to become the vice-president in charge of the sales division of the Chalmers Motor Co. The Hudson company also appointed O. Barit, former assistant purchasing agent, to succeed Mr. McCornack as purchasing agent.

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Bailey To Manage Cook's Patent Assn.

DETROIT, MICH., Oct. 5—G. Franklin Bailey has been appointed manager of the Cook's Patent Association, which controls the claimed basic patent for truck-making attachments for pleasure cars. Mr. Bailey was formerly the advertising manager of the New York *Globe* and more recently was connected with Charles T. Silver, Chalmers distributor in New York.

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Pulcher Heads New Detroit Club

DETROIT, MICH., Oct. 9—M. L. Pulcher will be the first president of the new Detroit Automobile Club when the organization perfects its charter membership plans. Mr. Pulcher is the vice-president and general manager of the Federal Motor Truck Co.

W. S. Gilbreath, secretary of the club, announces that charter members are rapidly being signed and that the 1000 mark will soon be reached.

The club incorporates a novel and interesting clause in its charter membership application which reads: "We do further agree, in furtherance of the interests of said Organization, to abide by and comply with all State Laws and City Ordinances governing and controlling traffic on the public highways in the State, and streets and highways in the cities, and to co-operate with and assist officials in every manner possible in compelling proper enforcement of said laws."

—

Gray Heads Hess-Bright Co.

PHILADELPHIA, PA., Oct. 7.—B. D. Gray has been elected president of the Hess-Bright Mfg. Co., this city, manufacturer of ball bearings. Mr. Gray, who was formerly vice-president, succeeds F. E. Bright, who will remain identified with the company as chairman of the board.

—

Hamilton Chief Engineer for Oakland

DETROIT, MICH., Oct. 9—A. C. Hamilton of the experimental department at the King Motor Co. plant in Detroit, has been appointed to be chief engineer for the Oakland Motor Co., to succeed Eric Wahlberg who recently resigned to join the Nash organization in the Jeffery plant at Kenosha, Wis.

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Weaver Returns to Timken Axle

DETROIT, MICH., R. B. Weaver has returned to the Timken-Detroit Axle Co., as chief engineer, succeeding J. G. Perrin, who resigned.

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Anderson Is Madison Sales Mgr.

INDIANAPOLIS, IND., Oct. 7—Harry W. Anderson has been appointed sales manager of the newly organized Madison Motors Corp. of Anderson, Ind. Mr. Anderson was formerly sales manager of the Stutz Motor Car Co.

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Newmark Succeeds Eustis with Chevrolet

NEW YORK CITY, Oct. 9—John R. Eustis has resigned as advertising manager of the Chevrolet Motor Co. and will be succeeded by J. H. Newmark., advertising manager of the Apperson Bros. Automobile Co., Kokomo, Ind. Mr. Eustis, before joining the Chevrolet company last May, had been motor truck editor of the *Evening Mail* for 5 years. Mr. Eustis will devote most of his time to publicity work.

—

Bias Is Mitchell Purchasing Agent

RACINE, WIS., Oct. 7—M. C. Bias has been appointed purchasing agent of the Mitchell Motors Co., this city, succeeding Guy Morgan, resigned. Mr. Bias has been identified with the Mitchell company since 1909.

Standards Men to Meet Oct. 18

Will Hold Its Session in Bureau of Standards at Washington

NEW YORK CITY, Oct. 10—By the courtesy of Dr. Stratton the October meeting of the S. A. E. standards committee will he beld in the U. S. Bureau of Standards at Washington, next Wednesday. On Monday and Tuesday there will be various division meetings and these may also be held in the bureau.

At Wednesday's meeting practically all the divisions will have reports to make and some of them are of particular interest. Firstly the electrical equipment division has much to say on the subject of headlamps and the standardization which is going to settle the glare problem. This work is nearing completion. In the evening, after the meeting, some demonstrations will be made with actual lamps to show the committee how the division has approached the problem, and to indicate the effect of the application of the standards suggested.

Will Discuss Trucks

The military truck specifications are not in shape to go before the committee in the form of a report, but they will be discussed informally and no doubt the division will receive many valuable suggestions. The proposed details of standard truck control will be ready for acceptance and this is one of the most important parts of any truck standard that can be created. Of course it is not intended that this standard control shall apply only to military vehicles, but to all trucks as far as possible. A standard control would mean that any driver could operate any truck with equal safety. Having once learned on one machine he would find nothing strange in handling another.

The October meeting is not faced by so full a program as was the meeting in May, since less committee work is done in the summer months which make the vacation season. None the less, nearly every division has something to report and a number of new standards will be ready for transmission to the society.

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Wright Is Cassidy Special Representative

NEW YORK CITY, Oct. 7—E. C. Wright, former eastern district sales manager for the Carter Carburetor Co., has joined the selling staff of the E. A. Cassidy Co., this city, as official representative. Mr. Wright will spend considerable time in the automobile manufacturing centers, in addition to looking after the selling interests of the company among the large distributers.

Used Car Show for Chicago

City's Automobile Trade Assn. Schedules Exhibition in Coliseum for May 8-14

CHICAGO, ILL., Oct. 10—A used-car show will be held May 8 to 14 in this city at the Coliseum by the Chicago Automobile Trade Assn., which has been working on this proposition for a year.

Space in the Coliseum will be sold at 40 cents per sq. ft., assignment to be by public drawing. The dealers will show rebuilt cars which they represent and other used cars they have taken.

The trade association will get one-half the profits, which will be divided among the members, the Coliseum getting the other half.

Tickets are to be 25 cents each. It is figured it will cost the exhibitors $60 per car for space.

—

Boone Is Disco Chief Engineer

DETROIT, MICH., Oct. 9—S. W. Elston, president of the Disco Electric Starter Corp., has secured John T. Boone as chief engineer for the Disco company. Mr. Boone was formerly chief engineer for the Heinze Electric Co., of Springfield, Ohio.

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Rainier Motor Corp. Chartered

NEW YORK CITY, Oct. 10—The Rainier Motor Corp. has been chartered in this state with a capital to $600,000 to manufacture the Rainier truck. The incorporators are J. T. Rainier, P. N. Lineberger, and J. A. Rainier.

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Trailer Makers Form Association

DETROIT, MICH., Oct. 10—Fifteen trailer manufacturers met here today and formed a permanent organization to be styled the Trailer Manufacturers Association of America. It contemplates a model trailer ordinance and other legislation and publicity. The officers are: President, C. A. Geiger, president Troy Wagon Works, Troy, N. Y.; vice-president, Miss K. Gleason, Rochester Trailer Co., East Rochester, N. Y.; secretary-treasurer, J. C. Endebrook, Sechler Co., Cincinnati. The temporary chairman was C. W. Shipley, of the Sechler Co. A. W. Keesler, Watson Wagon Co., Canastota, N. Y., acted as temporary president. An executive committee of four was named.

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May Copy Ford's Sales Plan

DETROIT, MICH., Oct. 7—The new departure of the Ford Motor Co., whereby it has given up its branches and allowed a general scramble for agencies, has set some of the big officials of other concerns thinking, with the result that before show season there is likely to be a similar plan adopted by others. Some of the companies that are making large productions now calculate that where they have one large distributor for a place, say like New England, a group of Southern, Western or Pacific States are wondering if it would not be possible to put over more cars if there were not one big distributor directing the affairs of his subagents, and have a lot of dealers, in fact like Ford, more than one in big cities.

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Metz Sales Plan Similar to Ford's

WALTHAM, MASS., Oct. 7.—The Metz Co. has signed a lease to take over a new building that is in process of erection on Commonwealth Avenue, Boston, Mass., which will be its general sales and service station for that city. It has sold its lease on the building 195 Massachusetts Avenue, Cambridge, Mass., where it conducted its sales department since it closed its Boston office. The general sales will be conducted from the factory at Waltham until the new building is ready for occupancy.

The Metz company inaugurated a plan similar to the Ford of closing its branches and substituting agencies, and at Worcester the Reo-Worcester Co. is its agent, while the Fiske & Naylor Co., at Providence, R. I., is its agent there. When the Boston building is finished the Metz company will also have other agents in that city handling its line.

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Stanley Is Briscoe Asst. Sales Manager

DETROIT, MICH., Oct. 6.—John L. Stanley has been appointed assistant sales manager of the Briscoe Motor Corp., Jackson, Mich. Mr. Stanley was formerly with the Paige distributer at Kansas City and prior to that time with the Mitchell and Jeffery Co. as district sales manager.

—

War Exports Gain $86,802,054 Over 1914

NEW YORK CITY, Oct. 10—Shipments of U. S. A.-Built automobiles and motor trucks to Europe for war purposes during the fiscal year 1916 totaled $86,802,054 more in value than in the fiscal year 1914, according to statistics issued by the U. S. Treasury department. The total value of cars and trucks shipped to warring countries for military purposes this year was $120,000,860, as compared with $33,198,806 in 1914.

—

Wisconsin Trucks in Production

SHEBOYGAN, WIS., Oct. 7—The Myers Machine Co. is now making regular deliveries of the Wisconsin motor truck. The company was reorganized several months ago to purchase the Wisconsin Motor Truck Co., Baraboo, Wis.

McFarlan to Make Expansion

Reincorporates with $3,000,000 Capital as McFarlan Motor Corp.

CONNERSVILLE, IND., Oct. 10—The McFarlan Motor Co. has been reincorporated at $3,000,000 as the McFarlan Motor Corp. and will expand its business. The officers, car and price will remain the same but later the company will build a high-priced truck. The incorporation is under Delaware laws. The old capitalization is comparatively very small, and the new plan means considerable added capital.

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Chandler to Continue Present Model

CLEVELAND, OHIO, Oct. 9—The Chandler Motor Car Co., this city, will continue its present model for the coming season and there will be no reduction in the price. There is a probability that the price will be advanced.

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New Era Buys Sly Tire Specialties

NEW YORK CITY, Oct. 10—The tire holder and tire lock business of the W. W. Sly Mfg. Co., Cleveland, has been purchased by Smalley Daniels, president of the New Era Spring & Specialty Co., Detroit, which has for 5 years been the sales department for those products.

The New Era company will remove the business to Detroit or Grand Rapids and combine its shock absorber and bumper plant and increase the tire holder production.

—

Hoyt Joins Bour-Davis

DETROIT, MICH., Oct. 10—G. W. Hoyt has been made production and factory manager of the Bour-Davis Motor Car Co., this city. He was formerly publication engineer of the company. Before joining this company, Mr. Hoyt was associated with Ray Harroun as assistant in the engineering department of the Nordyke & Marmon Co., Indianapolis, and later with the Maxwell company.

—

General Tire Adds Two Directors

AKRON, OHIO, Oct. 7.—G. F. Burkhardt of Akron, and J. A. Diebolt of Cleveland have been elected directors of the General Tire & Rubber Co., increasing the board to seven members. Charles Herberich, vice-president and treasurer of the Depositors Savings & Trust Co., has been elected treasurer. Other officers of the company are: M. O'Neil, president; W. F. O'Neil, vice-president and general manager; and W. E. Fouse, secretary.

BRAZIL

Large Field for Motor Truck Sales in State and City of Sao Paulo—Rio de Janeiro Can Also Use a Great Many Commercial Vehicles

Part III

By David Beecroft

EDITOR'S NOTE:—This is the third of a series of articles embodying the close observations of automobile and general trade conditions in Brazil made by Mr. Beecroft, Directing Editor of THE AUTOMOBILE, during a 10-weeks' trip through Argentina, Uruguay and Southern Brazil as a delegate of the United States Government and member of the Argentine Return Visit Committee. Subsequent articles will further analyze the possibilities of selling cars, trucks, and tractors in the United States of Brazil.

BOTH the State and City of Sao Paulo present a large field for motor truck sales, although one handicap in the State's road system is that most of the roads are private ways through the large plantations. There is not a completé system of public highways as we have in the U. S. A. Because of this when you make a trip in an automobile across the country you are constantly bothered opening and closing gates which admit you to different plantations. You frequently find one such gate every 3 or 4 miles. These gates are often padlocked and you must get permission to proceed from the owner before it swings open to admit you.

The city of Sao Paulo is a good market for trucks. True, the city is not nearly as large as Buenos Aires or Rio de Janeiro but it is growing very rapidly. To-day its population is approximately 500,000 and in 10 years it is expected there will be over 1,000,000 people. The buying capacity of Sao Paulo city for automobiles and motor trucks can scarcely be gaged by a population estimate. Its purchasing capacity is much greater than either Rio, Buenos Aires or Montevideo in ratio to population.

The city has increased nearly twenty-fold in the last 30 years. The great activity in the coffee area has been largely responsible for this growth, but to-day the city has within its boundaries so many activities and distributes to so large an area that its future as the second greatest and perhaps the greatest distributing city in all South America seems assured. Buenos Aires will unquestionably lead for many years, but Sao Paulo is sooner or later going to pass Rio as a great city. Perhaps this may not be in population but in energy, influence and progressiveness.

Ideal Streets for Trucks

The city is well paved and almost ideal for motor trucks. The newer streets are very wide. It is true that several of the older streets in the center of the city are narrow, but they are generally one-way thoroughfares, which helps traffic materially. As with all South American cities, the pavement is stone block with asphalt on the finer avenues. Sao Paulo reminds you much of Buenos Aires, with its wide streets radiating into every part of the city. These streets have double trolley lines, fine wide sidewalks and the usual strip of greensward between the curb and the sidewalk.

With relation to the truck-buying capacity of Sao Paulo it is best to bear in mind that there is an unusual concentration of business activities. An example: One hardware importer has large blocks of stock in six other diversified interests, such as a wire factory, a textile mill, a match factory, a hardware metal stamping plant and a wholesale provision store. Reaching this one man opens the possibility of selling trucks in six different industries. This is true with regard to many of the leading business men of the city. A second example: One large industry owner has a controlling interest in ten different concerns, some merchandising and others manufacturing plants. In addition he has a large interest in twelve other organizations. Here is a man with great influence in twenty-two different organizations. This particular person has his own steamboats and does an enormous business. Selling trucks to such a person and through him making it possible to reach twenty-two concerns, gives a new phase to motor truck sales and should tend to make the introduction of trucks into the city relatively easier and simpler than if individuals were largely tied to a single organization.

National City Bank Branch

In Sao Paulo the National City Bank of New York has had a branch for 2 or 3 years. This branch is already doing good work to make it easier for U. S. A. motor truck makers to do business in the City of Sao Paulo and also throughout the entire State. The bank maintains a large commercial department whose duties are entirely concerned with securing information on the different industries of the State as well as on the financial standing and the business honesty of the many firms of the State. This department has a corps of competent workmen, the same as in all of the other cities in South America where this bank has recently opened branches.

From this bank it is possible to get the financial standing of any house with which a U. S. A. truck maker would hope to open agency relations. It is possible to-day to get as accurate information on such firms as on firms in New Orleans or Buffalo. All of such arrangements should be taken up through the main office of the bank in New York City.

We spent nearly half a day with the head of this department going over the various industries in the City of Sao Paulo with the hope of seeing how many concerns are large enough and financially strong enough to be owners of motor trucks or motor delivery wagons. The bank has a complete

list of all business organizations in the city and has investigated them individnally. Many of these concerns are manufacturers, others are large importers, others large wholesalers and others engaged in the various lines of business that are to be found in any city.

162 Firms Need Trucks

We found there are 162 large concerns in the city who should be owners of motor trucks. Many of these should own fleets of trucks and delivery wagons. This estimate of 162 concerns is very conservative. No effort was made to make a big list, rather the idea was to be ultra conservative. It would be possible to double this number if you wanted to include those whose business is large enough to warrant the use of trucks. We differentiated between concerns having a business large enough to warrant their using motor trucks and those who are large enough and who are also financially strong enough to warrant their buying such at once.

This list of 162 large and financially strong concerns included all lines of business and the following gives a few of the more important ones. However, it must be remembered that these are only the more important of the industries of the city, or those who are obviously most in need of the improved transportation facilities brought by the introduction of motor trucks into their businesses. There are a number of other fields which should be considered.

Agricultural Implements.—There are twelve large firms importing such machinery from the U. S. A. and Europe. They generally carry very varied lines, including large supplies of spare parts. Not infrequently these firms sell automobiles, and also deal in mill machinery and machinery that can be nsed in garages such as lathes, drills, presses, etc.

Biscuit Factories.—There are two large ones and many smaller ones. The large ones should be using motor trucks. There are several of the smaller ones that would be warranted in using light delivery jobs.

Breweries.—There are two large breweries in the city and one in Ribeirao Preto, a city of 25,000 and 241 miles north in the heart of the coffee country. The use of trucks in the brewery trade in Sao Paulo is identical with that in any U. S. A. city.

Wholesale Clothing.—Ten large concerns are engaged in this work. They have to transport the goods from the depot to their warehouses and then make city distribntion to the different retailers. There is much teaming from the warehouse to the depots for shipment to interior cities and towns.

Dry Goods Importers.—There are in addition to the above nine dry goods importing houses. These firms have the usual use for trucks, transporting goods to and from warehouses.

Hardware Importers.—Sao Paulo has nineteen hardware importers, all handling varied lines of hardware merchandise and machinery. They have wide distribution to retailers and sell generally to other firms in the State and in adjoining States. Several of these importers are also large wholesalers.

Textile Mills.—There are all told about twenty-nine textile mills in the city. These mills vary in size, some being small and some large. All have a legitimate use for trucks. They will require vehicles of different capacity. They may require trucks for general use around the factory as well as the handling of raw and finished materials.

Sawmills.—Six sawmills are located within the city and there is much handling of logs and of the sawn lumber. There is delivery to lumber yards and for shipment by railway.

Importers of Provisions.—There are seven of these, all large concerns, and in addition are many smaller ones.

Shoe Factories.—The city has five factories given over to the manufacture of shoes. The leather has to be brought to the factory and deliveries of shoes to wholesale and retail local houses as well as to depots.

General Importers.—Six of these concerns, the largest in the field, have general use for trucks.

Leather Goods.—Four houses are devoted to this work.

Avenida Tiradentes, Sao Paulo, not the best, but one of the imporant residential streets of that city which is called the Chicago of Brazil. This avenue is a triple roadway and is an ideal street for motor traffic. There are many such in the city. Avenida de Paulista is the finest residential street of the city and motor trucks are not barred on the street. The city of Sao Paulo is located practically on the edge of the coffee country and all of the coffee shipped passes through the city by train

You see many streets like this in the towns and cities of the coffee areas in the State of Sao Paulo. This is a residential street in the city of Ribeirao Preto, a city of 25,000 in the heart of the coffee country. The streets are well paved, and everything is very clean. This city is distinguished as being the home of Santos Dumont, the Brazilian aviation hero. The city is destined to be a big coffee growing center. Recently the Ford dealer opened a selling branch there

In addition to these there are many other lines, as follows:

	No. Concerns		No. Concerns
Wholesale drugs	5	Meat packers	2
Electric goods	3	Lime maker	1
Foundries	3	Lead pipe factory	1
Glass factory	1	Campinas importers	3
Retail grocers	2	Screw factory	1
Contractors	2	Soap factory	2
Flour mills	3	Sugar mills	2
Hat factories	2	Wholesale stationery	2
Hop dealer	1	Rope factory	1
Jute mills	2	Silk factories	2
Newspapers	3	Seeds, etc.	3

To this list could be added scores of other concerns. No attention has been given to the hundreds of small shops who should be in the market for light delivery wagons of 500 or 800-lb. capacity. There are scores of bakeries, small grocers, etc. None of them is aware of the increased possibility of using light delivery wagons. They are inclined to look upon the light motor vehicle too much as merely an expense and an advertisement. They have not had it placed before them as an investment. They have not grasped the feature of extending business by the motor vehicle. They have not thought of improved service to customers because of faster and better delivery service.

Horse Labor Is Cheap

Horse labor is naturally cheap in the city. The grade of horseflesh is poor. The city, being in the tropics, is hot. The altitude assists in keeping the temperature lower, but in summer the heat is always present. Up to the present horseflesh has been considered very cheap, and the business houses have not carefully kept tab on what their horses really cost them.

There is a truck market in Sao Paulo. It is the best in Brazil at present. Perhaps in other years Rio will be greater but to-day it is not nearly so attractive as Sao Paulo. The city has plenty of good garages. There are plenty of places where you can get any kind of a good body built for a motor truck. In the city is one of the largest garages in South America. It has a body building department for passenger cars and trucks. Limousines and landaulets are made. It has every facility for the work. The U. S. A. truck maker will find no difficulty in getting any kind of truck body.

There are plenty of live automobile dealers in Sao Paulo. A few of them handle trucks. There should be no difficulty in making good truck selling connections.

How to Enter the Market

With regard to introducing trucks in the city the only way is to send one or two trucks there and demonstrate them. That is imperative. In addition there must be a big supply of spare parts carried in the city. You cannot sell vehicles without such stock of parts. You must have catalogs in Portuguese as well as lists of spare parts and instruction books in the same language. These should be ready when the trucks are shipped. You need them then and not a year later. Good exporting policies are needed in connection with truck sales.

Although the City of Rio de Janeiro is anything but an active motor truck market to-day there are notwithstanding good possibilities of selling trucks there when financial conditions improve and perhaps when the price of gasoline falls a little.

We made a careful estimate of the number of large industrial and other concerns in the city who are not using trucks but have a volume of business that would warrant the use of trucks, and their financial condition would also warrant their use. This list was made from the financial reports of the commercial department of the National City Bank of New York, which has a Rio office.

Without in any wise exhausting the field we found over 375 concerns that should be using motor trucks to-day. Some of these concerns are very strong financially, others not so strong have a big volume of business. For these firms motor trucks of all different load-carrying capacity are needed. Some will require fleets and others only individual vehicles.

Converting Passenger Cars

Although the sale of motor trucks practically ceased in Rio nearly 3 years ago there has been a growing movement by way of making old passenger cars into light delivery vehicles, and it is not uncommon to see a Renault or Benz converted into a 1500-lb. light delivery vehicle. This movement augurs favorably for a rapid development of the light delivery vehicle, because Rio merchants have just as much need for it as the merchants in any other city of nearly 1,000,000 population. Rio has really more need for motor vehicles than any city of its population, due to the hot weather. The city is located at water level and in the summer months of December, January and February it is very hot. In the Fall and Winter months you are quite comfortable in a palm beach suit.

In a short résumé of the concerns in the market for motor vehicles, no names will be given, but only a conception of the number of firms in different industries.

Meat Industry—As in all hot cities the question of meat delivery from the municipal slaughter houses is important. The animals are slaughtered in the morning and the meat must be in all butcher shops a few hours later. There is a good field for motor trucks here just as in Buenos Aires. In Rio are over 100 concerns in meat delivery trade who should be using motor vehicles of one type or another.

Seed Merchants—Of the firms engaged in the grain business ten at least should be using trucks. They have much

shipping as well as much delivery work to do.

Wholesale Textiles—At least twelve firms in this line would be warranted in using motor trucks. Brazil is a large textile industry, so far as South America is concerned.

Textile Factories—There are thirty of these factories within the city. All should be truck users. The raw products have to be taken to the factory, and the finished products delivered to depots, warehouses, etc. It is the general line of factory work.

Confectionery Houses—Over thirty houses in this line should use trucks. They will generally want light-capacity machines, although a few of them with large distribution will want the heavier-capacity vehicles.

Wholesale Houses—Rio is the big wholesale center for Brazil, its merchants selling to all of the twenty-one states, but not so generally in some lines as might be expected, due to such centers as Santos and Sao Paulo, Bahia, Para, Manaos, etc., buying direct and distributing to their own states.

There are ten wholesale grocers who could use trucks to advantage, twelve wholesale drug houses and many machinery houses.

Factories—Rio has quite an extensive and growing manufacturing colony, reference having already been made to its thirty textile factories. It has twelve shoe factories, six hat factories, five flour mills, three of which are very large, and two tanneries.

Business Houses—There are many business houses that should be in the truck market. They have to be convinced that their business warrants motor power. In this line are twenty furniture houses; you can add six important piano firms; add also twenty machinery houses, which do a big business in all kinds of machinery; then there are four firms in the mineral water trade; there are six concerns in the cigar and cigarette trade; you will find six concerns needing trucks for general milk distribution, four others in the hide-buying business; and a general line of others.

At the top is shown a very poor coffee plantation. The bushes are not as large as they should be and some of them have perished. You rarely see a single acre of land in the country that is level. It is all rolling and when motoring along the roads you have many good hill-climbs to contend with. It is this rolling nature that makes the land more suitable for motor truck use. It will not be difficult to build good roads in such a country. There will always be good natural drainage. Directly above is a view of the rolling coffee country in the center of the State of Sao Paulo. It is through this country that many U. S. A. motor trucks will be sold in the next 5 or 10 years. The white buildings on the hillside mark the home of a coffee plantation owner. Around his home he has all the necessary tanks for soaking the coffee and terraces on which it is afterward dried

Contracting Firms—Rio has the usual number of firms in cartage trade, but like other tropical cities, has hundreds of individuals who have only a poor cart and a still poorer horse or mule.

There are fifteen cartage houses who should be general users of motor transport. Their work embraces all possible lines. The city streets are generally good and conditions relatively favorable for the use of trucks.

The city has eight building construction firms, each having the usual needs for trucks; add to this two firms specially engaged in street pavement and other city improvement lines; to these can be added several city departments.

Department Stores—Rio has twelve department stores that should be buyers of trucks and deliveries. To this can be added twelve retail hardware houses. You may also add six hotels who have use for motor buses and baggage wagons.

Rio as a city should be a big truck field. This field may not be so large as its population would lead you at first thought to imagine. This is due to the high percentage of African population. Also do not forget that the city is surrounded by mountains without any roads leading to outlying cities. You cannot possibly go 40 miles out of the city. Rio, while fortunate in enjoying perhaps the finest scenic location of any city in the world, is not surrounded with a rich farming or mineral land that would call for a general use of trucks leading into the fertile areas around the city. Sao Paulo occupies a great advantage in this respect in that the coffee land lies all to the north and west of it. The trucks for Rio are for use only within the boundaries of the city.

(*To Be Continued*)

Turpentine as Fuel

The English market has been flooded with gasoline substitutes, since the use of gasoline has been restricted by law. *The Engineer* (London) states that nearly all these substitutes consist of kerosene with a small admixture of some other substance, and need an admixture of an equal quantity of gasoline before they are readily usable. It is also stated that some "substitutes" are mixtures of kerosene with turpentine. It would be interesting to know the exact function of the latter liquid.

Samuel Miles
Show Mgr., N. A. C. C.

C. C. Hanch
Treas., Studebaker Corp.

H. M. Jewett
Pres., Paige-Detroit Motor Car Co.

F. Jewett
Vice-pres., Paige Detroit Motor Car Co.

Show Spaces Allotted

New York Gains Fourteen Exhibitors Over Car Manufacturers at New York and

NEW YORK CITY, Oct. 5.—Ninety-eight automobile concerns, including five manufacturers of electrics, were allotted space at the New York show at to-day's meeting of the National Automobile Chamber of Commerce. This compares with eighty-four last year. Space was given to ninety-four automobile concerns for the Chicago show, as against ninety last year. Every foot of available floor space in Grand Central Palace has been taken, several of the new companies being placed on the fourth floor with the accessory exhibits. As at the New York show, space at Chicago is limited on account of the large number of space allotments.

This meeting each year is the big get-together assembling of automobile makers, who are usually in attendance or represented by others prominent in the business activities of the companies. To-day's meeting was the largest in point of attendance in the history of the Chamber, there being more than 100 automobile manufacturers represented. Charles Clifton, president of the organization, presided at the general meeting in the morning, and S. A. Miles, manager of the shows, came down from his summer home at Christmas Cove, Me., to preside at the space allotments.

That the meeting was a representative one is manifested by the list of those in attendance, including John N. Willys, Hugh Chalmers, W. E. Metzger, A. P. Chalfant, H. H. Franklin, W. C. Leland, Elwood Haynes, E. J. Moon, W. T. White, W. H. Van Dervoort, H. M. and F. Jewett, L. H. Kittredge, Charles Clifton, C. C. Hanch, C. W. Churchill and F. C. Chandler.

Overland in First Position

Willys-Overland, as in the past 3 years, again had the honor of selecting the first position, on account of having been the leader in the volume of business for the year. Following came Buick, Studebaker, Dodge and Maxwell, Cadillac, Chevrolet, Chalmers, Hudson, Packard, Reo, Oakland, Saxon, Hupp, Chandler and Olds. Others up in the drawing were Paige, Mitchell, Haynes, Pierce, Franklin, Nash, Cole, Velie and Stearns.

List of Manufacturers of Gasoline and Electric Automobiles Allotted

Car Exhibitors at New York

Main Floor—Automobile Section

Allen Motor Co.....Fostoria, Ohio
Buick Motor Co.....Flint, Mich.
Cadillac Motor Car Co.....Detroit, Mich.
Chalmers Motor Co.....Detroit, Mich.
Chandler Motor Car Co.....Cleveland, Ohio
Chevrolet Motor Co., of Michigan.Flint, Mich.
Cole Motor Car Co.....Indianapolis, Ind.
Dodge Bros.....Detroit, Mich.
H. H. Franklin Mfg. Co.....Syracuse, N. Y.
Grant Motor Car Corp.....Findlay, Ohio
Haynes Automobile Co.....Kokomo, Ind.
Hudson Motor Car Co.....Detroit, Mich.
Hupp Motor Car Corp.....Detroit, Mich.
King Motor Car Co.....Detroit, Mich.
Kissel Motor Car Co.....Hartford, Wis.
Maxwell Motor Co., Inc.....Detroit, Mich.
Mitchell Motors Co., Inc.....Racine, Wis.
Nash Motors Co.....Kenosha, Wis.
National Motor Vehicle Co..Indianapolis, Ind.
Oakland Motor Car Co.....Pontiac, Mich.
Olds Motor Works.....Lansing, Mich.
Packard Motor Car Co.....Detroit, Mich.
Paige-Detroit Motor Car Co....Detroit, Mich.
Pierce-Arrow Motor Car Co....Buffalo, N. Y.
Pullman Motor Car Co.....York, Pa.
Reo Motor Car Co.....Lansing, Mich.
Saxon Motor Car Corp.....Detroit, Mich.
F. B. Stearns Co.....Cleveland, Ohio
Studebaker Corp. of America...Detroit, Mich.
Velie Motor-Vehicle Co.....Moline, Ill.
Winton Co.....Cleveland, Ohio

Second Floor Automobile Section

Abbott Corp.....Cleveland, Ohio
Anderson Elec. Car Co.....Detroit, Mich.
Apperson Bros. Auto Co.....Kokomo, Ind.
Auburn Automobile Co.....Auburn, Ind.
Baker, R. & L. Co.....Cleveland, Ohio
Briscoe Motor Corp.....Jackson, Mich.
J. I. Case, T. M. Co.....Racine, Wis.
Jas. Cunningham Son & Co..Rochester, N. Y.
Dort Motor Car Co.....Flint, Mich.
Empire Automobile Co.....Indianapolis, Ind.
Fiat Automobile Co.....Poughkeepsie, N. Y.
Inter-State Motor Car Co.....Muncie, Ind.
Jackson Automobile Co.....Jackson, Mich.
Lewis Spring & Axle Co.....Jackson, Mich.
Lexington-Howard Co.....Connersville, Ind.
Mercer Automobile Co.....Trenton, N. J.
Milburn Wagon Co.....Toledo, Ohio
Moon Motor Car Co.....St. Louis, Mo.
Moline Automobile Co.....E. Moline, Ill.
Mutual Motors Co.....Jackson, Mich.
Nordyke & Marmon Co., Inc.Indianapolis, Ind.
Ohio Elec. Car Co.....Toledo, Ohio
Pathfinder Co.....Indianapolis, Ind.
W. A. Paterson Co.....Flint, Mich.
Peerless Motor Car Co.....Cleveland, Ohio
Premier Motor Corp.....Indianapolis, Ind.
Regal Motor Car Co.....Detroit, Mich.
Scripps-Booth Corp.....Detroit, Mich.
Stutz Motor Car Co. of Amer...Indianapolis
Westcott Motor Car Co.....Springfield, Ohio

Third Floor—Automobile and Accessory Section

Austin Automobile Co...Grand Rapids, Mich.
Ben Hur Motor Co.....Cleveland, Ohio
Bour-Davis Motor Car Co.....Detroit, Mich.
Columbia Motors Co.....Detroit, Mich.
Crow-Elkhart Motor Co.....Elkhart, Ind.
Crow Motor Car Co.....Elkhart, Ind.
Detroiter Motor Car Co.....Detroit, Mich.
Geo. W. Davis M. C. Co.....Richmond, Ind.
Drexel Motor Car Corp.....Chicago, Ill.
Elgin Motor Car Corp.....Chicago, Ill.
Enger Motor Car Co.....Cincinnati, Ohio
Hackett, Mansell, Hackett....Jackson, Mich.
Kline Car Corp.....Richmond, Va.
Liberty Motor Car Co.....Detroit, Mich.
H. A. Lozier Co.....Cleveland, Ohio
Lozier Motor Car Co.....Detroit, Mich.
McFarlan Motor Co.....Connersville, Ind.
Metz Co.....Waltham, Mass.
Monroe Motor Co.....Pontiac, Mich.
Standard Car Cons. Co.....Dover, Del.
Sterling Auto Mfg. Co., Inc..Bridgeport, Conn.
Sun Motor Car Co.....Elkhart, Ind.

Fourth Floor—Accessories and Motorcycles

American Motor Co.....Plainfield, N. J.
Barley Mfg. Co.....Streator, Ill.
Dey.
Dixie Motor Car Co.....Louisville, Ky.
General Engineering Co.....Detroit, Mich.
Emerson Motor Car Co....Long Island City
Harroun Motor Corp.....Detroit, Mich.
Jordan Motor Car Co.....Cleveland, Ohio

Among 98 Car Makers

Last Year and Chicago Four—Five Electric Six at Chicago—Record Attendance

Several well-known cars will not exhibit at the national shows this year, among these being Locomobile and White. Such cars as the Monitor, Champion, Farmack, Gadabout, Trumbull, Lescina, Fergus, Remington, S. G. V. and S. J. R. will also be missed from the list of exhibitors. White and Locomobile will be on exhibition in January at the importers' salon at the Hotel Astor, this city. The coming shows, however, will be featured with a large number of new cars, which have never before been exhibited. These include at the New York show: Monroe, Columbia Electric, Detroiter, Liberty, Bour-Davis, Ben Hur, Elgin, Drexel, American, Princess, Dey, Kent, Doble, Jordan, Emerson, Harroun, Monitor, Dixie and Roamer. The Chicago show will list such new cars as Stephens, Emerson, Dixie, Classic, Harroun, Drexel, Pan-American, American, Ben Hur, Liberty, Columbia, Monroe and H. A. L.

Changes in Spaces Allotted

There will be several space changes this year at New York. Of course, Overland, Buick, Studebaker and Maxwell will retain last year's spaces. Others on the first floor this year are King, Stearns, Olds, Paige, Mitchell, Winton, Pullman, Pierce, National, Nash, Allen, Grant, Saxon, Hupp, Franklin, Chandler, Haynes, Reo, Packard, Oakland, Hudson, Chalmers, Cadillac, Kissel, Velie and Cole.

At Chicago, as at New York, Overland, Buick and Studebaker have retained last year's spaces on the Coliseum main floor. Other changes in placement of spaces have taken place. Maxwell has moved along the cross aisle, next to the Overland. Chevrolet has moved across the aisle in a similar position in the space nearest the entrance. Others on the main floor are Scripps-Booth, Apperson, National, Dort, Grant, Pullman, Paige, Haynes, Saxon, Chalmers, Reo, Packard, Oakland, Dodge, Franklin, Velie, Winton, Chandler, Pierce, Olds, Cadillac, King, Hudson, Nash, Hupp, Kissel, Briscoe, Allen, Case, Mitchell, Marmon, Auburn, Moon, Stutz, Inter-State, Cole, Stearns, Fiat, Mercer, Regal, Jackson and Empire.

W. C. Leland
Vice-pres., Cadillac Motor Car Co.

Hugh Chalmers
Pres., Chalmers Motor Co.

John N. Willys
Pres., Willys-Overland Co.

Charles Clifton
Treas., Pierce-Arrow Motor Car Co.

Space at the National Shows To Be Held at New York and Chicago

Kent Motor Corp.....Nsw York
Monitor.
Princess Motor Car Co.....Dstroit, Mich.

Car Exhibitors at Chicago

Coliseum Main Floor—Automobile Section

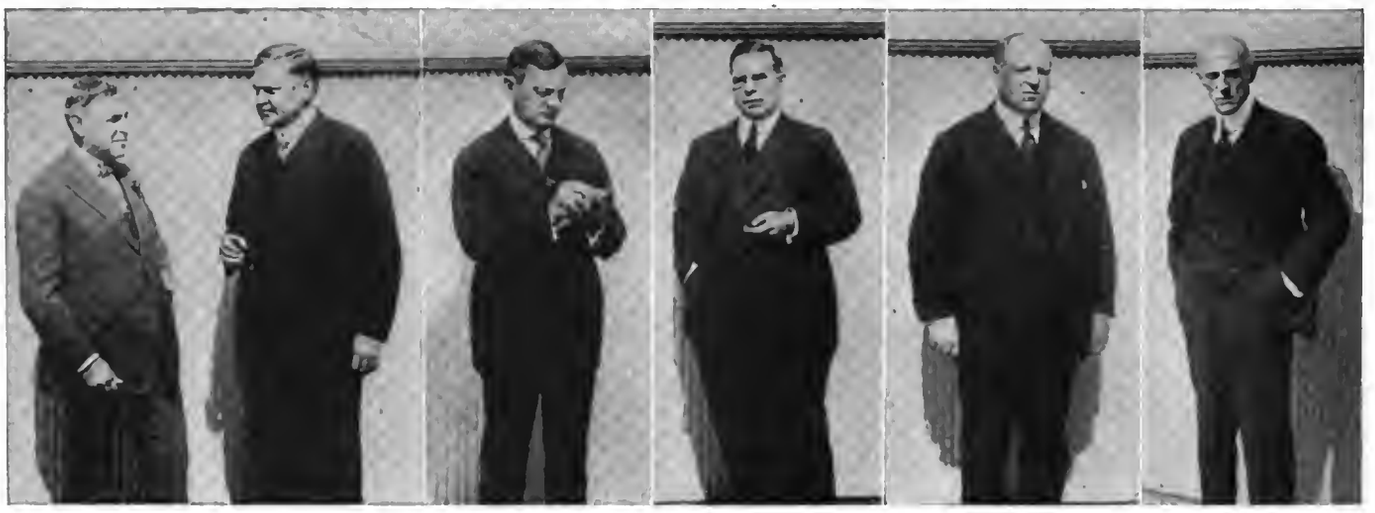
Allsn Motor Co.....Fostoria, Ohio
Apperson Bros. Auto Co.....Kokomo, Ind.
Auburn Automobile Co.....Auburn, Ind.
Briscoe Motor Corp.....Jackson, Mich.
Buick Motor Co.....Flint, Mich.
Cole Motor Car Co.....Indianapolis, Ind.
Cadillac Motor Car Co.....Dstroit, Mich.
Chalmsrs Motor Co.....Detroit, Mich.
Chandler Motor Car Co.....Clsveland, Ohio
Chsvrolst Motor Co., of Mich....Flint, Mich.
J. I. Case, T. M. Co.....Racine, Wis.
Dort Motor Car Co.....Flint, Mich.
Empire Automobils Co....Indianapolis, Ind.
H. H. Franklin Mfg. Co.....Syracuse, N. Y.
Grant Motor Car Corp.....Findlay, Ohio
Haynss Automobils Co.....Kokomo, Ind.
Hupp Motor Car Corp.....Detroit, Mich.
Fiat Automobils Co....Poughkespsie, N. Y.
Inter-Stats Motor Co.....Muncie, Ind.
Jackson Automobils Co.....Jackson, Mich.
Hudson Motor Car Co.....Detroit, Mich.
Kissel Motor Car Co.....Hartford, Wis.
Maxwell Motor Co., Inc.....Detroit, Mich.
Msrcer Automobile Co.....Trenton, N. J.
Moon Motor Car Co.....St. Louis, Mo.
Mitchsll Motors Co., Inc.....Racine, Wis.
National Motor Vehicle Co.Indianapolis, Ind.
Nordyke & Marmon Co., Inc.Indianapolis, Ind.
Nash Motors Co.....Kenosha, Wis.
Oakland Motor Car Co.....Pontiac, Mich.
Olds Motor Works.....Lansing, Mich.
Pullman Motor Car Co.....York, Pa.
Pierce-Arrow Motor Car Co...Buffalo, N. Y.
Paige-Detroit Motor Car Co...Detroit, Mich.
Packard Motor Car Co.....Detroit, Mich.
Reo Motor Car Co.....Lansing, Mich.
Regal Motor Car Co.....Detroit, Mich.
Scripps-Booth Corp.....Detroit, Mich.
Saxon Motor Car Corp.....Detroit, Mich.
F. B. Stearns Co.....Clsveland, Ohio
Stutz Motor Car Co., of Amsrica,
Indianapolis, Ind.
Studebakar Corp. of Amsrica..Detroit, Mich.
Velie Motor Vehicle Co.....Moline, Ill.
Winton Co.....Clsveland, Ohio

First Regiment Armory—Main Floor

Anderson Electric Car Co.....Detroit, Mich.
Abbott Corp.....Cleveland, Ohio
Austin Automobile Co..Grand Rapids, Mich.
Baker, R. & L. Co.....Clsvsland, Ohio
Barthoiomew Co.....Psoria, Ill.
Columbia Motors Co.....Dstroit, Mich.
Jas. Cunningham Son & Co..Rochester, N. Y.
Crow-Elkhart Motor Co.....Elkhart, Ind.
Dstroiter Motor Car Co.....Detroit, Mich.
Geo. W. Davis Carriage Co..Richmond, Ind.
Elkhart, C. & M. C. Co.....Elkhart, Ind.
Hackett-Mansell, Hackett.....Jackson, Mich.
Lexington-Howard Co.....Connersville, Ind.
Lozier Motor Co.....Detroit, Mich.
Lewis Spring & Axle Co.....Jackson, Mich.
Monroe Motor Co.....Pontiac, Mich.
McFarlan Motor Co.....Connersville, Ind.
Moline Automobile Co.....E. Moline, Ill.
Milburn Electric Co.....Tolsdo, Ohio
Mutual Motors Co.....Jackson, Mich.
Metz Co.....Waltham, Mass.
Pathfinder Co.....Indianapolis, Ind.
Pesrless Motor Car Co.....Cleveland, Ohio
Prsmier Motor Corp.....Indianapolis
Ohio Electric Car Co.....Toledo, Ohio
W. A. Peterson Co.....Flint, Mich.
Standard Steel Car Co.....Pittsburgh, Pa.
Woods Motor Vshicle Co.....Chicago, Ill.

Coliseum Basement—Automobile Section

American Motor Co.....Plainfisld, N. J.
Barley Mfg. Co.....Strsator, Ill.
Ben Hur Motor Co.....Clevsland, Ohio
Classic Motor Car Corp.....Chicago, Ill.
Elgin Motor Car Corp.....Chicago, Ill.
Emerson Motor Car Co....Long Island City
Engsr Motor Car Co.....Cincinnati, Ohio
Dixis Motor Car Co.....Louisville, Ky.
Drsxel Motor Car Corp.....Chicago, Ill.
Harroun Motor Corp.....Detroit, Mich.
Jordan Motor Car Co.....Cleveland, Ohio
Liberty Motor Car Co.....Detroit, Mich.
Princess Motor Car Co.....Detroit, Mich.
Pan American Motors Corp.....Chicago, Ill.
Stephens Motor Branch of Moiins Plow
Co.....Freeport, Iii.
Sun Motor Car Co.....Elkhart, Ind.



Horace De Lisser
Vice-Pres. Briscoe Motor Corp.

Benjamin Briscoe
Pres. Briscoe Motor Corp.

R. C. Rueschaw
Sales Mgr. Reo Motor Car Co.

J. W. Bate
Chief Engr. Mitchell Motors Co.

W. C. Silia
Sales Mgr. Chevrolet Motor Co. of N. Y.

O. C. Hutchinson
Mgr. Wholesale Br'ch Hupp Motor Car Corp.

J. I. Handley
Pres. Mutual Motors Co.

B. W. Twyman
Gen. Mgr. Inter-State Motor Co.

W. R. Vogeler
Export Mgr. King Motor Car Co.

Henry Larson
N. Y. Distributer Olds Motor Works

E. C. J. McShane
Mercer Automobile Co.

Wm. T. White
Pres. Mercer Automobile Co.

T. S. Johnston
Rep. Monroe Motor Co.

Norris Mason
N. Y. Distributer Monroe Motor Co.

M. I. Brock
Dir. of Sales Am. Motors Corp.

W. B. Pratt
Pres. Elkhart C. & M. Car Co.

Walter S. Austin
Pres. Austin Automobile Co.

W.H.Van Dervoort
Pres. Moline Automobile Co.

J. G. Menihan
Pres. Harroun Motor Corp.

Elwood Haynes
Pres. Haynes Automobile Co.

Percy Owen
Pres. Liberty Motor Car Co.

W. E. Metzger
Vice-Pres. Columbia Motors Co.

J. J. Cole
Pres. Cole Motor Car Co.

H. H. Hills
Sales Mgr. Packard Motor Car Co.

H. H. Rice
President Waverley Co.

Alfred Reeves
General Manager N. A. C. C.

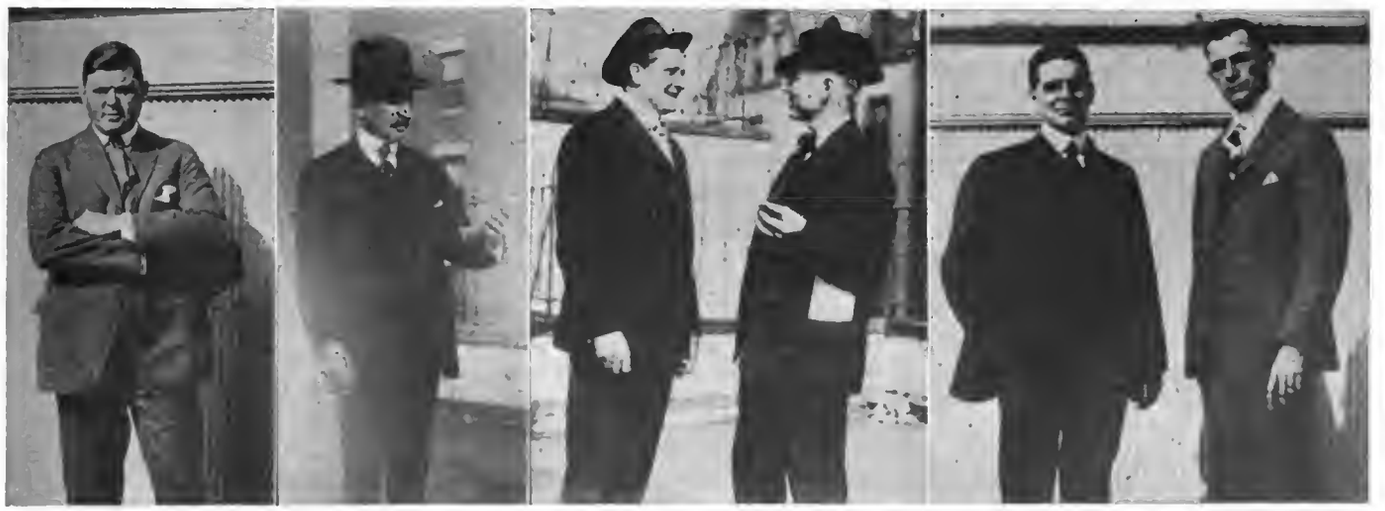
G. M. Dickson
Sec. & Treas. Nat'l Motor Vehicle Co.

F. E. Moskovics
Com. Mgr. Nordyke & Marmon Co., Inc.

A. E. Schaaf
Sec. Fiat Automobile Co.

W. B. Stout
Sales Mgr. Scripps-Booth Corp.

W. E. Stainaker
Sales Mgr. Pathfinder Co.



C. A. Baird
Sales Mgr. Jas. Cunningham Son & Co.

F. H. Clarke
Pres. Kent Motors Corp. of N. Y.

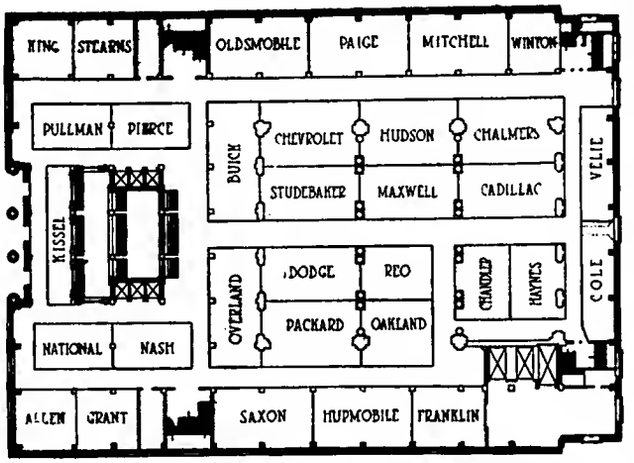
Winfield Graham
Supervisor of Sales, McFarlan Motor Co.

B. M. Barrows
Sales Mgr. McFarlan Motor Co.

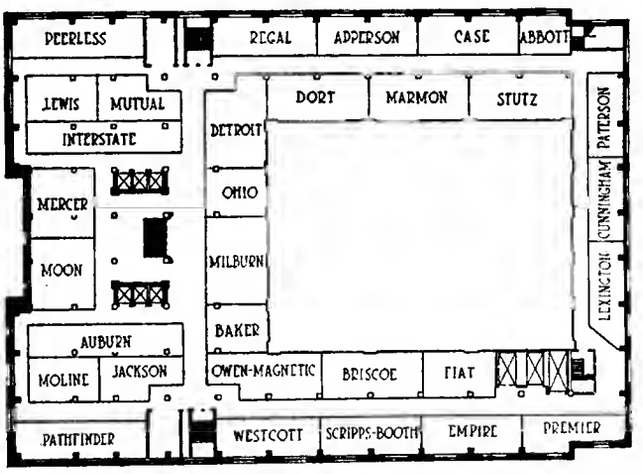
R. A. Pickens
Sales Manager Metz Co.

F. H. Oliver
Sales Mgr. Princess Motor Car Co.

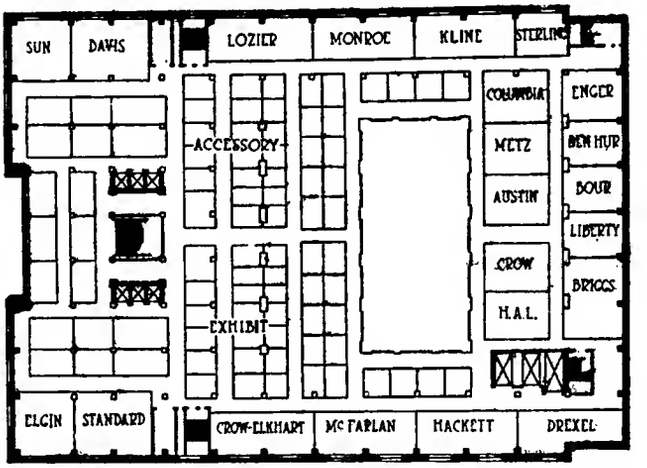
Exhibitors and Plans of New York and Chicago Shows



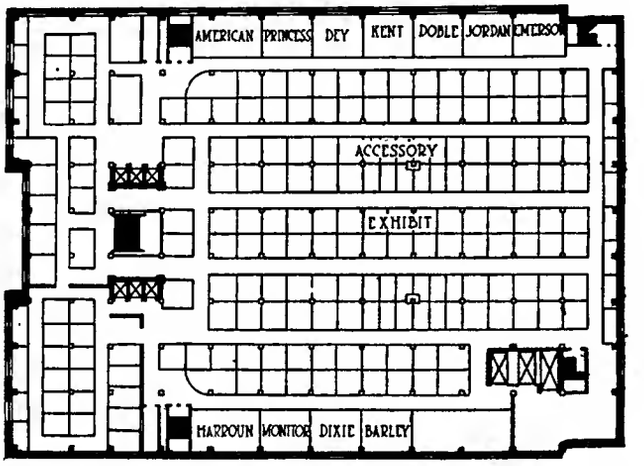
MAIN FLOOR GRAND CENTRAL PALACE, NEW YORK



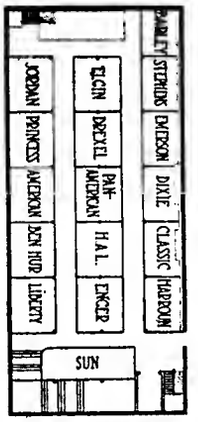
SECOND FLOOR GRAND CENTRAL PALACE, NEW YORK

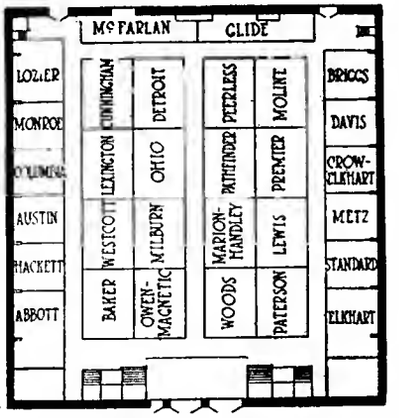


THIRD FLOOR GRAND CENTRAL PALACE, NEW YORK

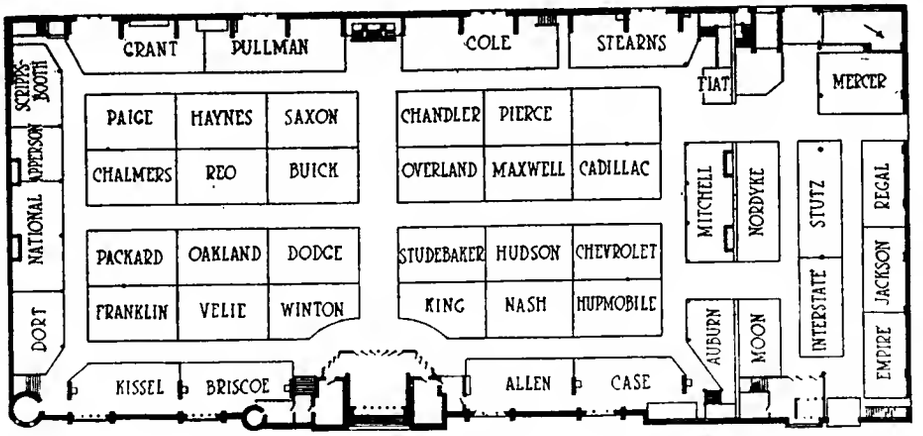


FOURTH FLOOR GRAND CENTRAL PALACE, NEW YORK





FIRST FLOOR OF THE FIRST REGIMENT ARMORY, CHICAGO



AT THE LEFT IS THE MAIN FLOOR OF THE COLISEUM AT CHICAGO WITH ITS ANNEX AT THE RIGHT SIDE. IMMEDIATELY ABOVE THE ANNEX IS THE PLAN OF THE ANNEX BASEMENT

Gravity Does Not Mean Power

Bureau of Mines Head Reports That Experiments Show Less Than 2 Per Cent Difference in Power Between 74 and 60-Deg. Gasoline

GRAVITY does not of itself furnish a satisfactory basis for buying gasoline, Van. H. Manning, director of the Bureau of Mines, told the Retail Merchants' Assn. of Washington, D. C., in an address delivered Oct. 4. The association has launched a campaign for purity in gasoline and Mr. Manning's report that tests made by his department showed a difference in power of less than 2 per cent between gasoline of 74-deg., and 60-deg. gravity prefaced his statement to the effect that, under proper engine conditions, power is not a matter of the gasoline used. Mr. Manning pointed out how the co-operation of automobile engineers has made the use of lower grade fuels practicable in the cars of to-day and then explained how the end point of gasoline had been increased by the refiners' use of heavier oils from 150 deg. Centigrade a year ago to 175 and 200 deg. Centigrade at the present time.

While our present gasoline supply is sufficient for only 27 to 30 years, without taking into consideration the probable yearly increase in the demand, Mr. Manning states that the remarkable development of the casing head gasoline industry during the past year gives promise that the coming years will bring into existence new methods of producing, increasing or utilizing the gasoline output so that the problems of the automobile fuel situation will be gradually worked out to a satisfactory solution. Mr. Manning's address follows:

"The Bureau of Mines is in entire sympathy with the campaign for purity in gasoline, and wishes to be of aid to the entire country in this important matter.

"We are to-day facing a serious condition in the petroleum industry. We have probably reached the summit of our crude oil production in this country. According to the United States Geological Survey, our future supply of petroleum is only sufficient to last us from 27 to 30 years at the present rate of consumption. This does not take into consideration any increasing demand as the years go by. In order to supply the fuel for the future automobiles, it will be necessary to make better use of our crude oil production in the future than we have in the past.

Production Is Inadequate

"In discussing the various problems involved, we must bear in mind that while the demand is steadily increasing, the production of crude oil, which is the raw source of the gasoline, is remaining approximately stationary, if it has not been declining in the past year. A year ago gasoline was selling at 11 cents a gallon and was a drug on the market, due to the tremendous production of gasoline-rich crude produced by the Cushing field in Oklahoma. This production, however, has declined from over 300,000 barrels of crude oil per day to less than 60,000 barrels per day.

"The Cushing crude contains from 25 to 30 per cent of gasoline. The new production which has compensated for the decline in the Cushing production, contains but from 15 to 17 per cent of gasoline. Notwithstanding the decline in the production of gasoline, the demand has steadily increased, due primarily to the increased use of the automobile. On Jan. 1, 1916, there were two and a quarter million automobiles in use in the United States. It is estimated by the automobile manufacturers that there will be in excess of 3,250,000 in use by January, 1917, and by January, 1918, there will be in excess of 4,500,000 automobiles in use. These figures are in addition to the increased use of motor trucks, farm tractors, stationary gasoline engines, motor boats, etc.

Automobile Engineers Help

"This increasing demand for gasoline has been met partly by the automobile engineers and refiners. The automobile engineers have improved their automobile engines and carbureters, making it possible to use heavier fuels in the automobile of to-day, which would have been impracticable a year or 2 years ago. The refiners, taking advantage of the work of the automobile engineers, have been able to use heavier oils for gasoline, thereby increasing the percentage of gasoline obtainable from the given amount of crude oil. This has resulted in increasing the end point from 150 deg. C., the end point of a year ago, up to an end point of 175 deg. to 200 deg. C., the end point of to-day.

"The end point is a term used in distillation of gasoline and is usually considered to be the temperature at which 95 per cent of the gasoline will distill off if distilled in a proper flask at the proper rate. Recently the Bureau of Mines purchased four samples of gasoline sold in the District of Columbia. These gasolines were analyzed and the end point determined in each instance. The gravity of one was 64.8. The gravities of the other three samples ranged from 61.5 to 62. The end point of the first sample was 210 deg. C. The end point of the other three samples was 175 deg. The high end point of the first sample, together with its high specific gravity indicates that this is a blended gasoline. This is further borne out by the analysis, which indicates that 21 per cent is distilled over under 75 deg., whereas less than 10 per cent on the other three samples is distilled over at this same temperature. This larger proportion of light products, which is responsible for the high gravity, indicates that casing head gasoline has been blended with heavy distillate, because the end point of this gasoline is 210 deg., as against 175 deg. for the other three gasolines analyzed. It is possible that this blended gasoline might prove satisfactory in some automobile engines.

"The end point is important because it is a measure of the readiness of the gasoline to vaporize, which is necessary and desirable information to have in selecting suitable fuel for gasoline engines. As a result, the refiners have been able to supply a lower grade fuel, which is now adaptable to the improved automobile engine. This, of course, automatically has a tendency to keep the price of gasoline down, as it can readily be seen that if the standard of quality is higher, the supply would be more limited and higher in price.

Old Cars Suffer

"This will probably explain some of the difficulties that the people are having with the character of the fuel used in their automobiles at the present time, particularly if the automobile is of a design of 2 or more years ago, not having the improved engine and carbureter design, it is not equipped to use the present-day low grade of fuel.

"Refiners are co-operating along another line to the same end, namely, to increase the amount of gasoline and at the same time to keep the price down to a reasonable basis, by

means of cracking kerosenes and heavier oils, thereby converting a certain proportion of the crude oil which was not formerly utilized for that purpose into gasoline. Last year there was produced by cracking processes approximately 2,000,000 bbls. of gasoline. This year it is estimated that there will be produced more than 5,000,000 bbls. of gasoline by cracking processes. This is all the more striking when it is considered that these 5,000,000 barrels of gasoline were made from oils which in the past did not enter into the making of gasoline, and indicates the possibilities of the present production of crude oil to supply the future requirements of the automobile.

"These are some of the problems that have to be taken into consideration in any specifications that are drawn up. We want to be sure as nearly as we can that we get a grade of gasoline that will be satisfactory for our needs; then we have to be sure that it is of such a grade that can be supplied by the refiners at a reasonable price. Unless the specifications do take these factors into consideration, they may result in restricting the supply and making the prices exorbitantly high, and also may deprive many people of the pleasure of owning an automobile by making the price of fuel prohibitive. With proper development of the cracking processes, and the co-operation of the automobile engineer, there is no reason why a suitable fuel should not be available for years to come and at a reasonable price.

Future Not Threatening

"The Bureau of Mines has for a number of years appreciated the seriousness of the motor fuel problem; in fact, long before the sharp increase in prices of gasoline, this bureau was aware of the conditions, and realized that this increase in prices would follow. It was at that time the bureau began a serious investigation of this entire problem. The special investigation bearing directly on the quality of gasoline was begun 8 months ago and is being continued to-day. Samples of gasoline were purchased in the open market in all parts of the country (and not from refiners), and were analyzed by the bureau's engineers, and engine tests were also run on the representative grades of gasoline. The results to date are contained in a publication to be issued in the near future by the Bureau of Mines. There is also in course of publication, and nearly completed, a report on gasoline specifications, which has taken into consideration the available supply, increasing demand and the protection of the public, as well as fair treatment to the refining industry—all with the purpose of assuring a future supply of gasoline to the public at the most reasonable prices.

Gravity Does Not Determine Power

"One of the results that may prove startling to the public is that the gravity of the gasoline does not of itself necessarily mean a satisfactory basis for the purchase of gasoline. Engine tests were run by the bureau on gasoline having a gravity of from 74 deg. to 60 deg. The net result of these tests showed a difference in power developed of less than 2 per cent between gasolines of 74 deg. gravity and gasolines of 60 deg. gravity. This is all the more remarkable when it is considered that 74 gravity gasoline is selling at 31 cents per gallon, while the 60 deg. gravity gasoline can be purchased at 22 cents per gallon.

"It is probable that the 60 gravity gasoline, which can be purchased for 9 cents less a gallon, can be used in the automobile with the same satisfaction as the 74 deg. gravity gasoline.

"All gasolines can, under properly regulated engine conditions, be made to develop quantities of power which are not greatly different. This result was obtained from experimental work in our laboratories in Pittsburgh, and indicates that the claim made by many refineries for the power-producing qualities of their gasoline are largely without foundation. It does not necessarily follow that all gasolines are equally good, but it is certain that exaggerated claims are made for the number of miles per gallon. The possible element of superiority undoubtedly lies in the quality some products have of giving maximum efficiency over a wider range of engine conditions. The fact of importance is, therefore, that if the user of gasoline takes sufficient care of his engine, he can obtain almost as good results from a cheap gasoline as from an expensive, high-test product, as the power developed under like conditions varies in our experiments.

Casing-Head Gasoline

"Recently, owing to the remarkable development of the casing-head gasoline industry, that is, obtaining gasoline from natural gas, there has been obtained a product called 'blended' gasoline. The casing-head gasoline as derived from natural gas is too volatile to be used directly. It is therefore mixed with oil just a little lighter than kerosene but heavier than gasoline. Such a blended gasoline may be of any gravity desired by the manufacturer, but is naturally different in composition and properties from the straight refinery product which it may chance to resemble in gravity only. This is due to the fact that it is generally composed of more of both of the heavier and lighter oils than gasoline made by the ordinary processes. On account of the larger proportion of light oil, it is possible to use a correspondingly large proportion of heavy oil and still have an average gravity the same as ordinary gasoline, but which may act very differently in an engine on account of the large portion of heavy oil contained in the blended product.

"This is not intended to discourage the use or manufacture of casing-head gasoline. If the casing-head gasoline is blended with the proper oils, that is, oils that are not too heavy, it can be used satisfactorily in an automobile engine. Casing-head gasoline is an important addition to our fuel oil resources, the production amounting to approximately 5 per cent of the total production of gasoline this year.

Preparing Gasoline Specifications

"The Bureau of Mines is now preparing gasoline specifications for the General Supply Committee of the Federal Government, which will undoubtedly be of interest to all users of gasoline. These specifications should be issued within the next 90 days.

"The Bureau of Mines has a complete testing laboratory, equipped with engines and other necessary apparatus, with which it will be possible to make power tests on gasoline, as well as on other internal combustion engine fuels. The results of these tests will be available to the general public, and will be of the utmost importance in clearing up the difficulties with which it is confronted to-day.

"In conclusion, I wish to emphasize the necessity of bearing in mind the following consideration in our efforts to obtain purity in gasoline. We must keep before us the fact that there should be the greatest possible use of the raw materials consistent with economic results. For instance, no specifications should be drawn up which would exclude certain materials now being used satisfactorily, for if eliminated, this would correspondingly restrict the supply and automatically increase the price. This of course, is not desirable. The bureau is exceedingly anxious that all the available resources for the making of gasoline be used to their greatest extent, and it is also interested in the encouragement of further economy in the design of the automobile engine. Any specifications that would restrict the use of some of the low grade oil resources would at once stop any further efforts toward improvement in engine design. At the same time, the bureau is interested in seeing that the public obtains a satisfactory fuel."

Ford Melting Pot, where graduates received diplomas on Oct. 1

Ford's Melting Pot

Company's English School Cuts Accidents 54% — Eliminates Interpreters

WHEN the Ford English School, commonly known as the Ford Melting Pot, graduated 250 of its pupils on Oct. 1, it marked the third graduation class since the opening of the school in 1914 and witnessed the disappearance of interpreters with a decrease of 54 per cent in the number of accidents in the production department.

Beginning with twenty pupils and one teacher, the school, has grown until it includes 2720 members with 163 instructors.

The instructors are all employees of the factory, composed of foremen, machine operators, clerks and workmen who, voluntarily and without compensation, give their spare time to this work. Lessons are similar to the Berlitz system.

Many types come to the classes. There is the type which has a good education in his native tongue but knows no English; and the type that has a fair education in the mother-tongue and knows a few disconnected English words, usually slang. Then there is the group which possesses little if any education, either native or English. The first and second classes progress rapidly. Some of the men are able to read, write and speak English with a fair degree of correctness at the end of 3 months, though the average time for completing the course has been found to require 6 months. One class, set aside by itself, is very slow, completing but ten lessons in 10 months.

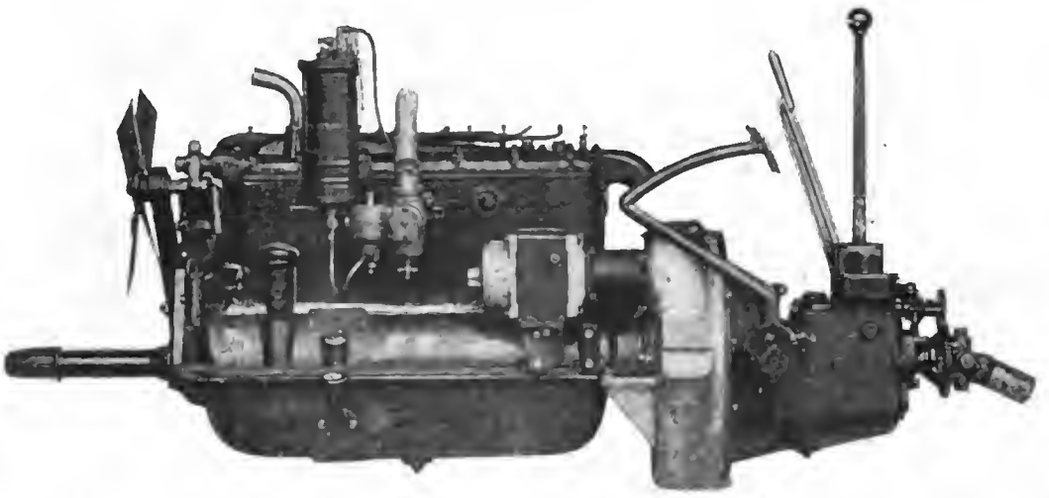
The usual class program consists of 45 min. in the morning and 1½ hr. in the afternoon so arranged because the men work in three shifts of 8 hr. each. The course consists of sixty-eight lessons taught in 34 weeks and includes 25 min. of oral training, 10 min. of reading exercises, 15 min. of writing lesson and 15 min. of review in each lesson. The first thing a man is taught to say is, "I am a good American," and a few minutes is devoted each day toward teaching the classes a few lines of the song "America." Attendance to the school is compulsory and men who refuse to attend are threatened by a short layoff. While the compulsion seems harsh to some, the Ford company believes that the end justifies the means and it is actually making more efficient, intelligent and valuable workmen by the plan already outlined.

The Ford Company also gives two other courses of study for its employees. They are the student course and the tool-making course. The latter includes a 2 years' study and was established to meet the scarcity of skilled mechanics. The members of the classes are required to have a previous knowledge of higher mathematics.

The student course qualifies employees for salesmanship and mechanical work. The more intelligent men only are selected and are thus built for the higher positions. They attend the school for a year and are constantly shifted from one department to another in the factory and offices and can later be used for branch managers or department heads. The company also places fifty Indians from the Carlisle College in this class every year. The college offers the Ford opportunity to its students who regard it as an incentive and strive to be among the fifty. Dean Marquis states that the Indians are among the best workmen in the institution.

Ford English school pupils and graduating class, sthered sround the Melting Pot on graduation day, Oct. 1, listening to an address by Dr. M. F. Rice

Lexington in Two Six-Cylinder Chassis



Six-cylinder Continental power plant used in the new Lexington sixes, showing high mounting of carbureter with Stewart vacuum fuel feed tank. Starter mounting is also shown. Note gear for speedometer drive in rear of three-speed gearbox and adjustment for pedal on lower end

Many Body Styles for Minute Man and Thoroughbred—Multiple Exhaust Continued

THE aim of the maker of the Lexington Sixes, the Lexington-Howard Co., Connersville, Ind., is to produce cars of high finish and excellent detail equipment. The chassis are made up of well known units, but it is the manufacturer's claim that the design has an unusual coherence for an assembly proposition, the reason being that several of the parts factories whence the Lexington company obtains its supplies are owned and operated by the same business heads.

Two Chassis—Many Bodies

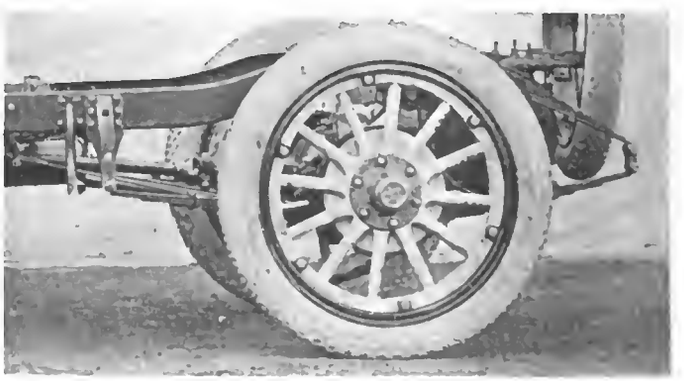
There are two different chassis, on which a fairly wide range of body styles are mounted. The smaller is known as the Minute Man six and sells for $1,185 and the larger is termed the Thoroughbred, costing $2,875. Both have Continental engines, the smaller 3¼ by 4½ in. and the larger 4⅛ by 5¼ in. but there is a special feature on these motors for which it is claimed that it gives a large increase in the power. This is the Moore multiple exhaust manifold, used in conjunction with two mufflers as may be seen in the chassis plan view. Briefly, this Moore system consists of an exhaust manifold so divided that the exhaust from one cylinder has no possibility of interference with that of the next. On the contrary, the escaping charge from one cylinder is believed to exercise some suction on the next. In six-cylinder engines where there is always one exhaust valve open and two open together at very frequent intervals interference most certainly does take place with the conventional exhaust system and it is a remarkable thing that the Moore system or some other device with a similar aim is practically never used except on the Lexington and one or two foreign cars.

In other respects the engines are typical Continental products. The two sizes differ a little in detail, but not very much, both being pump cooled. Lexington equips the larger with two separate ignition systems and twelve spark plugs, the smaller having only one distributer, but this is built into the engine and is not a part of the generator. The electric generator is located on the water pump side of the engine, and is driven by a quick detachable coupling specially designed to give soundless operation.

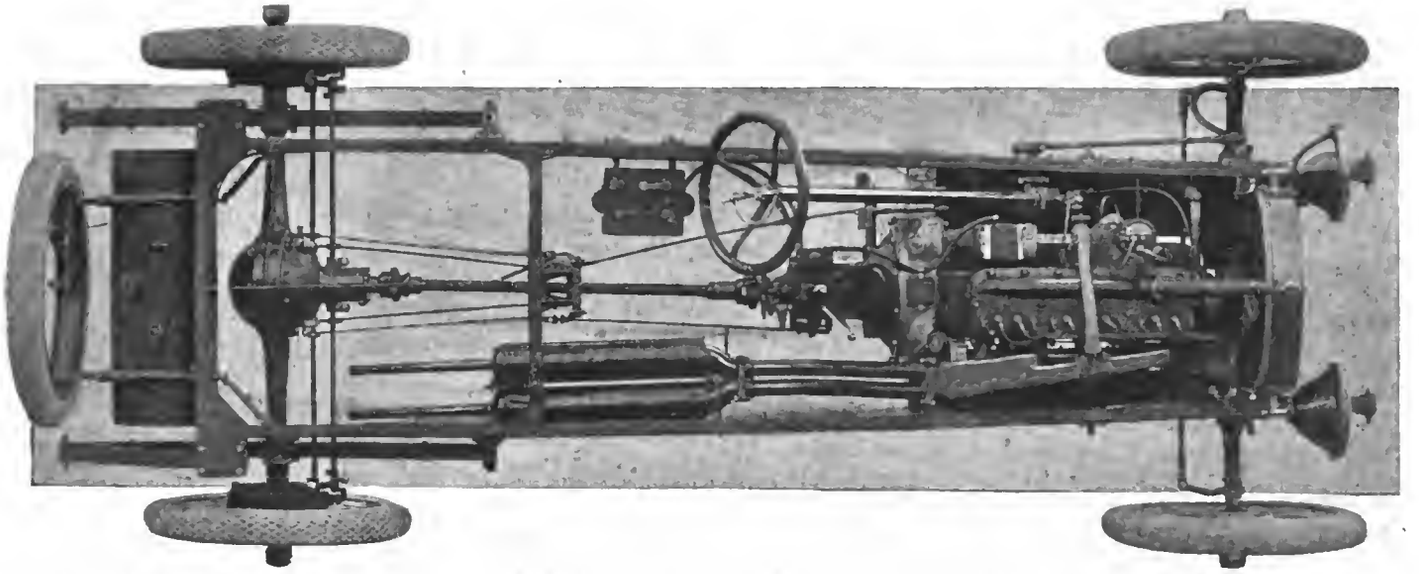
Force-Feed Oiling to Bearings

Each of the three main bearings of either engine gets its supply of oil forced direct from the pump, dip troughs being filled by the same pump for supplying the connecting-rod bearings and other parts of the motor by splash. The carbureters are mounted high, with gas passages as short as possible between throttle and cylinder, the fuel being fed by vacuum system in conjunction with a 22-gal. tank at the rear end of the main frame. Care has been taken to provide indicators so that the driver can see at a glance how his engine accessories are operating. Thus the oil system is provided with a large pressure gage which is set in the cowlboard, and the electrical outfit includes a cowlboard ammeter showing whether the battery is being charged or not, and also measuring the discharge rate when the battery is used with the car standing and engine stopped.

Driver's compartment of new Lexington, showing divided front seats, ample leg-room and control members



Rear of chassis, showing drop of forward spring end



Lexington Minute Man six chassis, showing dual exhaust system with separate outlet from each cylinder block and two mufflers. This view also shows carbureter hot air intake, storage battery mounting, rear fuel tank and spare tire carrier

Each of the two cars has a three-speed transmission bnt it should be noticed that the more powerful car has a substantially heavier gearbox with wider gears of bigger pitch, in proper proportion to the higher engine power. The clutches are different, as the Minute Man has a multiple dry disk pattern and the Thoroughbred a special cone clutch of Lexington design which has the leather face hand ground to a fine surface that fits accnrately in the flywheel. The leather has twelve spring inserts beneath the face.

Torque and drive stresses are taken care of by the three-quarter elliptical rear springs, the propeller shafts being fitted with universals at both ends. Extra large diameter tubes are used for the propeller shafts to guard against whipping when running fast. The rear springs are 50 in. long and underhung beneath the axle, vanadium steel being used throughout for spring work.

Frame Is Unusually Rigid

Another place where exceptional material is employed is in the frame and the manufacturer makes a special point of drilling the holes in the side rails and applying the rivets so that a particularly good job is made of the frame altogether. All the different brackets are hot-riveted, and at several points Lexington uses more rivets for a particular piece than is the conventional practice this, of course, assisting rigidity and preventing the production of creaks. The front and rear axles are conventional in type except that the former is carefully set to a give a caster action to the steering. Final drive is, of course by spiral bevel.

On the smaller chassis four body styles are available. The five-passenger open touring car which costs $1,185 is finished in dark green, with wheels in cream color and chassis, with fenders, black. The top and side curtains are black leatherette, and the top boot of the same material. The top clips to the windshield, which is set with a slight rake. The equipment is more than nsually complete for it includes a tire pump with accurate gage, a trouble lamp, double-bnlb headlamps and motor-driven electric horn as well as tire carrier and rim license brackets, etc.

A Convertible Touring Model

Alternative bodies on this chassis inclnde a convertible type touring car from which the windows can be detached individually. This body has been worked ont so that the top really fits the body beneath, the lines harmonizing as they do in a fully enclosed body. The color scheme is the same as for the open touring car and the equipment also. This convertible sells for $1,350.

There is an open roadster and a convertible roadster, following the scheme of the five-passenger cars, the former costing $1,185 and the latter $1,350, just as the touring car. The equipment is identical except that the roadsters are finished in a deep wine color instead of the dark green. All these bodies mount on the same 116-in. wheelbase chassis and wood wheels with 32 by 4-in. tires, non-skid rear, are standard.

Clubster with Small Tonnean

On the larger car there are two standard bodies, a seven-passenger tonring and a four-passenger close coupled design called the clubster. The clubster is not a clover-leaf, but is a small tonneau job with only two doors, these opening into the rear compartment. The driver and front passenger reach their seats by stepping forward in the aisle. There is a very roomy cnpboard in the rear end of this body which provides ample room for tools, inner tubes, etc. The spare tire at the rear acts as a frame for the door to this cupboard so that it is readily accessible at all times.

The seven-passenger also has divided front seats. The wheelbases differ, the touring car being 144 in. and the clubster 130 in. Both have five 36 by 4½-in. cord tires included in their equipment and both cars are finished in almost any color at customer's option this extending to the npholstery even. The touring car costs $2,875 and the clubster $2,675, inclusive of everything.

Lexington Minute Man six-cylinder five-passenger selling at $1,185 with full equipment. Note divided front seats and Boyce Moto-Meter

N. S. W. Car Imports Increase 138%

United States Ships Over One-Half of Bodies and Chassis—Rubber Imports Increase Over 300 Per Cent—Canada, Italy and France Gain — Country Is Prosperous But War Taxes Make Low-Priced Cars Most Popular

SYDNEY, AUSTRALIA, Sept. 15—The automobile buying power of New South Wales, Australia, has not been lowered, despite the war. This state, which is one of the leading commonwealths of Australia, made a large increase in its automobile purchases during the first half of 1916. During that period, automobile chassis valued at $1,757,140, bodies valued at $454,230, and rubber articles valued at $1,676,100 were imported. The value of the chassis and bodies alone increased 138 per cent while that of the rubber articles including automobile tires and tubes, increased over 300 per cent.

United States Leads

That the United States has established a good foothold in its automobile trade in that state is indicated by the importation of $1,513,055 worth of American bodies and chassis during the first 6 months of 1916, or over one-half of the total automobile imports.

The United States also came to the fore during the first part of 1916 as a shipper of rubber goods, of which automobile tires and tubes constituted one of the leading items. Rubber exports to New South Wales from the United States increased nearly 1000 per cent, or from $132,585 to $1,302,530.

Low-Priced Cars in Demand

Despite the fact that body building in Australia is an important industry, this state increased its body imports nearly 300 per cent during the first half of 1916. The United States also led all other countries, its shipments totaling $357,100 out of a total importation of $454,230 in bodies. This is probably due to the scarcity of labor in the factories on account of the war.

New South Wales has been a market for low-price automobiles, especially in the country districts. With this class of population purchasing practically 80 per cent of the cars, it is not surprising that the low-priced and medium-priced types should lead.

The demand for high-priced cars is small because of the high taxation on individuals. Added to general taxes that have

Comparative Return Showing the Imports of Automobile Chassis, Bodies and Rubber Articles, into the State of New South Wales, for the First 6 Months of 1915 and 1916 Respectively.

1915 CHASSIS

Country Whence Imported	Value	Country of Origin	Value
United Kingdom	$297,675	United Kingdom	$252,670
Canada	171,020	Canada	89,945
New Zealand	9,820	Belgium	18,705
Fiji	3,610	France	29,190
Belgium	2,840	Germany	7,140
France	4,470	Italy	72,665
Germany	2,445	U. S. A.	289,555
Italy	64,855		
India	455		
New Caledonia	10		
U. S. A.	202,670		
Total	$759,870	Total	$759,870

BODIES

United Kingdom	$51,075	United Kingdom	$52,065
Canada	46,630	Commonwealth	330
New Zealand	2,145	Canada	23,095
Belgium	875	France	1,510
Fiji	1,005	Germany	1,280
Germany	205	Italy	4,945
Italy	4,945	U. S. A.	84,455
India	330		
U. S. A.	60,175		
Total	$167,680	Total	$167,680

RUBBER ARTICLES

United Kingdom	$183,850	United Kingdom	$164,945
Canada	39,135	Commonwealth	85
Hong Kong	15	Canada	23,640
India	55	Austria	25
New Zealand	2,860	Belgium	25
Belgium	115	France	8,505
Fiji	530	Germany	2,445
France	155	Italy	12,385
Germany	200	Japan	85
Italy	5,030	Denmark	165
Japan	100	Russia	240
New Caledonia	60	Sweden	40
Philippine Islands	15	U. S. A.	132,585
Sweden	40		
U. S. A.	113,010		
Total	$345,170	Total	$345,170

1916 CHASSIS

Country Whence Imported	Value	Country of Origin	Value
United Kingdom	$204,470	United Kingdom	$140,910
Canada	216,045	Canada	273,775
New Zealand	11,270	Belgium	1,400
France	2,695	France	66,715
Germany	820	Germany	820
Italy	96,000	Italy	112,860
Java	20,110	Sweden	340
U. S. A.	1,205,730	Switzerland	4,360
		U. S. A.	1,155,955
Total	$1,757,140	Total	$1,757,140

BODIES

United Kingdom	$28,135	United Kingdom	$17,220
Canada	69,315	Commonwealth	165
New Zealand	6,340	Canada	61,735
Germany	190	Belgium	450
Italy	6,220	France	9,305
Java	230	Germany	195
U. S. A.	343,785	Italy	6,560
		U. S. A.	357,100
Total	$454,230	Total	$454,230

RUBBER ARTICLES

United Kingdom	$275,285	United Kingdom	$224,660
Canada	427,275	Commonwealth	1,325
Fiji	20	Canada	70,685
Hong Kong	15	Belgium	400
New Zealand	7,790	France	51,000
Bismarck Archipelago	55	Germany	415
France	7,180	Italy	22,435
Germany	330	Japan	2,545
Italy	17,745	Russia	85
Japan	2,545	Sweden	20
Java	1,980	U. S. A.	1,302,530
Sweden	20		
U. S. A.	935,850		
Total	$1,676,100	Total	$1,676,100

the effect of raising the cost of living, there are special automobile imposts varying from $10 to $50 according to size. In the truck field things are particularly bright, since the large number of users who have lost their vehicles to the government will buy anything capable of doing the work.

Country Is Prosperous

New South Wales has always been the leading automobile buying state in Australia on account of its exceptionally large farming and pasturage districts.

Despite the war, business in that state, in fact in the whole of Australia, remains prosperous and people are purchasing freely. That the Australian government is doing all in its power to better export conditions is manifested in the recent purchase of cargo steamers on account of excessive freight rates and the general difficulties in obtaining merchandise.

Canada, the United Kingdom, Italy and France ranked respectively next to the United States in the value of chassis shipments. Of the four, only Canada and Italy showed increases over 1915 shipments. Canada, which ranked second, exported $273,775 worth of chassis in the first half of this year, as compared with $89,945 in the first half of 1915.

U. S. Shipments $1,205,730

The accompanying table shows some interesting figures. Though shipments of chassis from the United Kingdom totaled $204,470, only $140,910 worth of automobiles actually were manufactured in that country. The total shipment of automobiles from the United States was valued at $1,205,730, while the value of the cars manufactured there and sent to New South Wales was $1,155,955. Canadian shipments to New South Wales were less than actually made for that country. Canada shipped $216,045 worth of automobiles direct to New South Wales, while the value of the cars made in that country and received in New South Wales was $273,775, which brings out the fact that many Canadian cars are either being shipped from the United States or are being sent to the United Kingdom and thence to their destination.

Paint Poles White at Danger Points

WHILE all kinds of efforts are being put forth by State and county highway officials to minimize the dangers of night driving to automobilists due to curves, bridges and other road conditions, one of the simplest safety measures possible seems to have been overlooked. If telegraph and telephone poles in the vicinity of the point of danger were painted white, drivers would recognize their significance at once, and, in fact, could hardly help noticing them so that they would be put on their guard. F. W. Pelton, publicity manager of the Mitchell Motors Co., Inc., Racine, Wis., is responsible for this suggestion to the highway commissions, his idea being that the ten poles on each side of the danger point should be painted about 10 ft. from the ground for about a 5-ft. strip of white with a red band about 1 ft. wide in the center.

At railroad crossings, Mr. Pelton points out, railroad officials would be glad to co-operate, for many railroad crossings are so obscured by buildings, trees or other obstacles to vision that a car driver does not realize the nearness of danger until he is right upon it.

Disk Wheel of Great Simplicity

AT the plant of the Detroit Pressed Steel Co., Detroit, Mich., A. L. Putman has recently developed a steel disk wheel which has an extreme simplicity in combination with good appearance and ease of manufacture. Putman uses only a single disk, and has patented a special machine wherein the disk is rolled in such a way that it is thickest at the center where attachment to the hub is made, and thinnest at the edge, the section tapering as shown in the sectional cut.

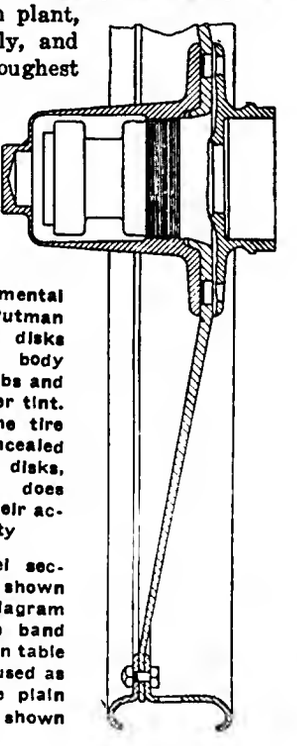
The outer edge of the disk can be riveted to any sort of felloe band to carry any kind of rim, and it is merely clamped between two plates on the hub, dowel pins being provided to take the drive for the rear wheels.

The outer shell of the hub is supposed to be made so that it can be unscrewed readily, and has some simple lock to keep it tight when holding the disk in place, this allowing the whole wheel to be detached as easily as any wire wheel.

The wheels are mounted on the car with the concave side outward, and it is noticeable that they have none of the clumsy look always possessed by disk wheels which stick outward at the center. The actual car has to be seen for it to be possible to realize how utterly different in appearance these wheels really are. Instead of looking heavy their real lightness is apparent at a glance.

It is reported that the Michelin company has lately developed a disk wheel in its French plant, which also uses a single disk only, and that this has proved equal to the roughest work in the war zone. The Putman wheel has been tried out on the roughest roads in Michigan without showing any trace of weakness.

In the experimental car with Putman wheels the disks are painted body color with hubs and rims in darker tint. Note that the tire valves are concealed behind the disks, though this does not hinder their accessibility



In the wheel section the hub shown is only a diagram and a felloe band for demountable rims can be used as easily as the plain clincher rim shown

The FORUM

Wants Greater Economy in Automobile Running Cost

By V. A. N.

IN these days when efficiency and economy are playing such an important role in manufacturing in general, and the automobile industry in particular, it seems to the layman quite incomprehensible that so little attention is being given to efficiency and economy in the finished product.

Efficiency and economy are largely synonymous. When we read descriptions of small bore, long stroke, high efficiency motors we naturally think of economy in operation, and when we read of conveyors shooting the parts around through the factory, each mechanic getting in his whack as the load passes, economy stares us in the face—until we behold the finished product; then what happens?

Consider for a moment in these days of advanced metallurgy, the cost of gasoline, tires, etc., the proposition of using a 2700 to 3000 lb. (or more) machine to haul five passengers over our highways more or less comfortably—adding in not a few instances a V-motor of eight to twelve cylinders to do the hauling. If that isn't a travesty on efficiency, what is it?

Is there any logical reason why we have not in the market to-day a well-made, comfortable, durable, accessible four-cylinder, 112 to 115-in. wheelbase, five-passenger car weighing ready for the road 2000 to 2300 lb. and selling for $1,200 to $1,500?

Franklin builds a real automobile weighing 2,289 lb., which is a delight to drive and ride in. Why is it that we have not the privilege of buying an equally durable and comfortable, efficient four-cylinder car of the water-cooled type?

Efficiency being so desirable in manufacturing, why not turn at least a little of it loose and head it toward the composition of the finished product?

Troubles with Kerosene and Water Cooling

By Harmon J. Kline

APPARENTLY the interest manifested during the past few months in the two-cycle type of motor has died out is so far as the discussion between the engineers is concerned. It seems to me that you were getting at the bottom of things, and if the various parties interested would do a little real work to find out where they stood instead of merely talking about their own inventions in particular, we would obtain some valuable information. The fundamental difficulties with the two-cycle motor have been bared and it needs some argument to disillusion ourselves of the fact that it has not been a very great success in the automobile field.

Any one who has had actual experience with kerosene engines, other than the semi-Diesel, will soon realize that even the best of vaporizers are not the final solution. One does not have to work on pure kerosene but the present motor fuel offers enough problems for the automobile engineer for the next few years.

It is impossible to obtain a fixed gas from kerosene at the temperatures available from the exhaust heat of the internal combustion engine as we know it. We may atomize the fuel and supply sufficient heat to keep it in the vapor form but it is not a fixed gas in that it will condense on coming in contact with a cooler surface. The latent heat of vaporization is about all we can hope to get. If there were more heat, it would merely expand the mixture and help to disassociate the fuel into other constituents, a thing not at all desirable owing to tarry deposits.

The present motor fuel contains from 25 to 40 per cent kerosene and it is this amount that is giving trouble to the man who must make the best of the situation. One does not have to look far to find that a great many motorists are having enough trouble starting and operating their motors in damp or cold weather to even think of using kerosene alone. It often takes some time to warm the motors up to the point where they will operate satisfactorily.

Air Cooling a Suggestion

Perhaps air cooling would make a decided difference, as has been proved in motorcycle practice where the engine is entirely exposed. The amount of metal involved is about equal in both the air- and water-cooled types but the latter has a body of water that must be raised to a temperature below the boiling point and having a specific heat much higher than that of cast iron or aluminum. However, to operate an engine on kerosene or even our low grade fuel, the operating temperatures are far below those at which the maximum efficiency may be obtained. The ultimate power developed, and pre-ignition, are practically the only limiting factors. These may be eliminated by careful design and internal air cooling, while extreme high speed is not desirable in motors where highest economy and durability are the controlling factors.

Present Fuel Troubles

The trouble found at present in the use of our so-called "motor fuel" is before the engine has reached its normal operating temperature. There are many, even dealers in cars, who have found that after 500 or 1000 miles' running they had more "oil" in the base of their engine than was originally put in. Many bearings have been burnt out as a result, and it doesn't seem like good advertising to boast of the mileage obtained per gallon of oil when often the public is paying a big price to do the same thing.

Heavy Fuel Possibilities

It must be evident to many of us that the four-cycle motor is not well suited to use fuels heavier than gasoline or motor fuel, in view of the present difficulties, unless some means are employed other than the kerosene carburetor and vaporizer. Of course, results may be obtained with special equipment in the hands of an expert and apparently satisfactory operation had after the engine warms up, but the rub is to obtain a motor that will give adequate service in the hands of the public. If the man who knows little of these matters is forced or wants to use kerosene in his car, it does not look like good business to sell him something not entirely satisfactory in service.

The matter of temperature control is important, but does not go far enough to give maximum economy and service. I think air cooling, if properly applied, would come closer to the mark than all the devices put on to make a satisfactory water-cooled job, at least in the motor car. I know of at least one prominent manufacturer who has discarded alumi-

num pistons for those of cast iron, mainly to obtain higher operating temperatures. The design of the piston was up to the best practice and long rods are used to reduce side pressure. I know of others who are having some trouble from pistons seizing as the speed is increased, though the clearance is large. Others are troubled with an excess of fuel in the crankcase, blown past the pistons. And yet the operating temperatures are not as high as to give maximum efficiency all the time and in some cases too high to give proper lubrication of pistons and even main bearings, the latter due to extreme speeds.

Invents Device To Keep Dust Out of Cylinders

By Dr. F. Strattner Orem

AS a subscriber I am writing for the information of Chas. E. Duryea relative to his comment on Mr. Schipper's article on U. S. trucks in Mexico, to the need of filters, to prevent dust entering the engine cylinders.

I have invented and have had in use for about 2½ years on a car that has made over 14,000 miles, a device that prevents dust entering the engine cylinders, does not lessen the amount of air the engine requires and does not need to be sent to the wash at all. A whisk broom used on the surface of the filtering material every 10,000 miles is advisable, but not always necessary. In this connection it may be stated that, due to keeping the road dust out of the engine cylinders, carbon deposits are practically nil.

Thinks Car Builders Do Not Provide Against Minor Noises

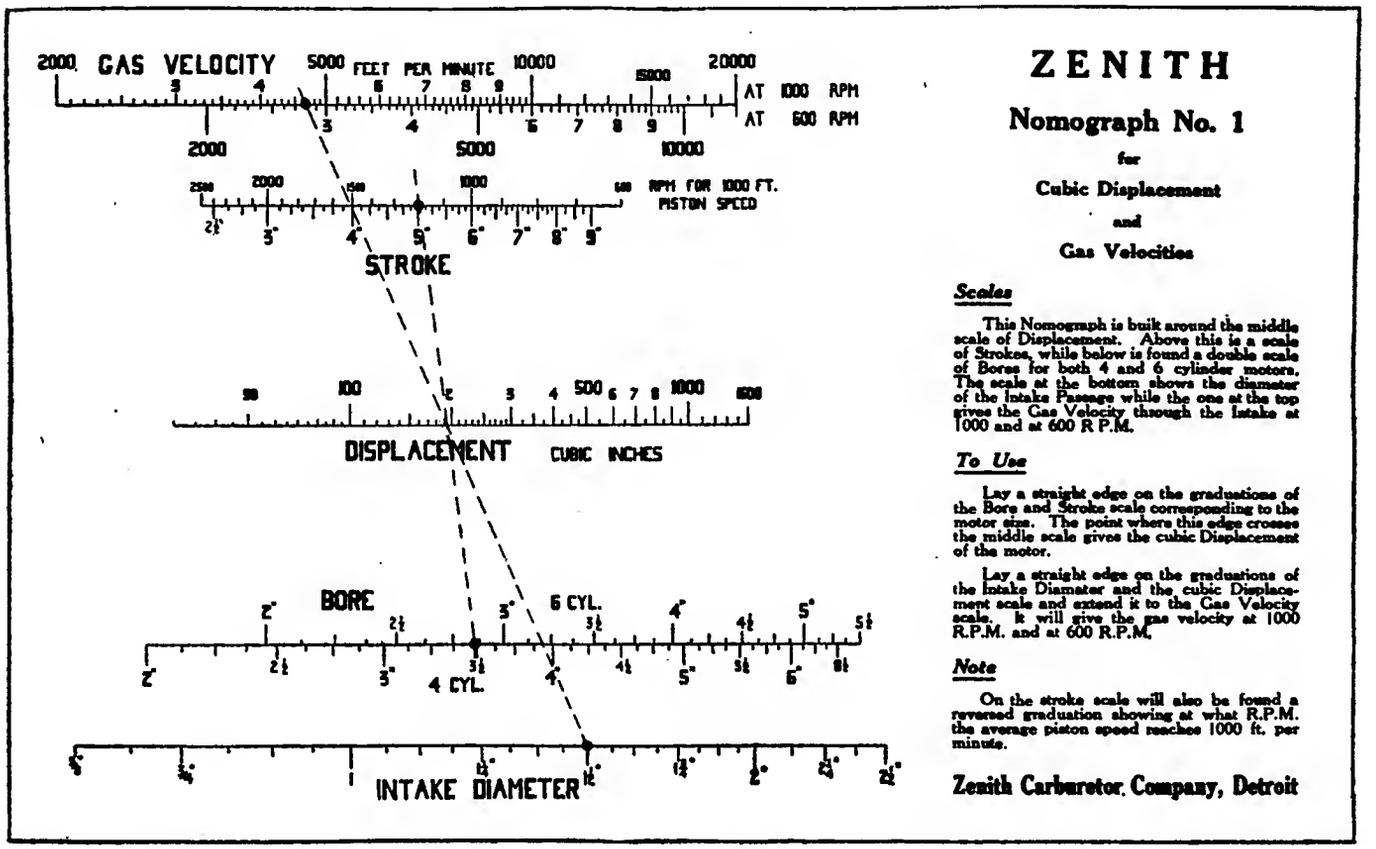
By M. K. Woodford

WHY do car manufacturers neglect to provide against the minor squeaks and rattles which develop after a new car has been run a few hundred miles? Frequently I have seen a beautiful high-priced car swaying gracefully and easily over a rough pavement or road without the slightest sound emanating from the engine or the transmission system, but a succession of viciously disagreeable and annoying squeaks and rattles radiating from almost every other part of its anatomy. These noises were all absolutely unnecessary and simply served to spoil the excellent impression given by the actual performance of the car.

It seems to me that a little attention on the part of the car maker to the sources and causes of these noises would enable him to provide against their development under what might be considered normal service. The most common causes of such noises are poorly mounted or lubricated springs, rattling doors, loosely-fitting floorboards, bad provisions for carrying tools and other loose equipment and defectively attached mud aprons, etc.

Some manufacturers, notably Nordyke & Marmon, have taken up this matter and have endeavored to provide against these noises by special points of design in the car, and other makers would find it to their lasting advantage and to the credit of the reputation of their cars to do something along the same line.

Zenith Nomograph for Displacement and Gas Velocities



The diagram reproduced above has been brought out by the Zenith Carburetor Co., Detroit, Mich., with the idea of rendering it possible to approximate quickly various quantities in connection with the displacement in cu. in., gas velocities of automobile engines, etc. The dotted lines illustrate the working out of these quantities in accordance with the directions given above when the engine under consideration has a 3½-in. bore and a 5-in. stroke, the intake diameter being 1⅛ in.

Running on Town Gas

Shortage of Gasoline Drives Omnibus Proprietors in England To Try Gas as Fuel—Essential Things To Be Observed in Engine Testing—British Patent Covers Device for Pre-Heating Fuel Going to Carbureter

By A. Ludlow Clayden

IN America many manufacturers use either natural gas or town gas for the preliminary testing of their engines, and any good gasoline engine will run well on gas, though it will not give the same power as on gasoline. The *Commercial Motor*, England, in a recent issue describes how a firm owning several omnibuses has tried to substitute gas for liquid fuel in running some local services in a small town in the British Midlands. The experiment appears to have been quite successful and is described as follows:

"Andrew Barton Bros., of Beeston, are as well known to the trade in the Midlands as Daimler or Leyland is to the industry as a whole. They are large garage proprietors, and run several useful omnibus services, besides, in more normal times, pleasure trips on chars-à-bancs.

"Recent troubles over gasoline supplies, and the necessity, for national purposes, of continuing their bus services, which mainly convey munition workers to and from their places of employment, caused the firm to cast about for other means of supplying power.

A Simple Bag Used

"That gas would serve as fuel they well knew. How to store it on the vehicles for use was the problem. At first a collapsible framework with canvas covering, built in the form of a bellows, was tried. Although this served the purpose, it was defective in practical application owing to the area it presented, in all directions, to the wind. The present style of reservoir, a simple bag, was tried with some misgiving, as it was feared that it would have a tendency to roll. As a matter of fact, the 'gasbag' is a most pronounced success. It gives to the wind, presenting a streamline form.

"This gasbag, a simply-made sack of canvas with rubber insertion, rendering it water and gastight, holds 450 cu. ft. It is roped or strapped to the roof of the chars-à-bancs, and is filled by coupling an inlet branch to the gas meter. The same branch serves for attachment of the flexible pipe conveying the gas to the engine. The fuel is conveyed to a point just above the engine throttle. An ordinary cock close to the engine controls the supply, and this is regulated by a lever directly coupled to the throttle-valve lever, so that the gas supply is increased or diminished in accordance with engine speed.

Many Advantages

"The advantages of gas as a fuel, used in this fashion, are many. It is clean; there is no waste by spilling; the shape of the bag gives an immediate indication of the remaining supply of fuel, while also serving as a perpetual check upon the relative efficiencies of different drivers; the engine gives off the same power, and can be made to run more slowly; it starts easier, and requires less lubricating oil owing to the absence of gasoline to wash it away. Moreover, judging by results, the actual engine economy must be considerable to judge by the small volume of gas consumed when the wagon is in the hands of a careful driver.

Short Mileage

"The disadvantage is, of course, the short mileage possible per charge of gas. Actual running costs, considering that of fuel alone, and leaving economies of oil, etc., out of the question, are strongly in favor of this fuel. Arrangements are being made so that the time occupied in filling each of the gasbags shall be 3 min.

"Barton Bros. pay 32 cents per 1000 cu. ft. of gas, being large users for industrial purposes. The mileage per 1000 varies largely with the efficiency per driver, but averages 30, the equivalent of 1 cent per mile. Calculating on a basis of 8 m.p.g. of gasoline—a conservative estimate with much stopping and starting — this means that, to compete, gasoline would have to be obtained at 8 cents per gallon, an impossibility nowadays.

"As concerning the weight of the receptacle, *it floats* when filled, and its cost—Barton Bros., Beeston, England, are arranging to sell them at $75 each."

Testing Scientifically

The Automobile Engineer, England, has devoted much space to tests and testing, and one of the most helpful articles which has appeared in recent years is given in a recent issue. This is written by W. Ferrier Brown and is intended to be a guide to those new to the work of testing gasoline motors. It outlines very clearly what the tester should observe and what he should record.

It is necessary to have some method of preserving and recording data. It need not be any particular system. In fact, an arrangement of one's own invention will probably give best satisfaction, because a system so built up will be perfectly familiar.

With engine test data certain items must be taken by direct test on the bench, or some similar test, and from these known items the others can be deduced. Also certain engine dimensions must be known.

Firstly, there are the data that must be taken from the engine by test. The values are taken at various engine revolutions for each item, and over the total range of the engine speed. These are:

(*a*) Brake-horse-power.

English bus equipped for running on uncompressed town gas

(*b*) Power required to drive engine, *i.e.*, the amount of power lost to friction in the engine.

(*c*) Fuel consumption and specific gravity of the fuel.

(*d*) Oil consumption.

The engine dimensions required are:

(*a*) Bore of cylinder.

(*b*) Stroke.

(*c*) Number of cylinders.

(*d*) Engine weight, complete with flywheel.

Under this heading might also be listed compression ratio.

From the preceding data the following can be calculated:

(*a*) Engine weight per b.h.p.

(*b*) B.H.P. per liter of cylinder capacity.

(*c*) Mechanical efficiency.

(*d*) Indicated thermal efficiency.

(*e*) Brake thermal efficiency.

(*f*) Torque.

(*g*) Mean effective pressure.

To illustrate the article, an engine of the following dimensions will be taken:

Bore, 85 mm.

Stroke, 130 mm.

Number of cylinders, four.

Engine weight, 530 lb.

This engine, then, has a cubic capacity of 2940 c.c.—that is, 2.94 liters. It may be preferable for some to have the engine dimensions in inches and the capacity in cubic inches or pints, but metric measure is easier to handle, especially if the bore and stroke are in metric. That, however, is a detail that can be made to suit.

Referring to Fig. 1, the curves of brake horsepower and friction horsepower are shown taken over a range of from 400 to 2000 r.p.m. The curve of b.h.p. can be taken by friction or water brake, or electric dynamometer, whereas, the curve of friction h.p. must be taken by an electric dynamometer, as the engine has to be driven. The power required to drive the engine is the friction h.p.

By adding the curves of brake horsepower and friction horsepower, the curve

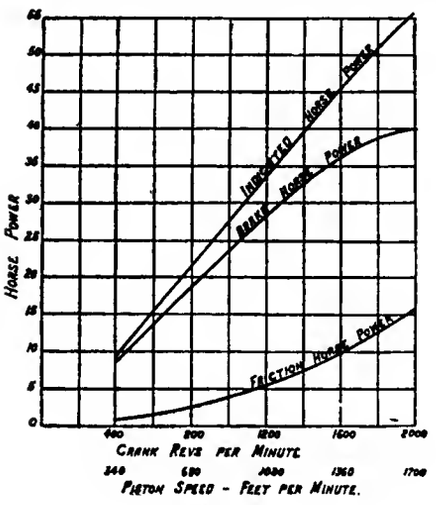


Fig. 1

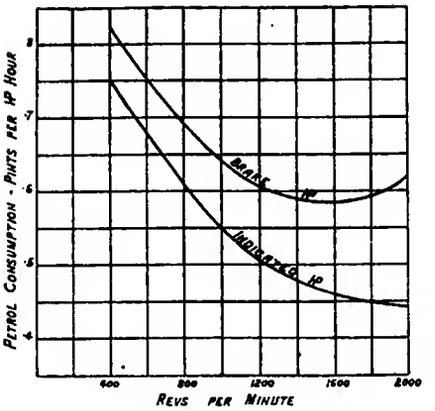


Fig. 2

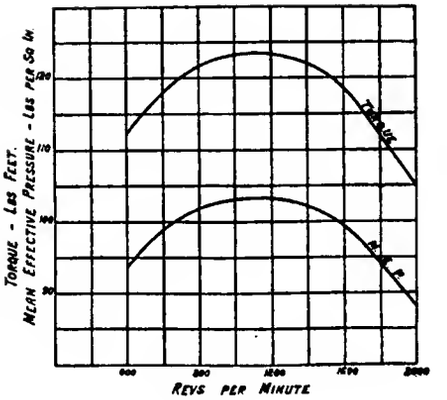


Fig. 3

of indicated horsepower can be constructed. The i.h.p. curve for the engine under consideration is shown in Fig. 1. This curve gives the amount of work performed in the engine cylinder. The curve of i.h.p. could also be constructed from an indicator diagram, but this method has not yet become anything like universal among manufacturers. These curves are plotted on a base of crank angles generally, but, as in this diagram, a second abscissa is given, namely, piston speed. This is a useful item to know, and, of course, varies directly as the engine revolutions.

The curves of fuel consumption (Fig. 2) are of first-rate importance, especially to the car user, because a low consumption means lower running costs. The two curves show the consumption in pints per b.h.p. hour and per i.h.p. hour respectively. As with the curve of b.h.p., the consumption must be taken by test at various engine speeds.

It may seem inconsistent to introduce pints or pounds when talking of fuel consumption after using metric measure for engine dimensions, yet it is customary, and one generally thinks of the values of various items in certain units and needs must have the values in those units to weigh up the relative performances and pronounce a judgment.

Fig. 3 shows curves of mean effective pressure (m.e.p.) in pounds per square inch of piston area, and torque, available at the crankshaft, in pounds at one foot radius. These items are functions of the b.h.p., and could be represented by one curve with two sets of values for m.e.p. and torque respectively.

The calculation is as follows:

(*a*) Mean Effective Pressure.

Let p = M.E.P. in lb. per sq. in.

$$p = \frac{\text{B.H.P.} \times 8262 \times 10^4}{\text{S}r k \text{D}^3}$$

where B.H.P. = Brake horsepower.

S = Stroke of engine in mm.

D = Diameter of cylinders in mm.

k = Total number of working strokes per revolution of the crankshaft.

r = Engine revolutions per minute.

(*b*) Torque.

Let T = Torque in lb. at one foot radius.

$$= \frac{\text{B.H.P.}}{r} \times 5252$$

In the foregoing formulæ the constants have been worked out to simplify the calculation.

Interesting and important are the curves of efficiencies as shown in Fig. 4. Four curves are given, viz., mechanical efficiency, brake thermal efficiency, indicated thermal efficiency, and available efficiency (as compared with the air standard).

Mechanical efficiency gives the percentage of useful work done at the crankshaft, that is, the b.h.p. as a percentage of the i.h.p. Thermal efficiency gives the useful work done, as a percentage of the total heat energy of the fuel.

One horsepower expressed in heat units is equal to 2545 British thermal units. Knowing the fuel consumption of the engine we can at once calculate the brake thermal efficiency. For general calculation, the heat value of one pound of gasoline of 0.720 specific gravity may be taken as 19,000 B.Th. units, unless, of course, specific values are stated. This will give 17,100 B.Th. units per pint.

Similarly, the curve of indicated thermal efficiency can be constructed, basing the calculation on the fuel per indicated horsepower.

In 1903 the Institution of Civil Engineers formed a committee to settle a basis of comparison for internal combustion engines. This committee recommended what is known as the "Air Standard Efficiency." The "air standard" gives the theoretical maximum thermal efficiency for internal combustion engines working on the four-stroke cycle.

Values are obtained from the formulæ:

$$\text{A.S. efficiency} = 1 - \left(\frac{\text{I}}{r}\right)^{0.4}$$

Where r = compression ratio.

$$= \frac{\text{Y} + v}{v}$$

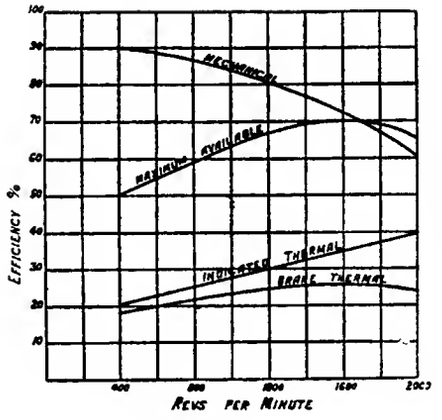


Fig. 4

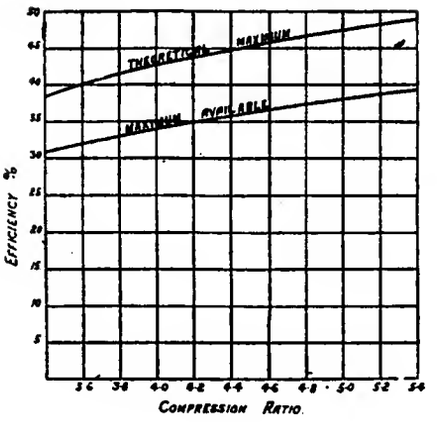


Fig. 5

V = volume swept by piston.

v = volume of compression space.

The "Air Standard" gives a very high value, so Dugald Clerk in "The Gas Engine" gives the "maximum available efficiency" as 0.8 of the air standard.

Fig. 5 shows the relative values of the "air standard" and the "maximum available" efficiencies as a percentage of the total heat energy of the fuel consumed.

An Efficiency Curve

Returning to Fig. 4, a curve of available efficiency is there shown. This curve is the brake thermal efficiency taken as a percentage of the maximum available efficiency as given in Fig. 5. This curve shows the engine performance in rather a better light, and gives a better idea of the engine efficiency.

The remaining items to be considered are shown in Fig. 6. These are b.h.p. per liter of swept volume, and engine weight in lb. per b.h.p. The curve of b.h.p. per liter is a function of the b.h.p., and is constructed by dividing the b.h.p. by the total swept volume of the engine in liters for various speeds throughout the range of the engine. Similarly, the weight per b.h.p. is constructed by dividing the weight of the engine by the b.h.p. developed. Both these curves are useful as a basis of comparison between engines.

Mention might also be made of oil consumption and compression pressure. Oil consumption is not so readily measured, as it requires rather a long period really to determine this factor, so that in general it is given a constant value, and averages approximately one-tenth of the fuel consumption, viz., .05 to .08 pint per b.h.p.-hour. In vehicle work the oil consumption is generally given as so many miles per gallon.

Compression pressure can be taken by gage while the engine is running, and the curve constructed from the values. This curve will give the maximum compression pressure at the various speeds. It is more general, however, to quote the compression ratio, that is $\frac{V+v}{v}$, as previously referred to. This ratio varies over a range of from 4 to nearly 6. The engines of racing cars approach the higher value. A compression ratio of 4 will give a pressure of 70 lb. per sq. in., and a ratio of 5 about 100 lb. per sq. in. Compression falls off at high speeds, due largely to wire drawing and heating of the inlet gases. The best value for good volumetric efficiency seems to be somewhere about 120 ft. to 130 ft. per second past the valve for inlet.

Having now completed the list of data required for an engine test record, the information to be gleaned from the various curves will be briefly considered.

The curve of b.h.p., Fig. 1, generally takes the form as shown, but in some cases the straight part continues to high speeds, whereas in others the curve falls away rapidly after about 1200 revolutions. The differences are due to small or tortuous gas passages retarding the flow of the gases, so that the cylinders are not being so well filled, and to the relatively larger proportion of heat lost to cooling and radiation at the lower engine speeds. The reciprocating weight also affects the power and speed. These differences are clearly shown in Fig. 7, where are plotted comparative curves taken from a heavy vehicle engine, a good car engine, and a racing type of engine, all of approximately the same cubic capacity. In the racing engine, the gas passages are liberal, consistent with the speed at which the engine is designed to run, and the moving weights are reduced to a minimum.

Torque and M. E. P.

Mean effective pressure and torque, Fig. 3, can be treated together, being similar functions of the b.h.p. The curves as shown are characteristic of average engines, varying in value and the amount of falling off at low and high speeds. As with b.h.p., the falling away at low speed can be accounted for by the larger proportion of heat passing to the cooling water; also to poor mixture with regard to quality and quantity. At the highest speeds the proportion of heat lost to cooling is relatively smaller, but the volume of gas entering the cylinder is reduced, as previously explained, hence the falling off. By way of example, suppose there are two engines of the same cubic capacity, one with twelve cylinders and the other with four. The torque curve for the twelve-cylinder engine would, in all probability, show a lower value at low speeds, due to the heat lost to cooling by the relatively greater cylinder surface for the volume. This lower torque would, of course, mean less h.p. at these speeds. The torque curve also gives the critical speed of the engine—that is, the point at which maximum power is developed relative to the engine r.p.m.

The curves of efficiency, Fig. 4, tell a similar story, and, in addition, the brake thermal efficiency curve gives the best engine speed for maximum thermal efficiency. In the case under consideration the best efficiency is at 1600 revolutions. In other words, the most economical speed with regard to petrol consumption is at this speed, as shown in Fig. 2.

Mechanical Efficiency

Friction hp., Fig. 1, and mechanical efficiency, Fig. 4, can be treated together, as the one is directly related to the other. The mechanical efficiency shows the influence of reciprocating weights and engine friction at a glance, and makes a strong plea for the reduction of these factors. An average value for mechanical efficiency may be taken roundly at 80 per cent, although in some cases 90 per cent has been reached.

The curves of b.hp. per liter and engine weight per b.hp., Fig. 6, give comparative values between engines for these factors. Average values of b.hp. per liter at normal engine revolutions may be taken at 8 for commercial vehicle engines, 12 for touring car engines, 10 to 15 for aeroplane engines (according to the engine being of the direct drive or two-to-one reduction design), and as high as 30 for racing engines. The engine weight per hp. may be taken approximately at 20 lb. for commercial vehicles, 15 for touring car engines, 5 for aero engines, and somewhere about 8 for racing engines.

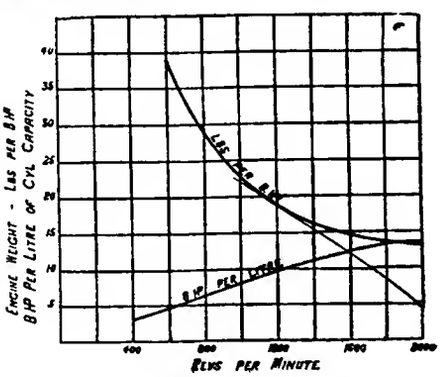


Fig. 6

With reference to the hp. curve, mention might be made that the position of the sparking plug has considerable effect on the power developed. Fig. 8 shows such a test result taken from an old type T-headed poppet valve engine. The sparking plug was normally situated over the inlet valve, when the power developed was as shown by the lower curve. By putting the sparking plug in the center of the combustion chamber the very substantial increase of power, as shown by the upper curve, was the result.

Present-day engines of the sleeve valve type and the overhead valve type naturally embody this feature in the design, and this probably accounts to some extent for the comparatively better power results given by such engines. Two sparking plugs per cylinder seem to have a similar effect.

Not Highly Accurate

In conclusion, the author would like it to be understood that the foregoing notes are not to be taken in the light of scientific experiment or investigation demanding a very high degree of accuracy in all results, and which, incidentally, would absorb much time. The aim is to make known the uses of such data as can be obtained in the routine work of engine testing, such as is done in the usual course of manufacture.

With Special Engines

Extraordinary results can be obtained with specially made engines, and it is up to manufacturers to incorporate these improvements as far as is practicable. But there are often parts in those special engines that are almost impossible from a commercial manufacturing point of view, or of so drastic a nature that the change would mean a big effort financially, and probably running the gauntlet with regard to popularity.

Test records made in the course of manufacturing have a most significant value, and may be of even greater value at the moment than what might be termed highly scientific research, because of the fact that these are the records of a commercial product. The higher researches get their reward in course of time, as improvements in design and efficiency become part of the manufactured article, and are as a guiding star to the industry.

General Charts of Value

In addition to the records of individual engines, general charts for each item and type of engine should be constructed. These general charts would all be plotted at the normal engine speed, or for similar engines at some predetermined speed, and would show at once the value of new experimental design and the general progress made.

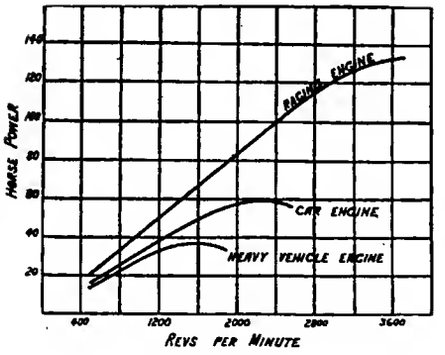


Fig. 7

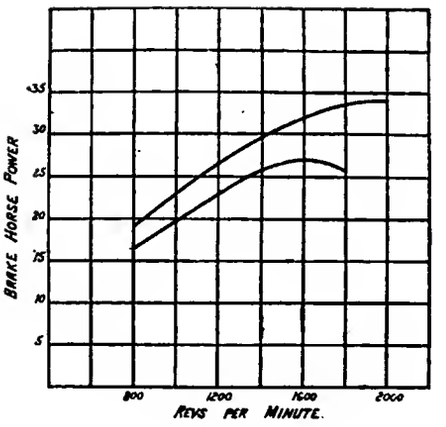


Fig. 8

Tanks—A British Account

IN its issue dated Sept. 22 *The Auto*, England, prints the following editorial, which is interesting, as it gives some of the history relating to the creation of the tanks, or super-armored cars, though it gives us no more than we have already had regarding the size or detail of these impressive machines. The British automobile press is, as a whole, so very reticent in mentioning the tanks that it is obvious no information is going to be available for some time to come. There seems, however, no doubt but that they are about the largest caterpillars ever built, and that they embody many ideas from both sides of the Atlantic. The editorial in *The Auto* says:

"At last the armored car appears to have really come into its own. No one who read Sir Douglas Haig's dispatch and the graphic accounts sent by the correspondents at the front relating to the work of the 'tanks' during the last great advance could have any doubt as to that. It would be going too far to say at this juncture that armored cars are destined to exercise a decisive effect on the fortunes of the war, but that they are likely to prove of superlative value there can be no room for doubt.

A New Weapon

"It is impossible for us at the moment to trace the full history of British armored cars in the present war. Not the least interesting of the post-war stories, however, will be that of the inside history of this new arm of the service—and written it will be when the time comes.

"The outbreak of the war found us without anything in the shape of a fighting car. In that we were not singular. As a matter of fact, we believe that the Germans were the only power possessing such vehicles. True, there were fighting cars of a kind, but these were anti-aircraft cars pure and simple, and thus did not fall within the category of armored cars as we now understand them. Even of these we ourselves possessed none.

"It was the navy which was responsible for their introduction to our own service. In the very early days of the war naval aeroplane squadrons were sent over to operate from Dunkirk and Ostend, and with them went certain improvised armored cars, which were constituted into a small force known as 'Aeroplane Support.' Considering their limitations of construction and armament, these cars did remarkably well, but it was seen that the type was quite unsuitable for the purposes of the fighting as it developed after the first 2 months of war. Then was evolved the real armored car as we knew it when it was working under the R.N.A.S., completely armored, with a revolving turret and armed with one or more machine guns. The navy was fortunate at that time in having at its head a first lord with imagination. It is not too much to say that had Mr. Churchill not been at the Admiralty when he was, there is a strong probability that armored cars and 'tanks' would not have come into being until long after they did. Clearly, armored cars are a part of the land service and, *per se*, had nothing to do with the navy. Still it was left to the navy to develop the arm, and Commodore Sueter, who was then at the head of the air department, threw himself into the job with the same enthusiasm with which he had pioneered the submarine and the aeroplane. The result was the R.N. Armored Car Division, which under Commodore Boothby and his officers became a highly disciplined and efficient force. Its units served and did well wherever there was fighting to be done. In France, Gallipoli, Egypt, Southwest Africa and East Africa, and even now in Russia, the naval cars and their personnel have rendered good service.

Evolving the Tanks

"All this time experimental work on a new and better type of heavy vehicle, more suitable for trench warfare, was being carried on, and when, from motives of policy, the army took over the cars from the R.N.A.S. rather more than a year ago, these experiments had practically resulted in evolving the design of the vehicle which has just proved such a surprise to the Germans."

Collier Is Rugged Light Truck

A Real Truck Design for Light Loads—Runs on Pneumatic Tires

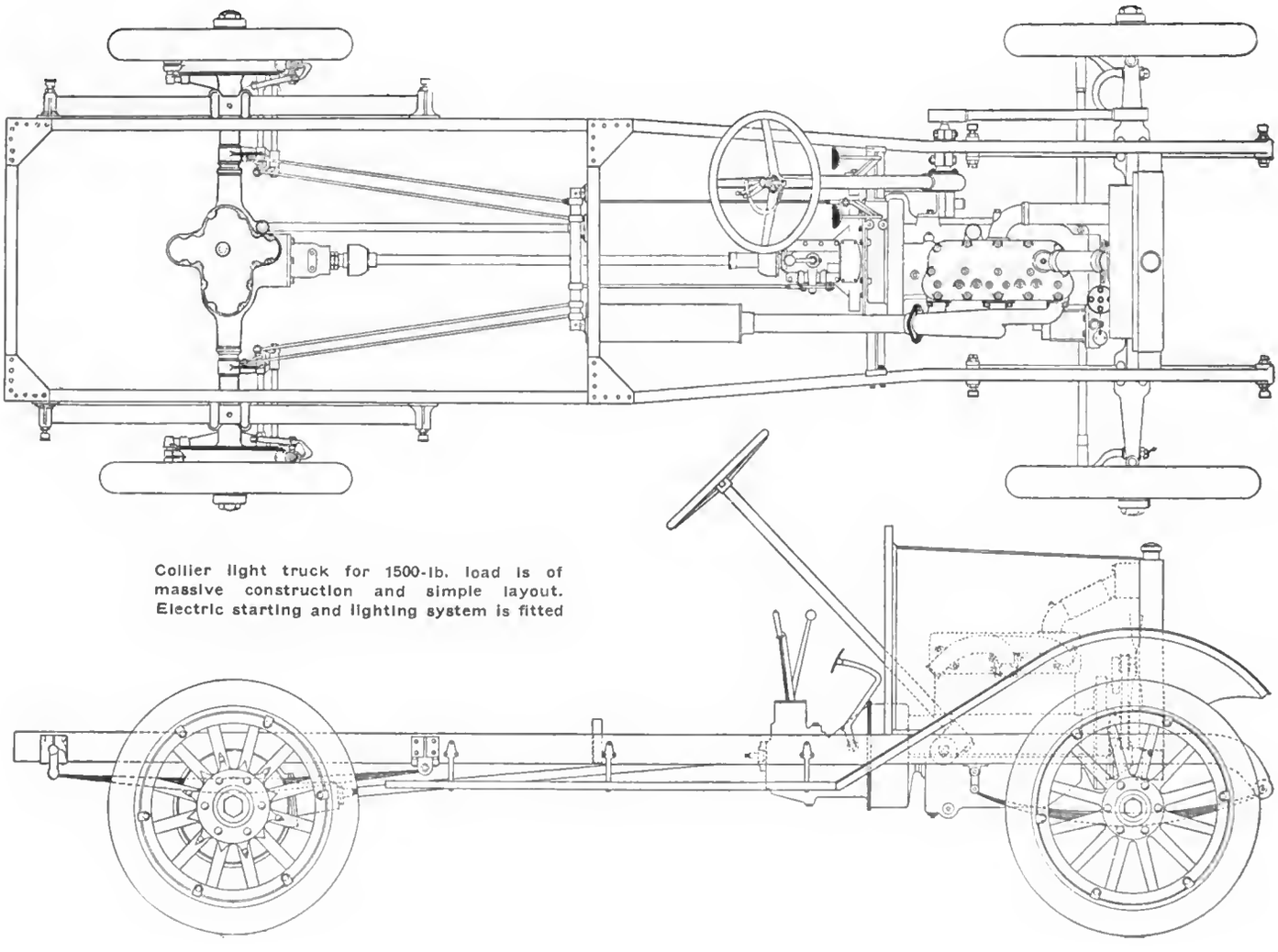
THERE are not very many 1500-lb. trucks that are really built for the job and are something more than extra strong passenger cars. One of the select few is the Collier, built by the Collier Motor Truck Co., Painsville, Ohio. This has a special Lycoming engine with four cylinders 3¼ by 5 in. with detachable head, making for easy carbon removal. The crankshaft has two bearings and is 2¼ in. in diameter; the valves are 1⅛ in. with ¼-in. lift and are operated by mushroom type cam followers. A somewhat unusual feature for a truck is the provision for an electrical starting and lighting system, this being a two-unit Dyneto outfit. The flywheel is recessed, and has a steel ring gear attached to is so as to guard against any risk of the teeth chipping. Lubrication is cared for by a gear pump and cooling is thermo-syphon, there being a 16-in. fan mounted on annular ball bearings. Either a Carter or a Zenith carbureter is fitted.

The clutch is a dry disk and the gearset gives three speeds, the transmission being in unit with the engine. All bearings, including the spigot bearing in the flywheel, are annular type ball, and the shafts are nickel steel. The rear axle ratio is 6 to 1, this being the high gear, and the low and intermediate gears give 18 and 10 to 1 respectively. The reverse is extra low for maximum leverage, being 24 to 1.

For the final drive a straight bevel is employed, this being easily accommodated of robust proportions with so high a ratio as 6 to 1. The axle is three-quarter floating, and a special point is made of mounting the spring tables very close to the wheels, so as to eliminate bending stresses on the ends of the axle sleeves as much as possible. Both brakes are on the rear axle, the foot brake being the external member of the pair. There are two universals designed to hold a large amount of oil and to require only occasional attention.

For the frame channel steel of a heavy section, 4 by 1½ by ¼ in. is used; very heavy spring hangers are used and these are held in place with an extra large number of rivets. On the springs the main leaves are made from silico-manganese steel to guard against breakage near the eyes, the other plates being heat treated carbon steel of the best grade.

Despite its robust construction the total weight is not excessive, so the tires used are 33 by 4 in pneumatic, on demountable rims. Crowned fenders are supplied of 20 gage steel, and there are running boards of heavy ash. Ash is also used for the body which is finished in vermillion and is 6 ft., 6 in. long, measuring from the back of the driver's seat to the tailboard.



Collier light truck for 1500-lb. load is of massive construction and simple layout. Electric starting and lighting system is fitted

The Rostrum

Overheating Causes Knock on Hills

EDITOR THE AUTOMOBILE:—I have a Buick C-25 driven about 10,000 miles which develops a knock on the hills and lack of power. Retarding the spark relieves the condition for several hundred feet when the knock is again apparent and engine has no power. Shifting into intermediate does not overcome the knock until the engine is running about the maximum speed on this gear. This trouble arises on grades that a 25-hp. engine should make with ease on direct drive. The knock is not so noticeable after having carbon burnt out but after running less than 100 miles it is as bad as ever. I have changed the firing point to at least six different positions, both retarding and advancing, but always return to the one setting which I find operates best. I have equipped the car with a Schebler carbureter and have tried various mixtures but, as with the spark, I find one setting is more satisfactory than others, neither spark nor mixture experiments relieving the trouble in question.

It has been suggested that I place shims under the cylinders, raising them anywhere from a 30 sec. to 1/16 of an inch, but as this would increase the combustion chamber I believe such action would make conditions worse. Being familiar with gas engine principles, what would your opinion be on this?

In view of the fact that all other units are apparently in perfect condition, also that compression is good, fat spark at each plug, connecting-rod and main bearings all tight, I would appreciate your views as to what causes this and also what action would be necessary to overcome the trouble.

The knock is a typical carbon clink, but the burning out of all carbon only partially overcomes the defect and it is only a question of 50 or 100 miles and the trouble is as bad as ever.

Norwood, Ohio. C. K.

—It appears that your trouble is probably due to overheating. Two possible things might cause this, one that the pump is not operating properly. Sometimes the pin holding the impellor of the pump shaft shears off and then the water circulation will be greatly restricted. This will heat up the water in the engine but it will not necessarily cause steam to be produced.

Another thing which sometimes happens is that the rubber hose connections give way internally and almost close up the hole with a spongy mass of rubber and cotton. It cannot be that the compression is wrong since these cars were designed to have quite a normal compression.

Knock Probably in Oldham Coupling

Editor THE AUTOMOBILE:—I have a Buick M 10 which has a peculiar knocking in the transmission. In letting the car run slowly on smooth road it sounds like a crooked shaft wabbling. In running fast on smooth roads it is a knock, in climbing hills it is a sort of pounding, on low gear or reverse this is not heard at all. I have put a new front transmission bearing and tightened the back one but this makes no difference. When the car is standing and the motor not running, by taking hold of high speed lever and sliding forward gently the transmission as far back as reverse seems to slide ahead about ¼ in. but reverse does not move. I also notice that the transmission shaft works back and forth and has worn a notch into the front bearing hanger about ⅛-in. deep. I took the bearing out and turned the hanger around and it has worn the other side of the hanger the same way. This has been bothering me for some time.

I have been to two of the best garages around and one says the large brass bushing in transmission is worn; the other says that the high speed yoke is out of adjustment. Can you tell me what it is?

Ceres, N. Y. H. A. L.

—From your brief description we believe the noise is caused by the knock of the Oldham coupling at the front end of the transmission, inasmuch as the car has been driven probably at least 5 years and the coupling is badly worn.

With reference to the transmission sliding forward ¼-in. this is no doubt caused by the thrust washers being badly worn and in need of replacement. This could be greatly improved by taking up on the adjusting screw located on the rear end of the transmission driveshaft. We would suggest that the transmission be given general overhauling as the end play is probably the direct cause of the excessive wear on the front bearing hanger.

Ford Accepts Only Unemployed

Editor THE AUTOMOBILE:—Could you tell me how the Ford Motor Co. employs help? What wages and what hours and if one is obliged to be a citizen of Detroit any certain length of time?

Edmeton, N. Y. L. C. H.

—The Ford Motor Co. employs only people who are out of work, who have been residents of Detroit from 3 to 6 months and who make application in writing to H. Sommers, superintendent of employment. Wages after a probationary 6 months are $5 a day as a minimum basis. Working days are 8 hr.

Climatic Conditions Affect Carbureter

Editor THE AUTOMOBILE:—Is there a Singer agency in Boston, and if so, what is its address?

2—How is Moto-Meter pronounced?

3—Are gearless differentials good? Why is it that automobile manufacturers do not use them?

4—Are not carbureters affected by climatic conditions? How are they adjusted?

5—I have a Chalmers which needs repainting and has a few bumps in the fenders? The tire average is about 1800 miles. The engine could have more compression and the battery is a year old. Otherwise it is in good mechanical order as far as I know. About how much could we expect if we turned this car in?

Cambridge, Mass. A. McM.

—There is no Singer agency in Boston.

2—As two words. Notice the spelling which is the style adopted by the company.

3—Many manufacturers next year will be using differentials other than the ordinary kind.

4—Heat, cold and variations in humidity will affect the

carbureter. The necessary adjustments to changes in climate depend entirely upon the design of the particular instrument.

5—Used cars are not at present selling for very good prices. It would not be possible to give you an estimate as to the value of your car. Even after an expert examination it would be almost impossible to say if your car was worth exactly so much.

Cannot Take Hills on High

Editor THE AUTOMOBILE:—I have a Warren-Detroit which has a 4⅛ by 4½-in. bore and stroke. The timing was scaled on rod through head. Exhaust valve opens 1 7/16 before bottom center and above 3/16 in. past top center. Intake starts to open as exhaust closes and is fully open when exhaust valve is seated. Intake is closed 1/16 past bottom center. Is this correct? Car will easily make 50 to 55 m.p.h. on level, has good compression, good spark, but will not take the hills on high as it should. The car rolls very easily by turning the propeller shaft with my hands. Can you suggest anything that will liven it up?

Bondsville, Mass. F. L. W.

—Your car cannot be expected to take hills on high in the way that a modern machine will do. Possibly the reason is that you have an extra high gear ratio in the rear axle which would make the speed, but would not permit good high gear performance on hills.

It is unlikely that the timing is wrong since the particulars you give would suit good pulling at low speed better than they would suit high speed. You might try the effect of changing one tooth and make the inlet valve close that much later.

Definition of a High-Speed Engine

Editor THE AUTOMOBILE:—What speed does a motor have to make to be classed as a high-speed motor?

2—What is the maximum speed of the Ford motor and the block r.p.m.?

3—What is the meaning of backfire?

4—What is the fastest mile to date made by a motorcycle, what machine and who holds the record?

Harpersville, N. Y. C. W. B.

—A piston speed much in excess of 1000 ft. per minute causes an engine to be rated as a high-speed one.

2—The Ford engine has a normal speed of about 1000 r.p.m. which is what you probably mean by the block revolutions. If allowed to race it might reach 3000 r.p.m. for a short time.

3—When the explosion takes place too early while the piston is coming up on the compression stroke it will reverse the direction of rotation, blowing the piston back again. This is called the backfire. The same word is often used to describe explosions in the muffler caused by an unfired charge being passed through the valve and down the exhaust line where it is fired by the next exhaust. This is not really a backfire.

4—The fastest mile in a motorcycle was made by Humiston in an Excelsior at Los Angeles, Cal., in 36 sec.

Speeding Up a 1908 Ford

Editor THE AUTOMOBILE:—I have a 1908 or 1909 Ford which has circulating pump that I would like to build over into a speedster. Would like your advice regarding changes to be made to give best results. Would rather increase the speed of the motor than make the gear ratio more than 3 to 1.

Genoa, Ohio. G. L. B.

—You would probably get the most satisfactory results by changing the gear ratio. There are several firms who make special gears which will fit the Ford axle and you could get what you want from one or another of them. To get speed from the engine you should see that the crankshaft and connecting-rod bearings are particularly well fitted, that the valves have not been so much ground that they are beginning to sink into the cylinders and of course that the ignition and carbureter are working as they should. It is sometimes possible to gain speed by shortening the intake manifold and raising the carbureter although you will have to rearrange the fuel feed to allow you to do this. You can also obtain sets of aluminum alloy pistons ready to fit to a Ford engine and these will give you many more revolutions without overstraining the crankshaft.

Wiring Diagram of Maxwell 25

Editor THE AUTOMOBILE:—Kindly publish diagram of electric lighting, starting and ignition system of Maxwell 25.

Hamburg, Pa. C. E. K.

—Diagram of the Maxwell electrical system appears in Fig. 1.

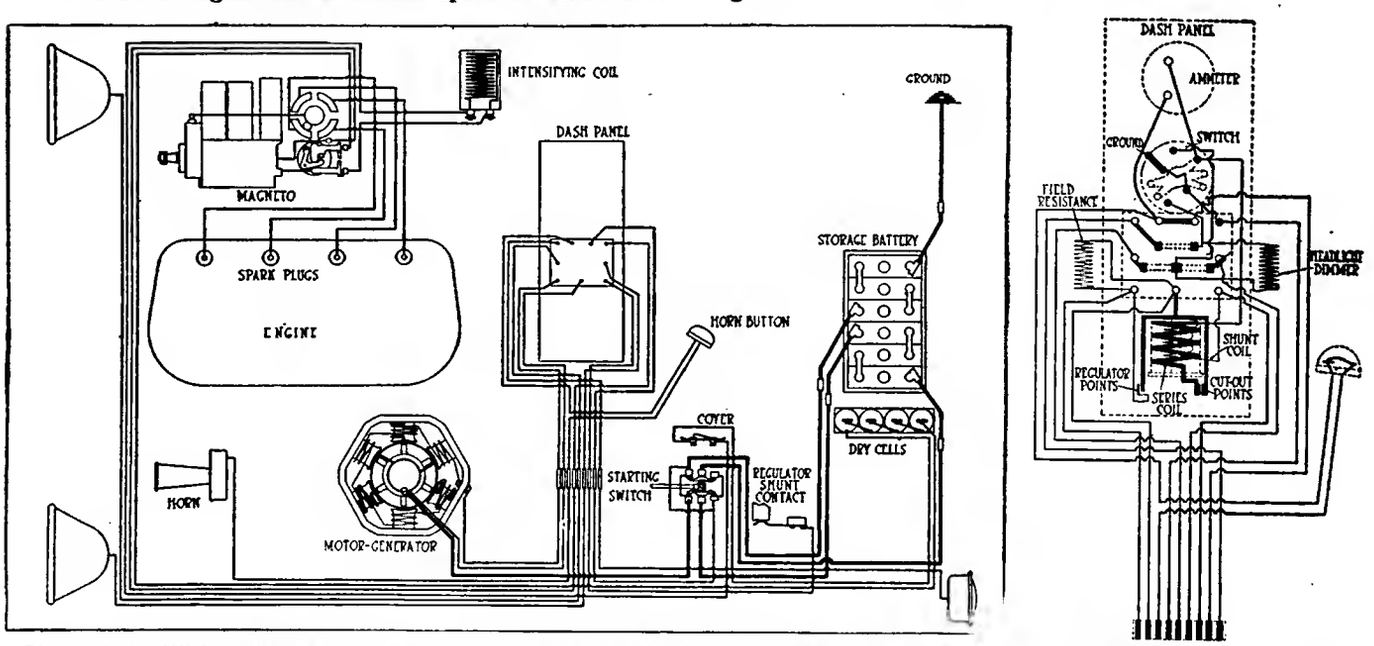


Fig. 1—Left—Wiring diagram of electric starting, lighting and ignition system of Maxwell 25. Right—Detail view of dash panel connections, showing shunt and series coils, field resistance, headlight dimmer, switch wiring, etc.

1000-Lb. Denmo Has Electric System

Deliveries on New Model To Start Dec. 15—Production Plans Laid for 5000 —Price To Be Under $800

BESIDES its 1¼-ton truck brought out a month or more ago the Denneen Motor Co. is bringing out a 1000-lb. wagon on which deliveries will start Dec. 15. It is planned to build this light vehicle in quantities of 5000 for the coming fiscal year and to sell it somewhere between $750 and $800.

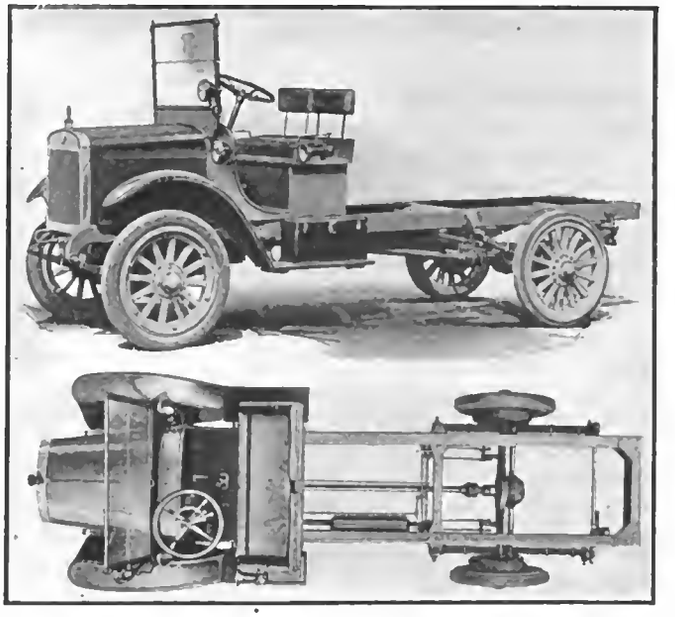
Like the larger vehicle, this 1000-pounder will be regularly equipped with an electric starting and lighting system, windshield, Boyce Motor-Meter. The standard Splitdorf generator and starter motor are used, the generator being so set as to cut in at approximately 5½ m.p.h. and to reach its maximum charging rate of 12 to 14 amp. at 11 m.p.h. This is the same as on the larger model. F. S. Denneen, president and designer, says that in the 1¼-ton capacity experimental truck the battery did not require recharging in a year of testing and general use. He calculates that in ordinary use the engine will run considerably more than the vehicle and so the possibilities of sufficient recharging are quite sufficient for battery needs.

In adding a complete electric lighting and starting system for light-capacity vehicles of this kind Engineer Denneen believes it possible to secure a better type of driver and also to economize quite materially in fuel consumption per year. The Gould battery is protected against jar by a spring mounting of the crate, which has worked out very successfully.

The use of pneumatic tires on the front wheels of the larger truck and on all four wheels of the 1000-lb. vehicle is in keeping with Denneen's plans to conserve the motor as much as possible and also make the truck easier to operate. When you start with electric starting and lighting, and add to this pneumatic tires and windshield you are giving the truck driver most factors necessary to conserve his energies, and if the conserving of driver's energies results in greater care for the truck and its machinery, then all of these parts should work for greater economy in the long run.

Both Denmo models are assembled jobs, the work of assembly being carried on in the Denneen Cleveland factory where 125,000 sq. ft. of floorspace is available and where the present capacity is ten trucks per week.

The units used in the 1½-tonner include Wisconsin 3¾ by 5-in. four-cylinder motor, Grant-Lees three-speed gearset, Torbensen front and rear axles, Ersac propeller shaft and universals, Fedders radiator mounted on a special spring-supported frame cross member, Pierce engine governor which governs according to the speed of the vehicle and not by the speed of the engine, Cooper springs, Borg & Beck dry-plate clutch, and 34 by 4½-in. pneumatics in front and 34 by 4-in. solids in rear. To these are added the Splitdorf electric starting and lighting outfits and Dixie magneto for ignition. The vehicle sells for $1,385.



Chassis of Denmo 1¼-ton, showing internal gear rear axle

Unit power plant construction is employed, the Wisconsin engine being incorporated with the clutch and gearbox.

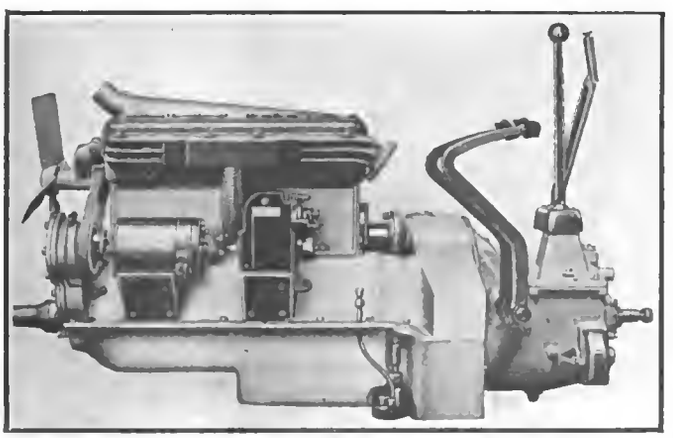
Thermo-syphon water circulation cools the engine, the radiator being of the Fedders cellular type, incased in sheet metal and mounted on a steel cradle, spring-mounted. This cradle extends across the bottom of the radiator so that there is no tendency for it to sag, the springs being flat ones, looped forward.

Gravity gasoline feed supplies the Stewart carbureter, and a short connection from a stove on the exhaust header furnishes hot air. The carbureter is mounted high enough to secure a short passage to the valves. The Pierce governor, driven by flexible shaft from behind the gearbox instead of from the motor, this drive limiting the truck speed only and having no effect on the motor otherwise. Thus the full power of the motor is available on the lower gears.

In the lubrication system of this motor pure pressure lubrication is used, a gear pump forcing the oil from the reservoir to the helical timing gears and over the bearings.

Driving the three-speed selective gearset is a Borg & Beck dry-plate clutch, from which the drive is taken on an approximately straight line, thanks to the tilting of the motor, to the Torbensen internal-gear-driven rear axle. Brakes on this axle are external and internal, the latter being foot-operated and the latter actuated by the hand lever.

The Hotchkiss drive principle is followed, the master leaves of the rear springs being made of vanadium steel for this purpose, the other leaves being of carbon steel, heat-treated. The radiator is carried well forward of the axle to shorten the wheelbase and still allow a generous length of load platform.



Unit power plant used on 1¼-ton Denmo, showing electric units

ACCESSORIES

Lexington Safety Signal

TWO circular 8-in. casings containing indicator dials and the necessary mechanism are the salient points in this signal. One of these casings is mounted at the front and one at the rear of the car, the front one having a small window for the observation of the driver, showing the working of the indicator and lamps. A black arrow on the white background of the casing points the direction the driver intends to take, and at night or in bad weather the arrow signal works in connection with the lights. There is a stop signal in the rear attached to the casing, consisting of a white hand with the word "Stop" in white letters. When working it is thrown into a horizontal position, with a red light directly over the word "Stop."

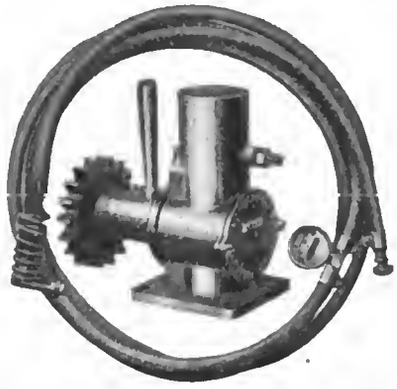
A 3½-in. three-way switch in a brass casing is clamped to the steering column under the wheel and operates the signals by four pushbuttons. The top button works the arrows to the right or left, and also the lights when the current is on. Another pushbutton on the top throws the current for the lights off and on, while the pushbutton underneath works the "Stop" signal. Another button on the end works the horn. The main feed wire is run to each indicator and to the switch on the steering column and then to the battery, return wires being properly connected. All wiring is run through conduits, preventing interference in any way with other parts of the car.—Lexington Signal Co., Lexington, Ky.

Tar Remover

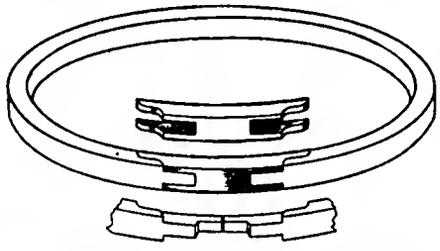
Asphalt or tar if allowed to remain on the car will discolor the varnish and destroy the finish. The directions for use of this tar and oil remover are as follows: After washing the car with soap and water and removing all grit, saturate a piece of cotton waste with the liquid and apply it to the damaged surface. Allow it to stand for a few minutes, and then rub thoroughly with the same piece of waste. Price, per pint, 50 cents; per quart, $1.—Cooper & Osterhout, Watertown, N. Y.

Union Piston Ring

Union rings are especially adapted to the small-bore, long-stroke engine in which good compression is essential to the high speeds necessary. The illustration shows the method of preventing leakage at the joint, the broad surface of the ring coming into direct contact with the cylinder walls and the blades fitting into the piston grooves being protected from breakage, the idea being to provide a perfect metal packing. Union rings are made from individual gray-iron castings, and the scale of the casting is retained in the ring to give maximum resiliency. The rings are ground to exact measurements after the union is inserted to insure a perfect fit. Rings of 2½-in. diameter and under sell for $1; 2½ to 3½, for $1.25; 3½ to 4½, for $1.50; 4½ to 5½, for $1.75, and 5½ to 6½ in. for $2.—Union Products Co., Rockford, Ill.



Rex valveless power tire pump, with hose



Union piston ring, showing the union

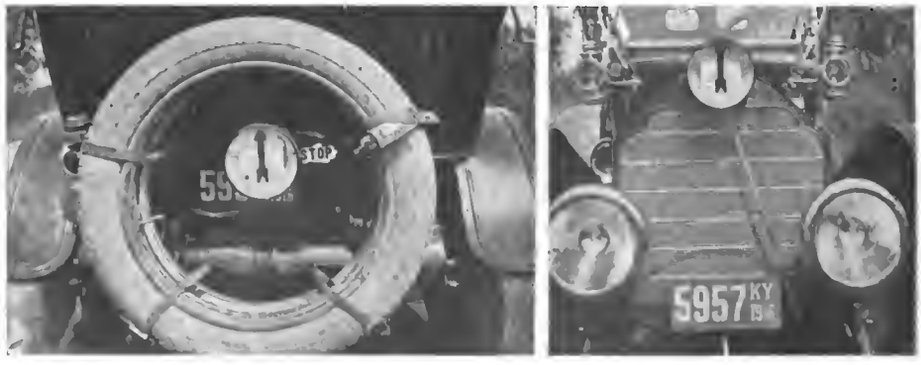
Lyon self-lubricating spring details

Rex Tire Pump

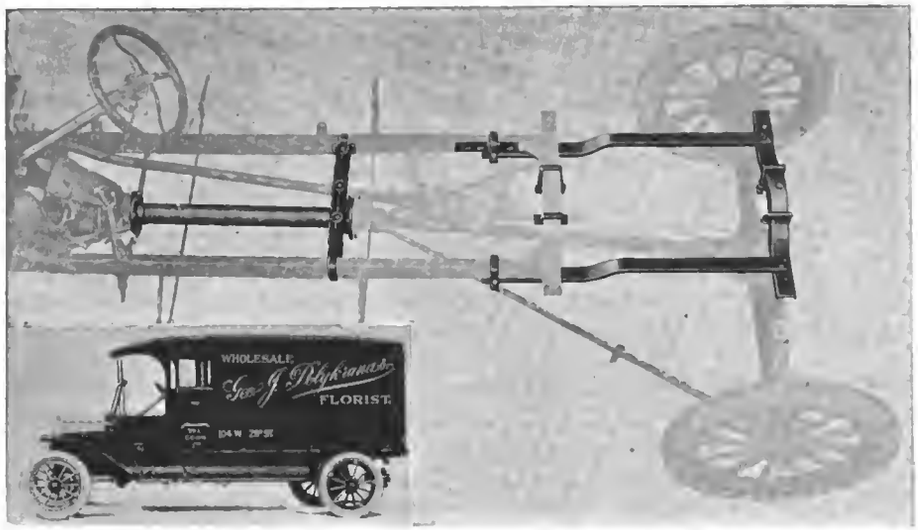
As there are no valves in this single-cylinder pump it may be operated at high speed without impairing its efficiency. The action of the pump shaft gives the piston both a vertical and laterally oscillating movement; in the side of the piston a groove is so located that when the piston starts upward on the compression stroke this groove coincides with the delivery port in the cylinder and remains in that position until the end of the stroke. The piston then oscillates, covering the outlet port and preventing the return of the air. At the end of the downward stroke the piston uncovers the vacuum passages, allowing air to rush into the cylinder. While the piston is traveling down and back over the intake port it is rotating in the cylinder, so that the delivery port is uncovered shortly after the intake port is closed.—Rex Pump Co., Chicago, Ill.

Lyon Self-Lubricating Spring

These springs are designed to use light cylinder oil, sufficient oil for about 3000 miles travel being retained by a felt pad carried in a concavity near the end of each leaf. Oil is reapplied with an ordinary oil can through a small duct from the end of the leaf. In the normal position of the spring there is only a slight pressure on the oil pad, but when running this pressure is varied by the road inequalities so that the pad acts in the manner of a sponge. Very little oil is forced to the outer surface of the pad and this is taken up by the spring leaves



Lexington safety signal, showing the two casings with indicator dial, one attached to the rear and one to the front of the car. Note stop signal



H-D extension for Ford cars, permitting the lengthening of the wheelbase 15 or 30 in. as on car illustrated at left

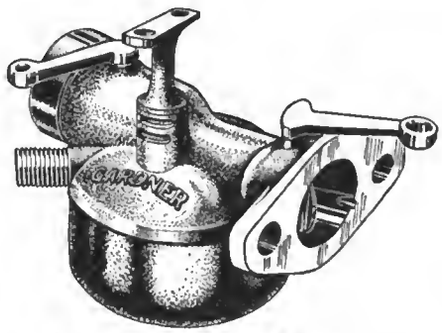
throughout their length by capillary attraction, insuring positive lubrication. The manufacturer carries in stock over 400 different numbers of springs.—Edward F. Lyon Co., Detroit, Mich.

Gardner Thermostat Carbureter

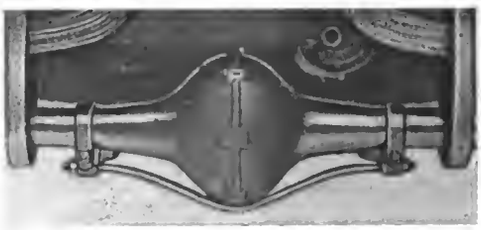
With this carbureter, designed for Fords, the gasoline supply is automatically controlled by means of a metallic thermostat. This thermostat is an integral part of the carbureter and requires no adjustment. It consists of a metal plug at the carbureter termination of the supply line and contains two openings admitting the fuel to the mixing chamber. One of these openings is controlled by the thermostatic flap-valve actuated by the changing temperature. In starting when the motor is cold the valve is open, giving a rich mixture. As the motor warms up the valve closes, giving an economical running mixture. The device sells for $10.—Gardner Carbureter Agency, 680 Woodward Avenue, Detroit, Mich.

H-D Extension for Fords

Simplicity is a feature of this extension, only five parts besides the brake-rod lengthening equipment being required to lengthen a Ford chassis 30 in. There is also a 15-in. extension, but the manufacturers consider the 30-in. type more generally desired. When the chassis has been lengthened it may be fitted with either a delivery or truck body or a seven-passenger touring design. The extension consists of a propeller shaft, tubular propeller shaft housing, a frame extension and the necessary equipment for lengthening the brake rods. The makers state that anyone can attach the device with a wrench and a hammer in a few hours, no boring or machine work being necessary. The extension may be removed at any time and the chassis restored to its original dimensions. Its use is especially advantageous, it is claimed, for fitting a Ford for the delivery of the small parcels which make up the great bulk of retail business. The 30-in. size sells for $60, complete, and the 15-in. size for $55.—Hayes-Diefenderfer Co., 237 West Fifty-fifth Street, New York City.



Gardner Thermostatic carbureter for Fords



Hoyt's axle truss for Fords

Weaver Towing Pole

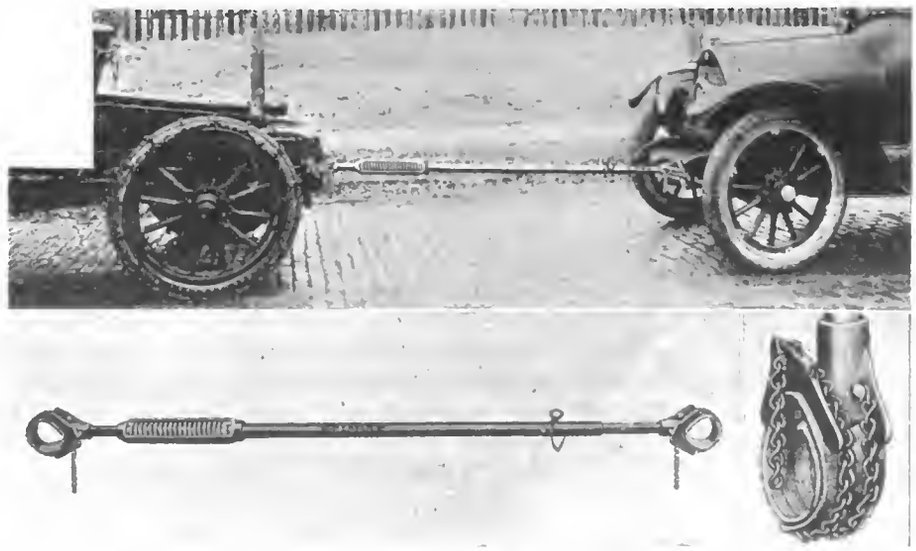
An adjustable-length pole that may be fastened to the front or rear axle of any car, enabling it to be towed with safety. The pole proper is made from steel tubing which is adjustable from 5 ft. 6 in. to 8 ft. by means of a keypin. At each end are metal sockets carrying a 30-in. leather strap that permits attachment either to the axle, spring or frame. The towed car may be pushed backward, cannot jam into the forward car on hills, and all shocks are absorbed by the double-acting spring mounted in the pole. Price, $10.—Weaver Mfg. Co., Springfield, Ill.

Hoyt Axle Truss

With this device the Ford rear axle is strengthened by a steel rod passing under the differential housing and clamped at each end to the rear axle. The device is claimed to take much of the strain from the central retaining bolts and to promote the life of the rear end assembly. It is easily installed and may be bolted in place by the owner. Price, $1.50.—Hoyt's Auto Supply Co., 370 Fairfield Ave., Bridgeport, Conn.

Rub-R-Tite Patch

This is a water-tight patching for tops, side curtains and cushions. After cutting to the desired size, the linen coating is removed from the adhesive side and the patch applied. It is said that the patch is scarcely noticeable. Price, one sheet, 4 by 12 in., 50 cents.—Auto Products Co., 40 Elm Street, Buffalo, N. Y.



Weaver adjustable-length towing pole, its application being illustrated above. Detail of socket is shown at the lower right

The Automobile

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Solving the Glare Problem

AT the January meeting of the S. A. E. the electrical equipment division of the standards committee offered the following resolution:

"Whenever there is not sufficient light within the limits of the highway location clearly to reveal all persons, vehicles, or substantial objects within said limits for a distance of at least 150 ft. the headlights of any motor vehicle in motion shall give sufficient light to reveal any person, vehicle or substantial object on the road straight ahead of such motor vehicle for a distance of at least 150 ft.

"The headlight shall be so arranged that no portion of the reflected beam of light, when measured 75 ft. or more ahead of the lamps, shall rise above 42 in. above the level surface on which the vehicle stands. Such headlights shall also give sufficient side illumination to indicate any person, vehicle or substantial object 10 ft. from the side of such vehicle at a point 10 ft. ahead of the lamps.

"The term 'beam of light' as used in the above provision shall be construed as meaning the approximately parallel focalized rays gathered and projected by a reflector, lens or other device."

When the report came to be threshed out in the general meeting the recommendation was cut down to merely the portion printed above in italics; it being considered by the majority that the original resolution was too sweeping; that it savoured too much of legislation and too little of pure engineering.

As amended the resolution was insufficient, as it stood originally it provided a definition for adequate light without excessive dazzle or glare. The great thing was that it defined what the light *should* be as well as what it should not be.

Glare Merely Contrast

Glare is simply contrast; it is the contrast between the bright patch of light and the dark surroundings. The human eye can bear a certain degree of contrast but no more; the S. A. E. definition goes practically far enough in its original form to define a degree of light and a system of lighting that will prevent too great a contrast from being presented to the ordinary user of the road. It is not a matter of volume of light at all, for there are many small side lamps giving a totally inadequate light for driving which are none the less able to glare horribly.

Unassisted, legislation might take the mistaken course of limiting the amount of light, which would not, of itself, help the glare question, while it would tend to make night driving unsafe by reason of robbing the driver of his power of sight. Too little light is as dangerous as glare to the road user, who may be overlooked altogether if he is not illuminated adequately.

The S. A. E. after modifying the original resolution and so greatly curtailing its value, asked that research work be done so that the resolution could be enlarged, stating in exact terms of scientific accuracy the degree of illumination desirable or necessary. This research work is being done and has been largely accomplished. The society will very soon be able to frame an entirely scientific recommendation which will not only state the amount of light necessary and the way it should be directed, but will tell how that amount of light and how that direction may be obtained.

Body Fashions

IN two years we have seen the average automobile body change from what now seems a rather clumsy assembly of curves and straight lines into a "continuous line" shape. Our automobile bodies today are not really streamline, for to be so they would need to have the largest section in front instead of behind, but all body designers seem to be aiming at the torpedo as the ideal shape.

How long will this craze last? Is it a permanent thing or is it to be succeeded by something altogether different?

In America the extremes of the European body builders have not yet been reached; the streamline type as it is called, can be developed much further than it has been carried. Say that we have a year more, or perhaps two, in which streamline bodies can be built to new designs and actually look different, and the question of what will follow arises.

In one or two instances it is possible to observe a breaking away from the curved plan view outline combined with parallel side elevation. Some of the most lately introduced cars have sharp lines in them, some have actual angles.

Argentine Trademark Law

Register Trademarks Before Cars Are Shipped—Dealer's Protection Needed

BUENOS AIRES, ARGENTINA, Sept. 15—U. S. A. automobile and accessory manufacturers should give early attention to the proper registering of trademarks in Argentina, otherwise they may find themselves barred from the privilege of using their own trade name.

There are certain U. S. A. cars sold in Argentina under different names than in North America and Europe. Their trademarks were registered here by local concerns. There are other concerns that have had to pay fairly large sums of money, well up in the thousands of dollars, to some person who has registered their trademarks in this country and held the matter under cover until cars have reached the custom house in this city. Before the cars were taken out of customs the U. S. A. manufacturer had to make his peace with the party owning the registered trademark.

R. W. Huntington, one of the best known authorities on patent laws and trademarks, etc., in Argentina, has recently written for the *Review of the River Plate*, the leading financial review of this country, a comprehensive outline on the trademark law and practices in connection with it. Mr. Huntington is a member of the American colony here and is a leader in his profession.

There are several points in connection with Argentine patent law which differ so widely from U. S. A. customs that they should be carefully considered. For example, in Argentina a trademark may be held by the registrant even though he may not use it. He can have it as long as he desires before he commences to do business.

Trademark by Class

Then again, if you have a trademark for one class of goods it will give protection for all different classes of goods. If you register it for automobiles it will hold for goggles.

In connection with selling automobiles and accessories here, the Buenos Aires dealer must be protected. To do this the trademark under which your goods are sold should be registered in the name of the Buenos Aires dealer, which can be done with every safety, as outlined later.

The following are some extracts from Mr. Huntington's paper:

"It should be borne in mind that there is a radical difference in the very basis of the trademark law of this country and that of Great Britain and the United States, for example, in which *previous use* counts rather than previous registration, whereas in this country *these conditions are reversed.* This fact is the cause of much of the misunderstanding which has arisen among foreign manufacturers regarding the protection or lack of protection of such marks or names in this country and the conditions affecting such protection.

"In this country a merchant, manufacturer or agriculturalist may choose his distinctive emblem and secure it for himself by registration, even before he commences to do business, where in the United States, for instance, he must actually use the mark before he can register it. For this reason the Argentine law might seem more just to the man about to go into business and less so to the established merchant or manufacturer. It is extremely difficult for the human mind to disabuse itself of all self-interest in judging of the right or wrong of any given law or measure.

"But whatever our opinion may be on this point, we must take the law as it is and not as we may think it should be.

"Another difference between the law of this country and those of some others lies in the fact that here a trade mark or name may be held by the registrant even though he may not use it, or he may hold a mark for many classes of goods while using it for only one. This also, while it may and undoubtedly does seem unjust to the mind of a person accustomed to the opposite conditions, is not without its defense; for instance, why should I lose an emblem which I have invented because I am prevented by financial or other reasons from carrying out my intentions to use that mark for the time being? Or why should I, who have a certain mark which I use to designate some table delicacy, not be able to prevent someone else from using the same mark or a similar one for axle-grease or rat poison? If your trademark is original you should have the right to insist that no one else may use it for anything—that when that mark is mentioned the idea conveyed and received shall be the name of the article for which you have made it famous, and that exclusively.

Trademark Piracy

"It is true that this particular phase of the law and practice here lends itself to what has been called 'trademark piracy' on account of the strictly national interpretation which is given to the law, although there has been a marked improvement since the year 1912, previously to which it was the practice in the Argentine Patent Office to grant the registration of a mark for all classes of goods for a single registry fee. Since that time each one of the twenty-five classes into which the new Argentine classification then adopted divides merchandise for the effects of trademark registration must be

(*Continued on Page* 638)

Freight Car Shortage Serious

Manufacturers Forced to Unusual Methods to Keep Shipments Close to Normal

DETROIT, MICH., Oct. 9—There is a shortage of 100 railroad cars per day in Detroit for automobile shipments. Using flat cars, Arm's palace horse cars, box cars and any other sort of a freight car with a 6-ft. door, manufacturers of automobiles in Detroit and other cities are attempting to meet with the serious shortage of freight cars suitable for transportation of automobiles, and they are finding it a difficult task.

Whether the blame for the shortage belongs to the 213,078 automobiles manufactured this year as compared with 139,829 of 1915, or to the vast grain movements now taking place, or to the delay in unloading of freight cars or, as many maintain, to the shortage in trackage and motive power, is not yet clear, but manufacturers are becoming pessimistic over the outcome and predict that even greater difficulties are sure to arise within the next few months.

Some Cut Production

Interviews with a number of car makers in Detroit disclose that many are now suffering to such an extent that they have been forced to cut down their production. At the Ford plant the traffic department reports that though they are not suffering much as yet, they have been forced to use ordinary box cars and to reload freight cars as soon as they are emptied in order to keep up to normal. Maxwell has been held up on shipments for the past 2 months and has seriously felt the shortage during the last 3 weeks. The company is using any kind of car with a 6-ft. door, and has had to cut down its production because of conditions.

At Packard private cars have been leased to care for the shipments, and up to the present they have been able to cope with the situation. Cadillac has suffered the greatest inconvenience through the Western equipment and, though running light on production at present, has had to use flat cars for the last 2 weeks. Studebaker has had several tie-ups and is shipping about three times as many cars at present as 3 years ago and is attempting to relieve the shortage by loading foreign cars to local points as far as possible. Hudson has leased many private Arm's palace horse cars, which are relieving them for the present, but shipping conditions are constantly becoming worse and take a pessimistic outlook. Many other companies report similar troubles.

Many plans are in process of consid-

eration and operation for the relief of the congestion. There are at present about 9000 railroad cars lying idle in the Detroit freight yards which are filled with household goods belonging to families in this city who have recently moved here and are unable to find apartments or homes in which to live. Every means is being used to have these cars unloaded as soon as possible. The Interstate Commerce Commission, local commercial organizations and the railroads are urging shippers to unload all cars as quickly as they can. The railroads have at the present time 10,000 new automobile freight cars in operation, as compared with a year ago, and have 8000 additional under construction orders, of which 5000 are expected to make their appearance this coming winter.

The railroads are attempting to prevent delay of unloading of cars by means of a higher rate of demurrage which they are trying to establish and which they believe will force shippers to unload. They claim that there should be a progressive charge, making it $1 per day per car for the first 3 days, $3 per car per day for the next 3 days and $5 per car per day for each succeeding day. It is likely that tariffs will soon be filed to cover this schedule.

—

Maibohm to Increase Production

RACINE, WIS., Oct. 5—The Maibohm Motors Co., this city, which began the Maibohm roadster about a year ago, is at present located in a factory of 110,000 ft. of floorspace and is making twelve cars per week.

The Maibohm company is an outgrowth of the Maibohm Wagon Co., which for 30 years has built vehicles. Experimental work on the first Maibohm car was commenced about 2 years ago.

—

Two Detroit Accessory Makers Bankrupt

DETROIT, MICH., Oct. 6.—Bankruptcy schedules, listing liabilities totaling more than $100,000 were filed yesterday in the United States District Court by the Victor Mfg. Co. and Ackerman and McNamara, two Detroit automobile accessory manufacturers.

The Victor Mfg. Co. is a Michigan corporation with its main plant in Detroit. It listed its total liabilities at $77,807 and assets comprising land and machinery at $114,724. The schedule was filed by Franklin T. Chapman, secretary and treasurer of the company. Adjudication was made Sept. 18.

Ackerman & McNamara whose plant is located at 535 Franklin Street, Detroit, listed their total liabilities at $39,606 and assets at $5,201. Adjudication was made August 29. Owners of the company are Joseph Ackerman and Frank McNamara.

Studebaker's Vast Expansion

Many Buildings Erected and Numerous Mechanical Changes Made in Year

DETROIT, MICH., Oct. 6.—This last year has been one of constant construction for the Studebaker Corp. Old buildings have been torn down and new ones added, factory methods have been overhauled and improved, and every feature designed to facilitate production has been adopted wherever possible.

A Year's Growth

Within the past 12 months three buildings have been erected, two structures enlarged and construction on another started. At plants numbers 3 and 4 where the additions are being made, a building 300 ft. long and 50 ft. wide, four stories high and constructed throughout of steel, glass and tile, has been equipped with a traveling crane which serves three floors and places stock directly from freight cars to the proper departments. The building will serve for frame assembling, storage and wheel painting.

The structure in course of erection will be 900 ft. by 50 ft., one story high and will be used for testing, tuning and getting cars ready for shipment.

Another new building consisting of one story 65 ft. by 140 ft. has been added to the heat treating and forging shop and will house work of similar natnre. On West Jefferson Street in the same plant, a one-story tuning and testing shop 50 ft. by 350 ft. has been erected and behind it a building has been increased from one to four stories and is used for a forge shop, wheel, rim and tire assembly and frame dip painting. There is also a new heavy forging shop 65 ft. by 265 ft. built entirely of steel, glass and tile.

New Forge Plant

The new building constructed for heavy forging is used for all crank shaft, front axle and connecting rod work. Three new 7000 lb. hammers, three 120-ton hydraulic presses for crank shafts and front axles, and four 2500 lb. hammers for connecting rods have recently been added to the general equipment. The shop is so arranged that all raw materials enter at the north end and are completed and inspected before leaving at the south end. The building is radical in its layout and differs from other plants, as the hammers and presses are ranged along the walls and the furnaces are placed in the center to secure ideal working conditions during the summer months. A 5-ton Toledo trolley crane serves the entire shop which is composed of a complete equipment of twenty-four forging furnaces and 4 Rockwell double chamber heat-testing furnaces.

One mile of new trackage has recently been laid and the Studebaker company can now load 100 freight cars on the company tracks at one time.

A new steel yard with capacity for 300,000 tons of forging steel and 400 ft. long by 65 ft. wide, has been added to the plant and takes the steel directly from freight cars by means of a 5-ton crane. The yard is so arranged that it feeds from the stock piled directly to the shears and to the two shops on each side of it.

Old Buildings Enlarged

The main building constructed 3 years ago has recently added seven forging gear blank headers and mnch minor machinery. It is 370 ft. by 65 ft. and until this year, was nsed to do all of the productive work at plants numbers 3 and 4.

An excellent illustration of the growth of the Studebaker Company is shown by the old De Luxe building. When the Studebaker Corp. purchased the site from De Lnxe there were several small buildings to the plant. To-day there is but one-half of a De Luxe building left and that is now used in connection with a new structure.

The Studebaker factory operates entirely npon a nnit system, and each separate piece is received in the raw in its specified room where it receives every part of the work needed to complete it and does not leave until it has been painted, inspected and made ready for assembly.

Conveyor System Used

Conveyors operate throughont the varions shops and carry the parts to the different assembly rooms eliminating all superfluons human movement.

Assembly work is carried on by a progressive plan. The third floor of the main building is filled with shops where parts are finished for assembly and placed in the conveyors to the fonrth floor. Here the frame starts at one end of the bnilding, receives its dip of paint and wheels with rims and tires inflated. It is then placed on a power conveyor and carried from room to room and point to point, receiving in each place, the varions additional parts it needs, until ready for the top, hood, floor boards and windshield which are placed on after the car leaves the power conveyor.

A one-story bnilding to cost $30,000, will be erected shortly at the South Bend plant. It will be used as a service station, stockroom, display room, and repair shop. Another story may possibly be added later.

Budd Wheel Co. to Enlarge

Will Have 3 Acres of Floorspace in New Body Plant of Budd Mfg. Co.

PHILADELPHIA, PA., Oct. 9—The Budd Wheel Corp., of Philadelphia, recently incorporated for $2,000,000 to manufacture steel and wire wheels of its own design, will occupy part of the new building being erected at Twenty-fifth Street and Hunting Park Avenue by the Budd Manufacturing Co., maker of all-steel bodies.

The new company will have about 3 acres of floorspace in the new building. W. B. Read is secretary and treasurer of both companies.

The new Philadelphia industry will be in charge of Charles Schenck, formerly with the Burdette Roundtree company, and well known in the railroad business. The stock is divided into $1,000,000 preferred and $1,000,000 common stock. Its officers are: Edw. G. Budd, president; H. L. Adams, of Chicago, and director of the Grant Motor Car Co., vice-president; W. B. Read, secretary and treasurer.

The Budd Mfg. Co. is at present turning out 1000 complete bodies a day and to meet the increasing demand for more is erecting the new building.

—

American 2-Tonner for 1917

NEW YORK CITY, Oct. 10—The American Motor Truck Co. has announced its 1917 model, a 2-tonner, equipped with a 36-hp. Wisconsin motor. The company's executive offices are in this city and the factory is in Hartford, Conn.

—

Elgin to Add to Factory

CHICAGO, ILL., Oct. 7—The Elgin Motor Car Corp., this city, which has increased its floor space more than 500 per cent within the past 80 days, will further increase it with an additional 200 per cent before another 60 days.

—

Herschell-Spillman Expands 25%

NORTH TONAWANDA, Oct. 9—The Herschell-Spillman Co., motor manufacturers, this city, is increasing its production 25 per cent by erecting a new building 165 by 65 ft., four stories in height.

—

New Stewart-Warner Buildings

BELOIT, WIS., Oct. 7—The large new foundry buildings being erected for the Stewart-Warner Speedometer Corp., Chicago, at the Warner works in Beloit, Wis., require a remarkable volume of materials. The specifications call for more than 1,000,000 brick; 120 tons of steel; 3000 cu. yd. of concrete, and 40,000 cu. yd. of filling ground, in addition to 50,000 panes of glass. The main building will be 122 by 522 ft. in size, and the auxiliary structure is 70 by 80 ft. Between 250 and 350 men will be needed to man the big shop when it is completed early next year.

—

Ford to Build Plant in England

DETROIT, MICH., Oct. 9—The Ford Motor Co. of Detroit states that the Ford Motor Co. of England, a separate corporation, will shortly erect a large plant near Southampton, England, for the production of Ford cars. Construction will be in charge of L. D. Perry who sailed for England on Oct. 6. The general details of the new factory have not yet been arranged and will be planned by Mr. Perry after his arrival.

—

Waupun Co. Builds Bodies

WAUPUN, WIS., Oct. 9.—The J. S. Morris Co., Waupun, Wis., carriages and vehicles, is now specializing in the manufacture of special motor car bodies, such as hearses, limousines, coupés and other types. Several hearse bodies were delivered during last week and orders for similar bodies are on the books and will require maximum production for 5 to 6 months to fill.

—

Chase Truck Makes Changes

SYRACUSE, N. Y., Oct. 7.—The Chase Motor Truck Co., this city, has appointed L. H. Abbott assistant sales manager. Mr. Abbott was formerly manager of the service department.

C. N. Gillette has been transferred to the New York City branch of the company. He was formerly traveling sales representative in the Southern territory.

—

No Trucks at Cleveland Show

CLEVELAND, OHIO, Oct. 9—There will be no trucks in the coming Cleveland automobile show to be held at the coliseum beginning Dec. 30.

The decision, which was announced to prospective exhibitors last week, is believed to mean a greater variety of passenger car exhibits and it is thought will bring more interest to the vast majority of persons attending the show.

—

Aprahamian's Sailing Date Was Earlier

NEW YORK CITY, Oct. 7—In THE AUTOMOBILE for Oct. 5 it was stated that A. Aprahamian would sail last Saturday for Africa and the Orient to represent American automobile and acessory companies. This was misleading, as Mr. Aprahamian's sailing date was nearly 2 months ago.

Co-operation Is Open Week Slogan

St. Louis Dealers Work Together To Interest Public in Cars —Some Sales

ST. LOUIS, MO., Oct. 9—Automobile Open Week closed at 10:30 Saturday night. Practically all of the firms who participated call it a success. Joseph A. Schlecht, chairman of the show committee of the Automobile Manufacturers' and Dealers' Assn., says that the effort has proved a very satisfactory substitute for the Fall show, which has been the rule in St. Louis. On two evenings the salesrooms were thronged to capacity and there was a fair daily attendance. Scores of country dealers were on hand.

But the best feature of the week was the spirit of co-operation that was developed. Those members of the association whose salesrooms are not on the row and who could not lease temporary quarters for the week were housed rent free by members who had large quarters. The visitors were permitted to bring their salesforces to the hosts' salesrooms and place their swinging signs on the fronts of the buildings. Also most of the dealers kept an automobile in front of their stores and should a visitor, after looking over the cars displayed there, express a wish to see another car, the car was placed at his disposal.

All Co-operate

There also was an agreement as to signs, all being exactly of the same design and stating only: Shown Here—name of car—and below: Open Week, 1916.

Two parades were given, each car carrying a card giving its name and price. This parade toured the principal part of the city and by noon reached the fair grounds where the machines were parked for the afternoon in a special space set apart. On Thursday afternoon the attendance at the fair was given as 30,000 and practically all of them looked over the cars.

Some Sales Made

There was some business done, cars being sold mainly to prospects brought to town by country dealers and who insisted on driving their new cars home. Other visitors who were greatly appreciated were out-of-town folk who came alone to see cars and then inquired how soon their local dealer could get this or that model.

The real occasion for Open Week is this: For 39 years a mysterious organization has given each year during the first week in October an illuminated parade called the Veiled Prophet.

This has drawn thousands of visitors to town and when the first automobile show was organized this week was selected because of the many out-of-town visitors. Recently there has been an agricultural fair the same week. This fair is new and is handicapped by a lack of buildings, so the fall show could not be held there and this year the dealers wanted to get into the national circuit, so they decided upon the choice of Open Week.

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Perfex Radiator Erects New Plant

RACINE, WIS., Oct. 7—The Perfex Radiator Co., Racine, Wis., one of the largest manufacturers of pleasure and commercial car and tractor radiators and cooling systems in the Middle West, on Oct. 9, began operations in its new factory at Holmes and Fleet Avenues. The new shop was dedicated on Saturday evening, Oct. 7, with a social party for employees and their families and friends. The factory is 75 by 255 ft. in size, and considered a model of factory lighting and sanitation. The capacity is increased to 400 radiators a day by the improvement. The Perfex company was established in Racine about 4 years ago and has met with much success. At present its orders are of such volume as to insure a continuous capacity run until the end of next year. More than 150 skilled men are employed at this time. The new plant represents an investment of $45,000 to $50,000. Officers of the concern are: President, F. M. Opitz; vice-president and treasurer, E. P. Wolf; secretary, J. P. Wolf.

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U. S. to Mark Mojave Desert

DETROIT, MICH., Oct. 9—Following efforts of good road enthusiasts for the past fourteen years, the government has just appropriated $10,000 for the erection of sign posts to water holes in the Mojave desert. The desert has recently been traversed from the east by many auto drivers who found traveling comparatively easy but complained of the need of water hole direction signs. The plan adopted by the government is not only to mark the highways but to also designate water supplies clearly and to keep them free from pollution as far as possible.

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Tractors Were of Latil Make

NEW YORK CITY, Oct. 7—The makers of the Latil tractor have written saying that in THE AUTOMOBILE for Aug. 24, on page 311, and again on page 314, the two illustrations which were stated to be Renault tractors were Latil machines. The Latil tractor was one of the first made in France and is one of the most successful. The French army is using many Latil and also many Renault tractors.

N. A. A. A. J. Remedies Trade Evils

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Sixteen-Month-Old Organization Holds Successful Convention in St. Louis

ST. LOUIS, MO., Oct. 6—The most successful convention of the National Assn. of Automobile Accessory Jobbers closed here to-day. It had a larger attendance, there was more enthusiasm and greater progress was made than at any session held in the brief career of the organization. The growth of the association is phenomenal so far as the automobile trade is concerned, for it has attained national proportions in 16 months.

Throughout the session there was evidence of a better spirit of co-operation. Members seemed disposed to work together for the common good and standards of practice were accepted upon a vote of the majority.

Trade Abuses Discussed

There were no idle addresses and little time was wasted under the direction of Commissioner William M. Webster. According to the system followed abuses in the trade are taken up, are discussed, referred to a committee, the committee's recommendation is discussed and action follows.

Monday and Tuesday were devoted to meetings of committees and directors and open sessions for all members were held Wednesday, Thursday and to-day. The entertainment program included a theater party Monday evening, attendance at the Veiled Prophets Parade Tuesday evening, a luncheon by the Business Men's League Wednesday, an automobile ride for women visitors Thursday to Shaw's Botanical Gardens, a banquet at the Sunset Inn Country Club, Thursday, given by the Curtis Pneumatic Machine Co., the McQuay-Norris Mfg. Co. and the Shurnuff Mfg. Co., a shopping tour Friday morning for the women, and a golf tournament Saturday.

An address on Business Co-operation was made Wednesday by Charles Nagel, former Secretary of the Interior, and H. G. Wilson, Traffic Commissioner of the Toledo Commerce Club, discussed Traffic and Transportation.

New Members

Thirty-four manufacturing members were admitted and 10 jobbing members. The jobbers' list is augmented by these members and by the Auto Supply Co., of Milwaukee.

The standards of practice set up will make much for the accessory trade. The principal recommendations follow:

The practice on the part of newspapers of using a car distributor as bait for participation in a blanket ad by the distributors' dealers was condemned.

Following an address by J. C. Thorpe, of the National Automobile Trade Assn., it was voted to work for greater co-operation with the retail organizations.

A committee was formed to investigate overhead expense.

Manufacturers were urged not to place excessive guarantees upon their goods.

Further emphasis was placed on the advisability of charging 10 per cent on returned goods.

The car manufacturer was taken to task for buying more accessories than he needs for car equipment and disposing of them at low prices to his branches and dealers. Trade directory publishers were urged to co-operate with the jobbers in compiling jobber's lists.

Jobbers were urged not to supply catalogs to dealers because this often enables the dealers to secure jobbing prices and he thereupon is able to sell at a figure so low that it upsets the trade.

Standardization of shipping and packing was urged and it was recommended that there be a movement among manufacturers toward small shipping units. Manufacturers were requested not to give prizes to the salesmen of jobbers, because this tends to upset the jobbers' regular business.

The committee on assisting the trade presented plans for the uplift of the retail division of the industry and was authorized to spend $1,000 in advertising.

A telegraph code was adopted.

It was suggested that manufacturers, when the goods are salable, repurchase bankrupt stocks and prevent the market being flooded with standard goods at ruinously low prices. It was the sense of the meeting that rebates should not be allowed to dealers.

On the question of payment of bills, dealers were urged to conform to the terms of the purchase agreement regardless of whether there is a cash discount, and manufacturers were urged to put their business on a more or less uniform discount basis.

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Auburn Adds Four-Story Building

AUBURN, IND., Oct. 9—Work has been started on a four-story building for the Auburn Automobile Co. The building will be constructed of cement block and brick. The contract calls for its completion Nov. 1.

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Mail Driver Must Obey the Law

BOSTON, MASS., Oct. 7—It cost Roland S. Ford, driver of a United States mail wagon, $10 in court to learn that he was not exempt from the automobile laws at Boston yesterday, and before the Highway Commission gets through with his case next week, when he has a hearing,

he may find his privilege to drive has been revoked. Ford has been driving a motor truck owned by the Boston Delivery Co., but leased to carry mail, and while going along Boylston Street, where it was muddy, he seemed to delight in creating splashes. The judge found him guilty of driving his machine in an unreasonable manner and refusing to show his license to the policeman, and he was fined $5 on each count. The Highway Commission was notified, and Ford has been summoned before that board for a hearing.

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Hood Bureau Increases Scope

DETROIT, MICH., Oct. 10—The Wallace C. Hood Service Bureau, this city, has increased its scope by securing agencies for dealers, by assisting the dealer or manufacturer in solving merchandising problems, analyzing territorial conditions, obtaining executives or workmen, and acting in an advisory capacity.

F. M. Eldredge has recently become associated with the Hood bureau of Detroit in the capacity of director of the bureau's advertising and publicity divisions. Mr. Eldredge will continue his present connection with various large industrial concerns as manager of their publicity departments.

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Thirty-three Entries for Chicago 250-Mile Race

CHICAGO, ILL., Oct. 10—Special Telegram—Thirty-three entries have been made for the 250-mile Grand American Automobile Race in this city next Saturday on the Speedway. Additional nominations are expected in later mails. All the prominent drivers and cars are included except the Sunbeams.

The race will probably settle the A.A.A. championship, as Aitken, Resta, Rickenbacher and DePalma are very close. As the winner of Saturday's race will be credited with 800 points, any one of the four to win will take the championship. Practice begins today.

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Giesel Federal Truck N. E. Sales Mgr.

DETROIT, MICH., Oct. 6.—A. A. Giesel after an absence of 3 years returns to the Federal Motor Truck Co. as New England sales manager.

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Dynamometer Set for U. of Wis.

MADISON, WIS., Sept. 23—An electric dynamometer and a gas engine manograph have been installed in the steam and gas laboratory of the college of engineering, University of Wisconsin, for experimentation with various gasoline engine manufacturers of Wisconsin. The dynamometer has a capacity of 150 hp. at from 2200 to 3500 r.p.m.

125,524 Cars in Bay State

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$1,118,981 Fees for First 9 Months of Year—452 Makes

BOSTON, MASS., Oct. 7—The demand for registrations for motor cars continues to increase so that now the figures show a continual gain over other years. Despite the fact that those who waited until Oct. 1 could register their machines at half price very few waited.

For the first 9 months of 1916 the Highway Commission received $1,486,000. For the entire year of 1915 the receipts were $1,118,981, so there is little doubt but what the $1,500,000 mark will be reached this year as prophesied early in the year. The total number of registration certificates issued for the 9 months of this year reached 125,524. According to the figures compiled by the New England Auto List officials the cars were listed as follows:

Ford	27,895	Little	105
Buick	8,169	Allen	104
Overland	7,333	Baker	95
Cadillac	5,805	Case	92
Studebaker	4,329	Warren	92
Hudson	3,962	Elmore	91
Maxwell	3,726	Trumbull	91
Packard	3,026	Renault	85
Dodge	2,811	Michigan	78
Chalmers	2,660	Moon	75
Reo	2,285	Speedwell	72
Metz	2,139	Westcott	71
Chevrolet	1,631	Crawford	69
Pierce	1,594	Rauch-L.	67
Oakland	1,588	Dort	66
Hupmobile	1,291	Autocar	64
Jeffery	1,239	Selden	62
Oldsmobile	1,183	Waverley	62
Stevens	1,093	Amer. Loco.	60
Chandler	943	Cartercar	60
Franklin	915	Palmer Singer	56
Paige	707	Flanders	55
Stearns	889	Brush	52
Saxon	816	Henderson	45
Stanley	750	Moline	45
Peerless	726	Paterson	43
Mitchell	722	Marathon	41
Pope	692	Berkshire	40
Winton	679	Lexington	40
Jackson	656	Atlas	39
Regal	559	Pathfinder	38
Locomobile	531	Bergdoll	37
Cole	519	Briggs	37
Velie	500	L. P. C.	37
E. M. F.	478	McFarlan	37
White	478	Motor Car	36
Haynes	428	Daimler	35
National	405	Nyberg	35
Kissel	400	Ohio	35
Stutz	397	Herreshoff	33
Dayton	364	S. G. V.	33
Knox	355	Marquette	31
Nordyke	317	Crow	30
Scripps-Booth	299	Hollier	30
Mercer	269	Grant	29
Premier	254	Corbin	27
Grant	235	Woods	27
King	231	Clarke	26
Lennox	227	Lancia	26
Lozier	212	Matheson	25
Inter-State	204	Elkhart	24
Flat	199	De Tamble	23
R. C. H.	190	Penn	23
Krit	168	Davis	22
Pullman	160	Garford	22
Anderson	156	Lyons	22
Simplex	155	Elec. Veh.	21
Apperson	150	Herff Brooks	21
Empire	144	Napier	21
Amer. Mot.	142	Pilot	21
Abbott	140	Babcock	20
Thomas	123	Courier	20
Everitt	122	Detroit	20
Marion	122	Moyer	20
Briscoe	121	U. S.	20
Columbia	116	Daniels	19
Imperial	116	De Dion	19
Auburn	115	Monroe	19
Bailey	110	Mutual	19
Vulcan	19	Hotchkiss	
Consolidated	18	Isotta	
Millburn	18	Gen. Mot.	8
Am. Volturette	17	Linscott	8
Owen	17	Buffalo	7
Acme	16	Cunningham	7
Berg	16	Enger	7
Columbus	16	Flint	7
Cutting	16	Gen. Veh.	7
Mercedes	16	Henry	7
Parry	16	Mora	7
Weld	16	Willy	7
Cameron	15	B. C. K.	6
Royal	15	Carhartt	6
Easton	14	Darracq	6
Partin	14	Itala	6
Royce	14	Panhard	6
Schacht	14	Stevens	6
Havers	13	Whiting	6
Johnson	13	Bay State	5
Lion	13	Car-Nation	5
Republic	13	Chadwick	5
Sampson	13	Delaunay	5
Standard	13	Hendee	5
Bell	12	International	5
Sears	12	Knight	5
United	12	Lorraine	5
Buckeye	11	Pickard	5
Fostine	11	Rocket	5
McIntire	11	Wayne	5
Argo	10	18 mfrs. each	4...72
Amer. Cycle	9	16 mfrs. each	3...48
Austin	9	47 mfrs. each	2...94
Detroiter	9	169 mfrs. each	1.169

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Wilson, of Redden, Gets Michigan

DETROIT, MICH., Oct. 9—C. Edward Wilson, at present Detroit manager for the Redden Motor Truck Co., has been appointed to control Michigan and other territory for the Redden trucks.

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Ramsden Is Oakland Branch Manager

DETROIT, MICH., Oct. 4—J. H. Ramsden has been appointed to succeed E. J. Kilborn as manager of the wholesale branch of the Oakland Motor Car Co. in Cbicago. Mr. Ramsden joined the Oakland organization a few months ago. He was previously prominently connected with the farm machinery industry of the Middle West and for the two years before his association with the Oakland company he was manager of the St. Louis branch of the J. I. Case Plow Works.

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Leach Gets King and Dort

LOS ANGELES, CAL., Oct. 7—The Leach Motor Car Co. has bought out the English Motor Car Co., and will handle the King and the Dort cars on the coast. The cars will be marketed through the former English company's organization, which has been continued practically intact by the Leach company.

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Makes Industrial Moving Pictures

NEW YORK CITY, Sept. 23—The Animated Advertising Corp. of New York is preparing for manufacturers moving picture films of their products in use and syndicating these films through a large chain of moving picture theaters. A number of films have been prepared for manufacturers of automobile commodities who are clients of the Animated Advertising Corp.

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Machine Tool Makers Add

MILWAUKEE, WIS., Oct. 7 — The Kearney & Trecker Co., manufacturing mining machines and other machine tools, is building a new smithing shop and otherwise increasing its capacity.

Globe Business Gains 40 %

Machine and Stamping Co.'s Output 1000 Boxes Per Day —Adds to Plant

CLEVELAND, OHIO, Oct. 5.—The Globe Machine and Stamping Co., this city, maker of tool and battery boxes, of which its output is now about 1000 boxes per day, reports a 40 per cent increase in business during 1916, the total business amounting to $600,000, or 100 per cent better than 1914. This company also manufactures hose clamps and universal joint cover clamps for the automobile trade as well as a line of special stampings and pressed metal parts to order, the latter amounting in volume to about $1,000 worth per day.

Additions Planned

The present factory now contains 80,000 ft., having recently been enlarged by a second-story added to the tool box building, 165 by 100 ft. New machinery has been installed during 1916 valued at $20,000. The company this year has also bought an acre of land near its factory, and is now adding a brick and concrete construction materials storage building. The ground floor of this building will contain about 10,000 sq. ft. Space is reserved around the sides of the plant for an L-shaped factory to be erected later, each wing of which will be about 200 by 60 ft., three or four stories in height.

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Colfax Mfg. Buys Top Co.

SOUTH BEND, IND., Oct. 7—The Frederick W. Loomis Co., manufacturer of automobile tops, has been bought by the Colfax Mfg. Co., this city.

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Business Good in Texas Despite Low Cotton Crops

DETROIT, MICH., Oct. 5—The automobile and accessory business has been excellent throughout the State of Texas despite a cotton crop that is two-thirds of the usual quantity, according to G. F. Bischof of Brownwood, Tex., who is at present in Detroit on matters in connection with the automobile business in which he is interested.

"The farmers have gone into the growing of wheat and oats and the raising of sheep and goats," said Mr. Bischof, "and by this means have more than offset the low cotton crop. My county had 445 Ford cars last year and has added more than 500 in the past twelve months."

The Ford agent in Brownwood is sold up to Jan. 1 and has refused to take additional orders until he fills those now on hand.

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McGraw Tire Capital Increased by $1,000,000

EAST PALESTINE, OHIO, Oct. 7—The McGraw Tire & Rubber Co. at stockholders' meeting increased its capital stock from $3,000,000 to $4,000,000. One million dollars of the new preferred has been underwritten by the M. H. Murch Co., Cleveland. Present outstanding issue of $475,000 preferred is being redeemed in full by payment at par and premium of $10 per share.

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Anderson Steam Vulcanizer Co. Formed

CINCINNATI, OHIO, Oct. 7—The Anderson Steam Vulcanizer Co., has been incorporated with $100,000, to manufacture steam vulcanizers. Incorporators are: Edward D. Woodward, Newton M. Anderson, Wm. D. Schwarting, Eugene Schmidt and J. C. Wells.

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Market Changes Slight

NEW YORK CITY, Oct. 10—Market prices remained for the most part unchanged last week. Activities in the metals, as usual, were mainly on future sales, spot sales being very scarce. The only product affected by the submarine incident was rubber, Para going up 1 cent a lb., while Ceylon rose 4 cents for the week and 2 cents yesterday. Tin naturally rose on news of the sinking of certain ships, its price going up to $43.00 yesterday, or $3.62 per 100 lb. for the week. The rest of the materials were steady in prices.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.61	.61	.61	.61	.61	.61	...
Antimony, lb.	.11	.11	.11	.11⅛	.11¼	.11¼	.00¼
Beams and Channels, 100 lb.	2.87	2.87	2.87	2.87	2.87	2.87	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl.	10.75	10.90	11.00	11.10	11.40	11.25	+ .50
Fish Oil, Menhaden, Brown, gal.	.58	.58	.58	.58	.58	.58	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.08	1.08	1.08	1.08	1.08	1.08	...
Lead, 100 lb.	7.25	7.25	7.25	7.05	7.05	7.05	— .20
Linseed Oil, gal.	.82	.82	.82	.82	.82	.82	...
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.40	2.40	2.40	2.40	2.40	2.40	...
Rapeseed Oil, refined, gal.	.90	.90	.90	.90	.90	.90	...
Rubber, Fine Up-River, Para, lb.	.72	.71	.71	.71	.72	.73	+ .01
Rubber, Ceylon, First Latex	.60	.60	.60	.61	.62	.64	+ .04
Sulphuric Acid, 60 Baume	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	39.38	39.63	39.88	39.88	39.88	43.00	+3.62
Tire Scrap, lb.	.06	.06	.06	.06	.06	.06	...

Security Price Decline

Submarine Incident Affects Prices—Unlisted Motors Show Largest Losses

NEW YORK CITY, Oct. 10—A period of liquidation set in on Monday at the Stock Exchange and Curb when news of the U-boat raid was received. Those selling short reaped a rich harvest on some of the automobile issues, whose recessions ranged from a fraction to 30 points. Goodyear Portage Rubber, Ajax and Paige-Detroit, were the only stocks out of nearly forty to withstand the heavy selling pressure and to come out with substantial gains.

An interesting point is brought out by the study of a few of the stocks and how they acted on the submarine news. Willys-Overland, for instance, under heavy buying pressure, had declined nearly 2 points before the news was announced. But instead of violently breaking on a declining market, the issue held steady and marked only a small loss for the week. This was also true of other issues on the Stock Exchange, especially Maxwell and Studebaker. In the Lusitania panic Studebaker went all to pieces, but yesterday it only declined 4 points.

Unlisted automobile and accessory issues did not act so well. Chevrolet declined 8 points, and Springfield Body 6 points.

Several of the issues on the Exchange, however, showed unusually large declines. These issues are selling at high prices and holders were for the most part heavily covered. General Motors common broke 30 points to 690; Chalmers dropped 15 points to 130; Packard went down 10 points; and Firestone Tire 10 points to 1120.

Several new issues will make their appearance on the Curb, these being Harroun Motors and Enger Motor Co. The latter company has listed 300,000 shares, par value $10.

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Casing Head Gasoline Production Increased 53% Over 1914

WASHINGTON, D. C., Oct. 7—The production of raw gasoline from gas during the last calendar year increased 53 per cent over 1914, the casing head gasoline industry extracting 65,364,665 gal. of raw gasoline, a gain of 22,712,033 gal. An average price of 7.9 cents a gal. was received for the unblended product.

It is estimated 24,000,000,000 cu. ft. of natural gas was utilized in the manufacture with the average recovery of 2.57 gal. of gasoline per 1000 ft.

Oklahoma led in production, with more than 45 per cent of the total. Califor-

nia, West Virginia, Pennsylvania, Ohio and Illinois followed.

Gasoline Extracted from Natural Gas and Sold in 1915

State	Number of plants	Quantity (gallons)	Value	Average recovery of gasoline per 1000 cubic feet (gallons)
Oklahoma	63	31,665,991	$2,361,029	3.60
California	20	12,835,126	975,397	1.60
West Va.	114	*10,853,608	927,079	2.30
Pennsylvania	139	*5,898,597	569,873	2.73
Ohio	50	2,198,715	167,138	2.80
Illinois	16	1,035,204	80,049	2.29
Texas	1			
New York	4			
Louisiana	2	*877,424	70,258	1.32
Kansas	2			
Colorado	2			
Kentucky	1			
	414	65,364,665	$5,150,823	2.57

*Includes gasoline resulting from natural condensation in gas mains.

Dividends Declared

United States Ruhber Co.; quarterly of 2 per cent on first preferred and 1½ per cent on second preferred, payable Oct. 31 to holders of record at noon Oct. 14. No action on common dividend.

Cole Motor Co.; 3 per cent, making a total distrihution in 1916 of 23 per cent.

Falls Motor Corp., quarterly of 1¾ per cent, on preferred, payable Oct. 15 to stock of record Oct. 1.

Kelly-Springfield Tire Co.; quarterly of 4 per cent on common, payable Nov. 1, 1916, to stock of record Oct. 16.

Reo Motor Car Co.; 10 per cent cash, payable Nov. 1; declaration of dividend delayed 2 weeks on account of consolidation of Reo car and Reo truck.

Harroun To Build 24,000 Cars

Company Will Make Its Own Motors and Trim Its Upholstery

DETROIT, MICH., Oct. 6.—Directors of the Harroun Motor Co. entertained citizens of Wayne at the Detroit Athletic club Monday evening. The dinner was attended hy nearly fifty in all, including a numher of Detroit newspaper men. John Guy Monihan, president of the Harroun company, acted as toastmaster at the dinner.

The Wayne officials told of their plans to house the workmen and to accommodate the company in every manner possihle, and officials of the Harroun company outlined the progress made in the formation of the company and its financing. It became known that the entire capital covering an output of 24,000 cars for the first year is in hand, the stock of the company being underwritten in New York. Plans for the huilding of a large addition to the Prouty & Glass Carriage Co. plant, which the Harroun company has purchased, were revealed. It was also made known that the company will huild its own motors and trim its own bodies.

Bernhardt and Hacquebart Join Harroun

DETROIT, MICH., Oct. 9—H. O. Bernhardt, for 2 years production manager of the Pierce-Arrow Motor Car Co., Buffalo, has become production manager of the Harroun Motors Corp. Peter Hacquehart has resigned as construction engineer of the Maxwell Company to take charge of the Harroun huilding operations.

His first duties will include the erection of an addition to the Prouty & Glass plants now standing in Wayne. This addition will he 130 ft. by 900 ft. in size and will he one story high. It will he used for progressive assemhly, store room and motor factory and will thus allow the use of the Prouty & Glass plant for the painting and upholstering of bodies.

Hupmobile Visits Half the Capitals

DETROIT, MICH., Oct. 6.—The Hupmobile capital-to-capital car has passed through Bismarck, N. D., ticking off 5918 miles of the 20,000 mile journey and with one-half of the capitals visited hut only one-quarter of the journey completed.

The one hig delay encountered was between Pierre and Bismarck when the tourists met with a fog that made path-finding extremely difficult. Visits are now scheduled for Boise, Idaho, and Seattle, Wash.

B. F. Goodrich Co. Gross Sales May Reach $77,000,000

NEW YORK CITY, Oct. 10—A total over-turn this year of $77,000,000 may be reached hy the B. F. Goodrich Co., Akron. Actual shipment of products for the 8 months ending Sept. 1 amounted

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.	63½	65	+ ½
J. I. Case T. M. Co. pfd.	82	88	—1
Chalmers Motor Co. com.	130	145	—15
Chalmers Motor Co. pfd.	95	99	..
*Chandler Motor Car Co.	104	106	—1
Chevrolet Motor Co.	190	194	—8
Fisher Body Corp.	39	42	—1½
Fisk Rubber Co. com.	90	105	—7
Fisk Rubber Co. 1st pfd.	110	120	..
Fisk Rubber Co. 2d pfd.	100	110	..
Firestone Tire & Rubber Co. com.	1120	1140	—10
Firestone Tire & Rubber Co. pfd.	110	111	..
*General Motors Co. com.	690	750	—30
*General Motors Co. pfd.	126	127	— ½
*B. F. Goodrich Co. com.	72⅛	72⅝	—1⅛
*B. F. Goodrich Co. pfd.	113¼	114½	— ¼
Goodyear Tire & Rubber Co. com.	296	298	+1
Goodyear Tire & Rubber Co. pfd.	107	108	+ ¼
Grant Motor Car Corp.	8¼	10	— ¼
Hupp Motor Car Corp. com.	5¼	6	— ¼
Hupp Motor Car Corp. pfd.	80	100	..
International Motor Co. com.	3½	5	—1½
International Motor Co. pfd.	15	25	—3
*Kelly-Springfield Tire Co. com.	79½	80½	—2
*Kelly-Springfield Tire Co. 1st pfd.	98	99	..
*Lee Rubber & Tire Corp.	43½	44	—2¼
*Maxwell Motor Co. com.	90	90½	—3
*Maxwell Motor Co. 1st pfd.	86⅛	86½	—1⅛
*Maxwell Motor Co. 2d pfd.	56½	57	— ½
Miller Rubber Co. com.	230	230	—20
Miller Rubber Co. pfd.	104	106	..
Mitchell Motor	64	66	..
Packard Motor Car Co. com.	165	185	—10
Packard Motor Car Co. pfd.	95	98	—2
Paige-Detroit Motor Car Co.	36	38	+2½
Peerless Truck & Motor Corp.	23½	24½	—1
Portage Rubber Co. com.	173	174	+3
Portage Rubber Co. pfd.	173	174	+3
Regal Motor Car Co. pfd.	17	22	..
Reo Motor Car Co.	44½	46	— ¼
Republic Truck	67¼	69	..
Saxon Motor Car Corp.	77¾	78⅞	—1½
Scripps-Booth	52	55	..
Springfield Body Corp. com.	90	100	—6
Springfield Body Corp. pfd.	120	135	—5
Standard Motor Construction Co.	7½	8¼	—1
Stewart-Warner Speed. Corp. com.	113	117	—1
Stewart-Warner Speed. Corp. pfd.	..	..	..
Stromberg	38½	39	..
*Studebaker Corp. com.	131½	132	— ½
*Studebaker Corp. pfd.	109¾	111	— ¼
Stutz Motor	66	67	..
Swinehart Tire & Rubber Co.	85	90	—5
United Motors Corp.	62½	62¾	—3½
*U. S. Rubber Co. com.	58⅛	58½	—3⅛
*U. S. Rubber Co. pfd.	113¾	114¼	..
White Motor Co.	55	55½	— ¼
*Willys-Overland Co. com.	43¾	44	—2¼
*Willys-Overland Co. pfd.	102¾	103	— ⅛

*At close Oct. 9, 1916. Listed New York Stock Exchange. Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS	Bid	Asked	Net Ch'ge
Auto Body Co.	41	43½	..
Chalmers Motor Co. com.	..	135	..
Chalmers Motor Co. pfd.	..	101	..
Continental Motor Co. com.	37	37¾	+1
Continental Motor Co. pfd.	9½	10½	..
Ford Motor Co. of Canada	326	340	+1
General Motors Co. com.	710	780	+10
General Motors Co. pfd.	126	130	+1½
Maxwell Motor Co. com.	91½	94½	— ½
Maxwell Motor Co. 1st pfd.	86	89	— ½
Maxwell Motor Co. 2d pfd.	56½	59½	+ ½
Packard Motor Car Co. com.	..	184	..
Packard Motor Car Co. pfd.	100	102	..
Paige-Detroit Motor Car Co.	37½	38½	+1½
W. K. Prudden Co.	49	51	..
Reo Motor Car Co.	44	44¾	—1⅛
Studebaker Corp. com.	133½	136½	+2
Studebaker Corp. pfd.	107	..	..
C. M. Hall Lamp Co.	28	30	+1
INACTIVE STOCKS			
Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd.	18	..	..

approximately to $50,000,000, a gain of 40 per cent over the same period of last year, or stated in terms of 1915's total sales, the volume of goods billed to customers in the first two-thirds of 1916 was within $5,400,000 of gross sales for all of the 1915 year, up to that time high record. If the company can hold this 40 per cent gain, the total turn-over is expected to be reached.

In 1912 Goodrich did a gross business of $37,533,000.

—

Tractor Show for Kansas City

DETROIT, MICH., Oct. 9—The Kansas City Tractor Club is completing arrangements for the tractor display to be held during the same week of the Kansas City automobile show. Many new tractors will make their first appearance at the coming exhibition.

—

Republic Truck on Transcontinental Run

DETROIT, MICH., Oct. 5—A 1500-lb. Dispatch model of the Republic Motor Truck Co., started from this city today on a transcontinental run. The truck is driven by Lester Peyer and the run will last 6 weeks.

—

Perfection-Stanweld Merger

(*Continued from page* 597)

1906 on a capital of $100 and was formed by Christian Girl and M. M. McIntyre. Five years later it was doing a gross business of $209,310 and 5 years after that its gross was $1,645,829. That was for the year ending June 30, 1915. For the year ending June 30, 1916, the gross business amounted to $3,200,000 and its net earnings for the first 9 months of the fiscal year was $282,811.

The Standard Welding Co. which makes steel tubing, rims for vehicle wheels, motorcycle and bicycle parts, motor vehicle rod assemblies and heaters, and does job welding, was incorporated in 1899. The company employs 2500 men and has a yearly output of approximately 50,000,000 ft. of tubing and 1,000,000 rims and bands. It is expected that the output of the combined concerns will be the same as the output of the present companies.

Officers of the Perfection Spring Co. are Christian Girl, president and general manager; E. W. Farr, vice-president; P. A. Connelly, secretary; T. E. Borton, treasurer. They together with F. F. Prentiss, C. C. Bolton and W. R. Clymer make up the board of directors.

C. W. Bingham is the president of the Standard Welding Co., H. P. McIntosh, vice-president and treasurer, and J. H. Champ, secretary. The board of directors comprises the officers and H. P. Bingham, H. P. McIntosh, Jr., C. C. Bolton and D. S. Blossom.

Giant's Despair Won by Chalmers

—

Junk, Pike's Peak Winner, Takes Free-for-All—H. A. L. Second—Other Events

WILKES-BARRE, PA., Oct. 7.—Fred Junk, winner of one of the events in the Pike's Peak hillclimb this year, captured the free-for-all event in the Giant's Despair hillclimb to-day by driving a Chalmers up the steep mountain course in 1 min. 41 sec., the best time over the course for the day. With this victory went the John Welles Hollenback trophy, that has been held by the Knox Automobile Co. since the Giant's Despair climb was abandoned several years ago.

An H. A. L., driven by Turcotte crowded Junk for the free-for-all honors, his time being 1:45 3-5. Third honors went to Hughson, in a Pathfinder, his time being 1:47. Dalton, driving a Packard, was fourth, covering the course in 1:50 2-5. Emerson, at the wheel of an S. S. E., a Philadelphia entry, took fifth place with a time of 1:57 2-5. Zwally, driving a Stutz, was sixth, his time being 2:10. Haines of Philadelphia, in a Mercer, came in seventh in 2:15 3-5.

In the opening event a Saxon car, the only one entered, developed engine trouble and was disqualified. In event No. 2, Durham, driving a Maxwell, went over the course for first place in 1:50. Junk crowded him close, and C. J. Rogers, of Philadelphia, driving a Lexington, finished fifth; time, 2:56 3-5. A Mercer, driven by Haines, captured the third event in 1:49. Durham, in a Maxwell, was second, and Emerson, driving an S. S. E., was third. Time, 2:05 3-5.

Forty thousand people were on the course when the races started. More than 4000 automobiles were parked along the mountain road. Despite the large crowd, not an accident of any kind occurred. The summary follows:

SUMMARY OF EVENTS

Event No. 1

Car and Driver	Time
Saxon—Roberts	Failed to finish

Event No. 2

Maxwell—Durham	1:50
Chalmers—Junk	1:51 3-5
Overland—Alsfelt	2:13 2-5
Oakland—Smith	2:42 1-5
Lexington—Rogers	2:56 3-5

Event No. 3

Mercer—Haines	1:49
Maxwell—Durham	1:50
S. S. E.—Emerson	2:05 3-5
Haynes—Conway	2:08 1-5
Mercer—Oliver	2:26
Willys-Knight—McDermott	2:59 3-5

Event No. 4

Packard—Hohl	1:44 4-5
Maxwell—Durham	1:47 1-5
H. A. L.—Turcotte	1:48 3-5
Mercer—Haines	1:49 3-5
Pathfinder—Scholler	1:54 3-5
Winton—Kohl	2:51 3-5

Event No. 5

Maxwell—Durham	1:45 3-5
H. A. L.—Turcotte	1:46
Mercer—Haines	1:48
Pathfinder—Scholler	1:53

Event No. 6

Chalmers—Junk	1:45
S. S. E.—Emerson	1:59 1-5
Haynes—Seaner	2:05

Event No. 7

Pathfinder—Hugheon	1:47 2-5
Stutz—Zwally	2:20 1-5
C'ther Duryea—Crawford	2:31 4-5

Event No. 8—Free-for-All

H. A. L.—Turcotte	1:45 3-5
Chalmers—Walden	1:41
Maxwell—Durham	1:45 1-5

—

Christiaens Returns to England

NEW YORK CITY, Oct. 6.—Joseph Christiaens sailed yesterday for England on the *Finland*. He took with him the two Sunbeam racing cars he has been campaigning in America. Mr. Christiaens hopes to return next year after making a number of changes in design based on his experiences of this season.

—

Shields, Anderson's Mechanic, Dies

INDIANAPOLIS, IND., Oct. 9—Bert Shields, mechanician for Gil Anderson, who was injured when their car turned turtle in the recent race at the Cincinnati Speedway, died at his home in Crawfordsville, Ind., Oct. 1. Shields' back was broken. Anderson is recovering.

—

Eastern Canada Show Jan. 20-27

MONTREAL, QUE., Oct. 6—The 1917 National Motor Show of Eastern Canada will be held Jan. 20-27 in the Almys Building, this city. The entire floor-space will be 26,000 ft., all on the third floor.

A large automobile freight elevator will be especially erected for show purposes and there are six passenger elevators and four large stairways.

The 1916 Montreal show was held only in the basement of the same building.

—

Hollier Wins Wager Race

BOSTON, MASS., Oct. 7—As a result of a discussion relative to the merits of six and eight-cylinder cars between dealers at Houlton, Me., a race was arranged between a Hollier eight and a Chalmers six from Houlton to Boston, a distance of 363 miles, and it was run off yesterday. The Hollier was driven by Jake Wise, while A. D. Holyoke drove the Chalmers for George W. Boyer. The arrangements were that the first car to check in at the Adams House, Boston, should win a wager of $500. Both machines left Houlton at 7 in the morning. From that town in the northeast corner of Maine

Records Made in Giant's Despair Hill Climbing

Year	Car	Driver	Time
1906	English Daimler	H. N. Harding	2:11 1-5
1907	Matheson	J. B. Ryall	1:59 2-5
1907	Simplex Peugeot (Motorcycle)	W. H. Wray	1:40
1907	Stanley (Steam Car)	E. W. Harper	1:56 4-5
1908	Great Chadwick Six	Willie Haupe	1:38 2-5
1909	120 h.p. Benz	D. Bruce Brown	1:31 3-5
1909	Indian Motorcycle (7 h.p.)	W. H. Wray	1:41 2-5
1910	Fiat	Daiph De Palma	1:28 2-5

they raced down through Bangor, Portland, Portsmouth, Newburyport to Boston. Wise reached the Adams house at 8:30, in just 13½ hr. He had hardly time to announce his arrival when Holyoke drove up, and he was very much surprised to learn that he had been beaten by 10 min. Both men drove the entire distance without stopping to eat.

—

Suggests Precautions Against Fire

BOSTON, MASS., Oct. 7—Fire Prevention Commissioner of Massachusetts, has sent out some suggestions through the press as to what automobilists can do to aid in making garages safer, and in lessening the dangers from fire in structures where cars are handled. He says that many fires are the result of carelessness, and not paying attention to the laws governing such structures.

—

2 Months for Underspeeding

WORCESTER, MASS., Oct. 7—While thousands of motorists have been arrested and fined for fast driving in Massachusetts the first case where a motorist was brought into court for slow driving occurred here yesterday. Edward C. Smith of Leominster was before Judge Utley on a charge of driving so slowly that he obstructed traffic. Traffic Officer Lyman J. Gorton testified that Smith came along to Harrington corner, the busiest place in Worcester, and he drove his car so slowly that he held up traffic. He was sentenced to 2 months in the house of correction.

—

Two Receivers for Twin-City Speedway

MINNEAPOLIS, MINN., Oct. 7—The Twin City Speedway Assn. now has two receivers. The Hennepin county court has appointed Elijah Barton at the request of the Minneapolis Trust Co., representing the mortgage or bond interests. The previous appointment was in Ramsey county of P. W. Herzog in the interest of creditors. The new receiver has power to protect the property with watchmen and insurance.

—

Device To Prevent Car Overturning

COLUMBUS, OHIO, Oct. 9—The Shilling Automobile Bumper Co., Columbus, has been organized with a capital of $100,000 to manufacture a safety device to prevent automobiles from turning turtle when an accident happens, the invention of E. C. Shilling of Columbus.

E. C. Shilling is president and Jacob Dagger of Urbana, secretary-treasurer. It is planned to open a factory in the Buckeye capital to make the device which can be operated so that the driver instantly can throw heavy bars on either side, when there is danger of overturning.

Mechanics to Share in Race Prizes

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New System of Distribution at Harkness Event—Special 50-Mile Race

NEW YORK CITY, Oct. 7.—A new system of prize distribution in which the mechanics will also come in for a share of the money will be started at the coming Harkness Trophy race on Oct. 28 at the Sheepshead Bay Speedway. A 50-mile special race for non-winners will follow the trophy event. It will carry $2,500 in prizes.

In addition to the $10,000 in prizes for the first six cars to finish the 100-mile race, $2,650 has been set aside to be distributed in lap prizes, 70 per cent of which will go to the driver and 30 per cent to the mechanician.

The bonuses will be awarded to leaders at the end of the various laps as follows:

Miles	Bonus	Miles	Bonus
10	$100	54	$50
12	50	56	50
14	50	58	50
16	50	60	100
18	50	62	50
20	100	64	50
22	50	66	50
24	50	68	50
26	50	70	100
28	50	72	50
30	100	74	50
32	50	76	50
34	50	78	50
36	50	80	100
38	50	82	50
40	100	84	50
42	50	86	50
44	50	88	50
46	50	90	100
48	50	92	50
50	100	94	50
52	50	96	50
		98	50

The regular prize money will be awarded as follows: First, $4,000; second, $2,500; third, $1,500; fourth, $1,000; fifth, $600; and sixth, $400.

—

Connecticut Registrations Gain 33 per Cent

HARTFORD, CONN., Oct. 7—Receipts for the present fiscal year from the registration of automobiles, motorcycles, trucks and individual drivers in Connecticut total $768,727.91, as against $536,970.09 for the corresponding period a year ago, or an increase of approximately 33 per cent. It is expected that the annual business will total $1,000,000.

—

Good Roads Day in New Hampshire

CONCORD, N. H., Oct. 6—Following a proclamation by Governor Spaulding designating last Saturday as Good Roads Day, various motor bodies busied themselves and with the granges doing their share the improvements on highways received a good impetus. At Nashua the automobile club celebrated the opening of the last link in the South Side highway, which joins it to Milford. The Milford Club also joined in the celebration. In Westmoreland, Lyme, East Kingston, Litchfield, Laconia, Londonderry and Keene special work was done. Members of the legislature made addresses and impressed upon the people that it was important to aid in building the smaller roads leading to the State highways.

—

Public Parking Spaces in Boston

BOSTON, MASS., Oct. 7—The Boston Street Commissioners have at last thrown open to motorists the first public parking place in the city, a small section of Boylston Street, where it will be possible to park some 50 machines. A part of Park Square nearby is also under consideration, where a dozen more cars may stand. There is no time limit on their stay.

Cars are allowed to stand against the curb in a few other places such as alongside the Boston Common and on a couple of other streets, but only for half an hour.

—

1897 Model Wins Haynes 12

KOKOMO, IND., Oct. 9—The award of the Haynes twelve, offered by the Haynes Automobile Co., this city, to the owner of the oldest car in America goes to Ed J. Howard, of Jeffersonville, Ind. Mr. Howard has an old gear-driven Haynes which he purchased at the factory in the summer of 1897. Since that time the car has been in his possession. After a 19-year period of service in the hills of the Ohio valley, the car is still in running condition. It was the oldest of 140 entries.

—

Brockton Outdoor Show a Success

BROCKTON, MASS., Oct. 6—New England's most pretentious automobile show for an outdoors exhibition held in connection with the Brockton Fair proved to be a success. More than 125,000 people visited the grounds.

There were 125 cars and trucks exhibited. While the greater number of spaces were taken by the Brockton agents, a few were paid for by the Boston dealers. There were forty makes of cars and eight makes of trucks, the latter not including the tractors. In the accessory gallery there were about twenty-five exhibitors.

—

Dimmers Required in Phoenix

PHOENIX, ARIZ., Oct. 6—An ordinance requiring the use of dimmers on automobile headlights, and requiring all drivers of motor vehicles to stop behind standing street cars has been adopted by the city commission under the "emergency clause" and is now in effect. The commission's action followed a series of accidents said to be due to the blinding glare of headlights.

Argentine Trade—Mark Law an Important Factor

(*Continued from Page* 629)

made the subject of a separate application to be paid for separately at the same price which before would have secured the mark for the entire mercantile gamut.

"Under the former ruling it became quite the custom for an applicant to claim all classes of goods, for the simple reason that he could do so without any additional cost. And for the same reason many foreign applicants, on sending their applications through their attorneys, found themselves in absolute control of their particular mark in this country, to the exclusion of all future applicants for the same mark for any kind of goods whatsoever. I venture to state that there are many British and American registrants of Argentine trademarks who are to-day in ignorance of the fact that no other person may register their marks for any class in the Argentine without their consent—a state of things which, quite possibly, they may have neither requested nor desired, and which was only brought about by the thoughtless action of the local attorney or agent.

Foreigners Worst Offenders

"From these circumstances there arose in a great measure the reputation of the Argentine as a trademark pirate, when as a matter of fact the foreigners have been the greatest sinners in this respect—not because the former is so much more upright than the latter, but rather because the greater part of the commerce and industry of the Argentine Republic is carried on by foreigners.

"Now the marks covered by what might be called 'blanket' registration previously to 1912 hold good up to the date of their expiry after a period of 10 years. Then they may be renewed for each or every one of the classes covered, and in the majority of cases this is being done for a limited number of classes, although some even now are willing to pay the registry expenses for each class in order to enjoy the absolute monopoly of their mark. Conditions are therefore becoming more favorable for the registry of foreign marks, and as time passes they will become even more so.

"The above-mentioned conditions have undoubtedly been taken unscrupulous advantage of in many cases, and there have been some notable instances of the legitimate owners of foreign trademarks being forced to pay exorbitant sums to secure the registry here.

"Nevertheless, in the majority of cases where it has been found impossible to register a foreign mark here it has been for natural reasons arising from the facts above indicated. For example, some time ago an American manufacturer wrote to the Argentine consulate: 'We have learned that our trademark has been pirated in the Argentine'; the fact being that the mark in question—the name of a mythological deity—has been registered and in use here by a local firm in the same line of business for more than 40 years, or some 10 years before the existence of its accuser.

Business Relations

"A phase of this subject which should receive earnest and impartial attention is that which refers to the relations between foreign manufacturers and their Argentine representatives. So little attention has been generally given to the appeals of the latter for protection by registry of trademarks that it has become almost the universal custom for any firm here, before making deliveries of an article bearing a new trademark or name, to register the same at once in order to forestall the unscrupulous action of anyone who might attempt to do so for speculative purposes. The foreign manufacturer is usually advised of such registry by the representative or agent, and in nine cases out of ten pays no attention to the offer of the latter to transfer the registry in consideration of reimbursement of the expenses incurred. As time goes by question may arise between the two parties, and the agent finds himself in possession of a defensive weapon which he had not thought of using for that purpose but which he believes himself justified in doing.

"Now, it is undoubtedly true that manufacturer and agent have or should have equal interest in building up a good business. It is equally true that although the manufacturer may act in perfect good faith, it is frequently impossible for him to give absolute protection to the agent, for the reason that the goods may be bought through commission houses and shipped to the agent's competitors without the knowledge of his principal. The only way to fully protect the local agent as the exclusive importer of his principal's product is to have the mark under which the goods are sold registered in his name. This can be done with perfect safety to the manufacturer by executing the proper document whereby the registry will revert to the manufacturer on termination of the agency contract.

"For example: If the foreign manufacturer makes a contract with an Argentine representative whereby the former is to ship his product exclusively to the latter, and if competitors here secure the same goods through other channels and put them on the market at cost or at least lower than the 'exclusive agent' can afford to do at a fair profit (a thing, by the way, which has been repeatedly done), the 'exclusive agent' has no redress whatever if the trademark under which the goods are sold is registered in the name of the foreign manufacturer, since in spite of the production in court of the exclusive agency contract the competitor, on proving that the goods sold bore the genuine trademark of the manufacturer in whose name it was registered, and that the goods were genuine, would be absolved by the court with costs to plaintiff.

"But if, on the contrary, the trademark is registered in the name of the local agent, he is then in a position to completely protect his interests in such a case, and incidentally the real interests of his principal. I would therefore recommend that in such cases the trademark, if already registered, be transferred to the agent during the period of the exclusive agency contract.

Too Much Protection

"But the question will naturally arise, Does registration of the trademark in the Argentine really give protection? And the reply is—*Too much protection!* I mean that the protection is so strong as to be dangerous when in unscrupulous hands. A few plain facts without any comment whatever will make this evident to the judicial mind. These are the facts:

"1. The penalty for infringement includes fine and imprisonment.

"2. The imprisonment is not redeemable hy payment of money.

"3. The suit is thus of a semi-criminal nature.

"4. *But suit may be withdrawn by plaintiff at any time before sentence is pronounced!*

"It is almost unnecessary to state, in view of the above, that the majority of infringement cases which might otherwise enrich Argentine jurisprudence never come to sentence.

"There are two notable exceptions to the general rule that first registry entitles registrant to the mark as against first use. Proper names and portraits of persons are protected to the fourth generation of the heirs, and the courts have repeatedly restored to the foreign claimant a registered mark containing or consisting of a proper name, or even the name of a company or corporation. The names of commercial firms doing business and duly matriculated in the Argentine are protected without being registered as trademarks, although it is quite usual to so register them or as a part of the mark. But foreign firms have no such common-law protection, and their names should be registered as trademarks or in connection with the same."

(Next week the various classifications for the trademark law will be given.)

Factory Miscellany

Metal Parts Company to Build—The Metal Auto Parts Company, Indianapolis, Ind., has completed plans for the erection of an $80,000 building.

Cadillac in Toledo—The Toledo-Cadillac Co., Toledo, Ohio, has taken a long lease on the building at the northwest corner of Madison Avenue and Eleventh Street, formerly occupied by the Lichtie Auto Co. and has occupied it as an exclusive salesroom for used cars.

Million-Gal. Pumping Engine for Firestone—The Firestone Tire & Rubber Co., Akron, Ohio, has placed an order with the Milwaukee works of the Allis-Chalmers Mfg. Co. for the manufacture and installation of a 1,000,000-gal. high-pressure pumping engine for its Akron shops.

New Upholstery Company in Chicago—L. J. Blumenthal, connected with the automobile and carriage trimming business for the past five years, has entered business for himself under the name of Blumenthal Brothers, to carry a line of automobile and carriage trimmings at 115 West Lake Street.

Westgard Plant Started—The Westgard Tire & Rubber Co. has started work on its plant in Warren, Ohio. The main building will be 140 ft. wide and 350 ft. long. Next to the main building the powerhouse, 40 by 40, will be built. Two hundred men will be employed at the start. This number is to be doubled in the near future.

Ind. Factory Activities—The South Bend Motor Car Co. has closed a deal with New York City whereby the South Bend concern is to build 10 fire trucks for the use of the metropolis. The trucks will be similar to those in use in South Bend.

The laying out of the foundation for the fourth building to be erected by the Bowser Oil Tank & Pump Works, Fort Wayne, this year has been commenced. The building will be used for storage purposes and will measure 80 by 150 ft.

The Advance-Rumely Co. of Laporte, Ind., is experimenting in the manufacture of an all-steel tractor. Heretofore considerable wood has gone into the construction of tractor bodies. Recently the possibility of manufacturing an all-steel tractor gained headway in the Rumely offices, and Chris. Nyberg, one of the company's draughtsmen, was detailed to the Battle Creek, Mich, offices of the company and help in the plans of getting out an all-steel tractor. Mr. Nyberg says he believes the experiment is a success since the work has been completed.

Wis. Factory Items—The Western Malleables Co., Beaver Dam, which introduced a line of automobile parts several months ago, to supplement its output of railroad and other malleable castings, is enlarging its facilities to properly accommodate the large volume of business being booked in both directions. The Elm Street plant at Beaver Dam is being enlarged by the erection of a 53 by 120-ft. addition, and a new core room, 90 by 26 ft., and a new sand shed are being added to the South Street plant.

The Osborne Casting Co., Racine, is the name of a new concern which is establishing a grey iron foundry in Racine to cater to manufacturers of automobile engines and complete cars. The backers are J. H. Osborne and C. G. Holmes, experienced foundrymen. More than $20,000 is being expended in the erection and equipment of a new foundry at Layard Avenue and the North-Western tracks, and this plant will be ready for operations on or before Jan. 1. Forty to 50 men will be employed at the start.

The Gillette Safety Tire Co., Eau Claire, will be ready to start manufacturing Nov. 1, according to present plans. The first unit of the new factory is now completed and the equipment and machinery is being installed. Ground has been broken for the office building, which will be 50 by 80 ft. in size and conform to the outline of the factory.

The Waukesha Motor Co., Waukesha, will break ground Oct. 15 for the erection of a new office building and draughting shop, to be 44 by 88 ft. in size, two-story and basement. The plant is being enlarged to accommodate the unprecedented demand for engines for pleasure and commercial cars and tractors.

The Automobile Calendar

ASSOCIATIONS

Oct. 13—Flint, Mich., Fall Meeting National Aeen. of Automobile Accessory Jobbers.

Oct. 25-26—Columbus, Ohio, Automobile Trade Assn., second annual meeting, Virginia Hotel.

Dec. 2-9—Electricians' Countrywide Celebration.

Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.

CONTESTS

Oct. 7-14—Troy, N. Y., Show, Motor Mart Bldg.

Oct. 14 — Chicago Speedway Race.

Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.

Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.

Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race, Arizona State Fair.

1917

April—Los Angeles to Salt Lake City Road Race.

May 19—New York Metropolitan Race on Sheepshead Bay Speedway.

May 30—Indianapolis Speedway Race, Championship.

June 9—Chicago, Ill., Speedway Race, Championship.

June 23 — Cincinnati, Ohio, Speedway Race.

July 4—Omaha, Neb., Speedway Race, Championship.

July 14 — Des Moines, Iowa, Speedway Race, Championship.

July 28—Tacoma, Wash., Speedway Race, Championship.

Aug. 4—Kansas City Speedway Race.

Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.

Sept. 15 — Providence, R. I., Speedway Race, Championship.

Race, Championship.

Sept. 29—New York, Speedway

Oct. 6—Kansas City Speedway Race.

Oct. 13—Chicago Speedway Race.

Oct. 27—New York Speedway Race.

SHOWS

Oct. 9—Kansas City, Mo., Fourth Annual Trade and Booster Tours, Kansas City Motor Car Dealers' Assn.

Oct. 14-21 — Pittsburgh, Pa., Thirteenth Annual Show, Motor Square Garden. Automobile Dealers' Assn. of Pittsburgh.

Oct. 14 - 21 — Dallas, Texas, Show, State Fair.

Nov. 10-18—Providence, R. I., Show, Rhode Island Automobile Dealers' Assn.

Dec. 2-9 — Springfield, Mass., Show, Auditorium. H. W. Stacey, Mgr.

Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Jan. 27-Feb. 3, 1917 — Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb.—Minneapolis, Minn., Show, National Lamp Co. Factory.

Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.

Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

March 3 - 10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

TRACTOR

Oct 14-29—Dallas, Tex., Demonstration, Texae State Fair.

The Week in the Industry

Pomeroy Joins Michigan Motor Car Co.—B. H. Pomeroy, M.E., for several years connected with the Dayton Motor Car Co., The Mead Engine Co. and Rapid Motor Vehicle Co. as chief engineer and superintendent, has been appointed factory manager of the Michigan Motor Car Co., Detroit. Mr. Pomeroy was formerly connected with the DeDion-Bouton Motor Car Co. of Church Lane, Brooklyn, N. Y., also with the Locomobile Co. and the Mobile Co. in the steam car days.

Wiese Made Studebaker Branch Manager—J. S. Wiese has been appointed to be branch manager for the Studebaker Corp. at Buffalo. He succeeds J. O. Hahn, who formerly operated the Studebaker branch at Cleveland and who is now the treasurer of the Studebaker Sales Co., which is the result of the merger of the Blevins Auto Sales Co. of Toledo and the Davis Motor Car Co. of Cleveland.

Louisville Items—The Louisville branch of the Ford Motor Co. will discontinue selling cars and parts at retail.

Seven agents have been appointed to handle the Ford in this city. They follow:

Atlas Machine Co., 728 West Market; Browder & Hoskins, 628 South Third; Broadway Motor Sales Co., 1012 East Broadway; F. P. Harter, 1064 Bardstown Road; Louisville Motors Co., Jackson and Broadway; Monarch Auto Co., 206 East Broadway; Roy E. Warner Co., 928 South Third.

Canadian Trade—George Primm has been appointed the West End representative for the sale of Ford cars and has opened temporary show rooms at 4280 St. Catherine Street, West Montreal.

Clermont & Rousseau have opened Ford show rooms at 994 St. Denis Street, Montreal.

The East End Garage, 789 Berri Street, Montreal, have taken on the representation of the Stanley steamer for Montreal.

Hartford News—The R. D. Britton Co., Allyn and High Streets, Hartford, Conn., is to take over the second floor of the building now occupied when the Universal Auto Co. removes to the new concrete sales and service building on Allyn Street. It is expected that the change will be made about Dec. 1.

Charles Ledgard of the sales department of Metcalfe & James, 134 Church Street, Firestone distributors, has been appointed manager. He assumes the new post this week. R. B. Metcalfe of the firm has returned to New York and will remain there until next spring, when he will return.

The Reid Motor Co. is to take over the salesroom of the Hartford Buick Co. at 356 Main Street as soon as the latter concern can renovate the recently acquired Park Casino on Elm Street, which is to be a combined sales and service building. The Reid company will also take over a portion of the new Buick service building on upper Elm Street and will release the present salesroom at 278 Main Street.

G. H. Gabb, Hartford, Conn., Auburn, Haynes, Kelley truck and Smith Form-A-Truck representative, has removed his sales office to 278 High Street.

Nine manufacturers accepted the invitation of the Automobile Club of Hartford for a public demonstration of dimming devices at Charter Oak Park this week. Each device was given a separate trial, after which lunch was served by the club at the Allyn House. The various representatives then explained their devices.

Wash. Trade Activities—Realizing the importance of Tacoma as a trade center and distribution point for southwest and central Washington, the Firestone Tire & Rubber Co. has established a direct factory branch at 705 Commerce Street. It is under the management of E. A. Stewart.

Form May-Kelleher Co.—A. C. F. Kelleher and H. H. May have formed the May-Kelleher Co., Pittsburgh, and will handle Pierce-Arrow cars. Kelleher has for the last 4 years been connected with the Foss-Hughes Co., Philadelphia, Pierce-Arrow dealer.

Philadelphia Items—The Packard Motor Car Co. is having plans prepared for an eight-story concrete building to be erected at Broad and Wood Streets. It will measure 70 by 180 ft.

The Fanning-Mathis Co. has leased the garage in the new building now being erected at 1611-15 Vine Street, and will use it as a service station.

Oliver Brothers, 600 North Broad Street, Philadelphia, have added the Roamer.

Edward Wilkie has formed the Wilkie Motor & Supply Co. and will handle Buick sales in that city on an exchange car basis at 677 North Broad Street.

Ariz. Trade News—The Babbitt-Polson Co., Phoenix and Flagstaff, has been appointed Arizona agent for the Jordan cars, and will also act as distributor for New Mexico and part of west Texas. M. L. Burkhead, formerly with the Haynes sales agency of El Paso, has been appointed salesman by the Babbitt-Polson Co. in the territory mentioned.

Controlling interest in the southern Arizona Motor Co., Tucson, Buick agent, has passed from B. A. Snow to C. Edgar Goyette, S. E. Lannis, H. M. Hartley and F. E. Patterson. Goyette is president of the company under the new organization, and S. E. Lannis is car sales manager. H. M. Hartley will have charge of the tire and accessory department of the company.

Boston Changes—F. A. Hinchcliffe, for many years manager of the Winton Motor Car Co.'s branch at Boston, Mass., in charge of the New England district, has resigned to become agent for the Jordan car there.

P. L. McKinney, assistant manager of the Peerless company at Boston, has taken the Maine and New Hampshire territory for that line, with headquarters at Manchester, N. H.

Columbus News Items—W. R. Jones & Co. have taken the central Ohio distributing agency for the Prismolite headlight lens, made by the Standard Glass Specialty Co., Morgantown, W. Va.

Fred A. Walz, formerly a harness dealer at 325 South High Street, has opened a store to handle automobile tires and accessories at the same location.

E. W. Penton, connected with the Service Garage at 122 Fourteenth Avenue, has taken the central Ohio agency for the General Vehicle Co., maker of electric trucks.

The Ensign Motor Car Co., Springfield, Ohio, has taken the agency for the Empire in that city and surrounding territory.

Cruikshank, Son & Robbins, central Ohio agents for the Pathfinder and Briscoe, have moved into new quarters at 151-155 North Fourth Street.

New England Trade Items—Crosby Adams, who has just become manager of the Mitchell and Saxon agencies at Springfield, Mass., has taken on the Jordan car.

The S. L. Crosby Co., Bangor, Me., has secured the Maxwell agency for central Maine.

An agency for the General Motor trucks has been placed with the Western Massachusetts Cadillac Co., Springfield, Mass. It has three Massachusetts and one Vermont county.

The Grant Six car has been taken on by the Walter F. Kelley Co. at New Haven, Conn.

The AUTOMOBILE

Vol. XXXV
No. 16

NEW YORK, OCTOBER 19, 1916

Ten cents a copy
Three dollars a year

Over 1,500,000 Prospects

Every car needs a Stewart Vacuum System. Every manufacturer concedes this. The public is realizing it more and more every day.

In spite of the tremendous tank business we are now doing, still there are 1,500,000 cars in use that have not been equipped with the Stewart Vacuum System.

That's your market, Mr. Dealer:

Get busy.

"It will pay you to see that the car you buy is equipped with Stewart Products"

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Stewart

Vacuum System

$10

The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, OCTOBER 19, 1916—CHICAGO No. 16

Brown-Lipe-Chapin Co. Sold

United Motors Buys Biggest Maker of Differential Gears in America

NEW YORK CITY, Oct. 16.—The Brown-Lipe-Chapin Co., Syracuse, N. Y., largest manufacturer of differential gears in America, has been purchased by the United Motors Corp. and the same policy with regard to the Brown-Lipe-Chapin Co. will be followed as is used by the United Motors Corp. with the several other concerns it has purchased. President Alfred P. Sloane, Jr., of the United Motors Corp., is authority for the statement that the general policy of Brown-Lipe-Chapin will be continued as at present but that the capacity of the plant in the manufacture of differentials will be doubled as soon as additional buildings can be erected. The large resources of the United Motors Corp. will give a broader foundation and scope to the Brown-Lipe-Chapin Co., and it is hoped to be able to manufacture differentials for all concerns needing them. President Sloane's name will be added to the board of directors of Brown-Lipe-Chapin, but H. W. Chapin will continue as general manager as he has in the past.

The purchase of the Brown-Lipe-Chapin Co. does not in any wise involve the Brown-Lipe Gear Co., of Syracuse, and which to date has been very closely connected with Brown-Lipe-Chapin. The Brown-Lipe Gear Co. is practically controlled by Messrs. Brown and Lipe, both

(*Continued on page* 650)

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Moore Heads Western Spring Sales

NEW YORK CITY, Oct. 14—Kirk Moore has been appointed general sales manager of the Western Spring & Axle Co. For some time Mr. Moore has been production manager of the Vim Motor Truck Co., Philadelphia, previous to which time he was sales manager for Weston-Mott and Northway motors. The Western Spring & Axle Co. comprises the Cleveland Axle Mfg. Co., Canton, Ohio; Cleveland-Canton Spring Co., Canton, Ohio; Hess-Pontiac Spring & Axle Co., Pontiac, Mich.; Hess Spring & Axle Co., Cincinnati, Ohio; J. B. Armstrong Mfg. Co., Flint, Mich.; Cincinnati & Hammond Spring Co., Cincinnati, Ohio; Amsted Spring & Axle Co., Connersville, Ind.; Spears Axle Co., Wheeling, W. Va.; Champ Spring Co., St. Louis, Mo.

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Coffin on Defence Commission

NEW YORK CITY, Oct. 12—President Wilson has named seven members of the Advisory Commission, associated with the Council of National Defense to study and suggest methods of increasing industrial and military efficiency of transportation and manufacture of munitions of war. The automobile industry is represented by Howard E. Coffin, other members being Daniel Willard, president of the B. & O., Samuel Gompers, President of the American Federation of Labor, Dr. Franklin H. Martin, Bernard Baruch, Dr. Hollis Godfrey and Julius Rosenwald.

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King to Raise Car Prices

DETROIT, MICH., Oct. 15—The King Motor Car Co. will soon increase the price of its cars to take effect in about 60 days. The firm states it will soon be impossible to manufacture an automobile of the quality of the King eight-cylinder type to retail at $1,350.

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Standard Parts Co. Merger Name

CLEVELAND, OHIO, Oct. 15—The corporation to be formed by the consolidation of the Perfection Spring Co. and Standard Welding Co. may be known as the Standard Parts Co. Seven per cent cumulative preferred stock may be offered at par or very close to that figure in the near future.

G. M. Corp. Capital $102,600,000

Readjustment Plan Approved —$82,600,000 Common and $20,000,000 Preferred

NEW YORK CITY, Oct. 16—The final organization of the new General Motors Corp. which has been effected under Delaware laws, reveals that the authorized capital stock will be $102,600,000. The formal approval of the readjustment plan which was first made public in THE AUTOMOBILE for Sept. 28 has been given by upward of 70 per cent of the holders of outstanding stock and has been forwarded to the shareholders of the General Motors Co. The plan has been signed by every member of the board of directors except J. A. Haskell, who is in Europe.

Readjustment Plan the Same

The readjustment plan is the same as was first made public. Of the total capitalization $82,600,000 is common stock and $20,000,000 is non-voting preferred stock, all shares having a par value of $100. The preferred stock is entitled to receive cumulative dividends at the rate of 6 per cent and is subject to redemption at the option of the company at $110 on Nov. 1, 1918, or any subsequent dividend date.

The distribution of stock in the Delaware corporation remains unchanged, shareholders of the General Motors Co. of New Jersey having the privilege of exchanging each share of preferred stock for one and one-third shares of new preferred stock, and one share of common stock for five shares of the new common stock. Deposits for exchange are to be made with the Guaranty Trust Co., New York, between Oct. 15 and Dec. 16 inclusive. The readjustment plan becomes effective Nov. 1.

Accessory Space Allotted

Stiger Succeeds Lovell as Assn. Pres. and Bradley Takes Sweet's Place

NEW YORK CITY, Oct. 14—Eighty-seven accessory concerns have been allotted space at the national shows in this city and Chicago. After adding sixteen concerns which will exhibit in this city only, the New York total thus far reaches 103. Twelve concerns will exhibit only in Chicago, thus making the total number to date there, ninety-nine. Last year New York was given eighty-seven and Chicago, eighty-three.

A meeting of the show and allotment committee of the Motor and Accessory Manufacturers was given yesterday at which space was given to 115 members, compared with ninety-five last year.

Several new companies will exhibit at these shows this year, including the following: A. B. C. Starter Co.; Au-To Compressor Co.; Detroit Weatherproof Body Co.; Evapco Mfg. Co.; Ferro Machine & Foundry Co.; Hall-Thompson Co.; Kokomo Electric Co.; Leather Tire

(*Continued on page* 681)

Olympian Motors Co. Formed

PONTIAC, MICH., Oct. 17—The Olympian Motors Co., this city, has been organized to build an automobile selling at less than $1,000. R. A. Palmer, prominent in the business activities of the Cartercar company, will head the new company and he will have asseciated with him as executives G. C. Bull, treasurer; C. E. Callender, secretary; and A. M. Stryker, advertising manager.

McClure Tire & Rubber Co. Formed

COLUMBUS, OHIO, Oct. 14—The McClure Tire & Rubber Co., which has been in business for about 3 years in East Gay Street, has been incorporated with J. A. McClure, Jr., president; E. Buchanan, vice-president, and Robert McClure, secretary and treasurer. A lease has been taken on a new building now in course of construction at 214-218 East Gay Street.

Thompson Is Miller Advertising Director

AKRON, OHIO, Oct. 14—C. S. Thompson has been appointed advertising director of the Miller Rubber Co., this city. Mr. Thompson was formerly president of the Thompson-Carroll Co., Cleveland.

Hutchinson Overland Branch Manager

TOLEDO, OHIO, Oct. 14—Guy Hutchinson has joined the Willys-Overland Co. to act as branch manager for Willys-Overland, Inc., New York City. Mr. Hutchinson was formerly sales manager and treasurer of the firm of Hart & Hutchinson.

G. M. Graham will assume the position of research and publicity manager for the advertising department of the Willys-Overland company on Nov. 1. Mr. Graham was formerly the sporting editor and automobile editor for the Philadelphia *North American*.

Manhattan Electrical Supply Reorganized

NEW YORK CITY, Oct. 14—The Manhattan Electrical Supply Co., this city, maker of the Red Seal battery, which was recently reorganized with an issue of $1,500,000 first preferred, $500,000 second preferred and $3,000,000 common, reports that all of the 7 per cent first preferred stock issued has been purchased.

Organize Truck Holding Co.

DETROIT, MICH., Oct. 13—Organization of a holding company in New York to be known as the United Truck and Equipment Co., with incorporation in Michigan, to operate the United Motor Truck Co., is being perfected. Other companies may be controlled by the holding company, possibly including the Republic Truck Co., Alma, Mich.

Capitalization of the new company will be more than $400,000, and it is understood that $60,000 or more will be stock without par value or practically common stock.

New Auto Parts Corporation

DETROIT, MICH., Oct. 14—The Canton Auto Parts Mfg. Co., Canton, Ohio, has been organized and incorporated with a capital stock of $300,000 to manufacture all kinds of automobile parts. S. S. Kurtz who is vice-president of the McCaskey Register company of Alliance, Ohio, and J. M. Kurtz are the principal stockholders. The company will be ready for operation about Oct. 24.

Eisenberg Is Scripps-Booth Engineer

DETROIT, MICH., Oct. 17—H. O. C. Eisenberg, formerly engineer of the S. G. V. Co., has been appointed chief engineer of the Scripps-Booth Corp., succeeding Charles A. Ericston, who has resigned.

Kopf Opens Chicago Office

CHICAGO, ILL., Oct. 16—M. G. Kopf has opened an office at 620 Chemical Building, Chicago, and will specialize in chemical electrical lines as applied to automobile engineering and patent matters. Mr. Kopf was formerly chief engineer of the McCormick Laboratories, Dayton, Ohio.

Lenox Co. To Make Tractors

Two Models at $4,500 and $2,000 Respectively—Passenger Cars Continued

HYDE PARK, MASS., Oct. 9.—Two tractors, one selling for $4,500 and the other for $2,000 represent what the Lenox Motor Car Co., with a plant at Hyde Park, Mass., is now building. They are to be known as the Lenox-American tractors. They will not interfere with the building of automobiles. The tractors were designed by R. B. Morton, whose father built the first ones made by the International Harvester Co. Additional capital has been brought into the company, President Howard having resigned from a big shoe concern to take the presidency.

The Lenox-American large tractor weighs 12,500 lb. The two big features of these tractors are the four wheel drive and four wheel steer. Self starters are a third. There is a three-speed transmission, patented worm and sleeve clutch and the same lever that operates the clutch also operates the brake. Another good feature is the control lever that takes the place of the governor. This little lever drops into a notch and takes up the speed of the engine. The operator steers the axles, not the wheels. The big tractor was made to turn in a circle the inner diameter of which was less than its own length of 16 ft. The steering gear is not of the ordinary cast type, but is worm and gear run in oil. The drive chain performs like a belt.

Axles are semi-floating and packed in grease. The power is transmitted direct from the driving axles to the face of the four lightweight drive wheels by pull rods so that none of the driving strain comes on the spokes. The wheels of the big tractor are 60 in. high, with 18 in. face, and the smaller are 48 by 10 in.

Two levers control the tractor. One is used solely to shift gears. With the other first the clutch is released, then the throttle closes and last of all the brake is applied. On the reverse motion of this second lever the brake is released, engine speeded up and the clutch engaged.

The company plans to build about 300 of the tractors the first season.

Wilson Takes Over Sales Duties

DETROIT, MICH., Oct. 17—George D. Wilson, production manager of the C. R. Wilson Body Co., has also assumed the duties of sales manager. Charles F. Barth has been appointed works manager of the company.

Crankshaft Corp. Issues Stock

2500 Shares 7 Per Cent Preferred and 7500 Shares of Common

DETROIT, MICH., Oct. 16—The Automobile Crank Shaft Corp., which recently absorbed the business of the Auto Crank Shaft Co., has authorized the issue of stock amounting to $250,000, which is divided into 2500 shares of 7 per cent cumulative preferred stock, par value $100, and 7500 shares of common stock of no par value.

According to a statement issued by James M. Hibbard, secretary and treasurer of the corporation, the company will manufacture 72,000 crankshafts this coming year, which is less than one-third of the business offered, the records showing that, because of limited capacity, the company was forced to refuse 153,000 shafts.

Provision is now being made to at least double the capacity of the plant by February, 1917. Present customers include over twenty-five of the most prominent concerns in the automobile industry among whom are Studebaker, Stutz, Stearns, Winton, Peerless, National, Mercer, Locomobile, Hupp and Cadillac.

The net earnings of the company are 300 per cent in excess of those of 1914 and equal to eight times the maximum amount of dividends upon the preferred stock. The directorate includes among its members: A. R. Demory, vice-president of the Timken-Detroit Axle Co., and Henry H. Sanger, vice-president of the Hayes Mfg. Co.

AUTOMOBILE CRANKSHAFT CORPORATION STATEMENT FOR 8 MONTHS ENDING AUG. 31, 1916:

Assets		
Land and buildings		$56,397.85
Equipment, tools, furniture, fixtures and machinery		186,672.63
Less reserve for depreciation	$2,938.58	
Work in process (labor and overhead expense)		16,845.20
Factory materials and supplies		6,748.37
Accounts receivable (customers)		70,719.27
Less reserve for doubtful accounts	16,323.40	
Insurance premiums unexpired		100.12
Prepaid taxes		1,444.96
Total assets		$342,878.79
Liabilities		
Preferred stock—7 per cent cumulative—2500 shares, par value $100		$250,000.00
Balance represented by 7500 shares of no par value common stock		65,565.41
Accounts payable—trade creditors		18,394.99
Bills payable		None
Accrued salaries and wages		7,431.74
Accrued liability insurance		486.41
Reserve for Federal income tax		1,000.00
Total liabilities		$342,878.79

Woodruff Is Simplex Sales Manager

NEW YORK CITY, Oct. 18—A. A. Woodruff has been appointed sales manager of the Simplex Automobile Co., succeeding R. M. Barbour, resigned. Mr. Woodruff joined this company this year as manager of the body department. Later he became assistant sales manager. He has been in the automobile field since 1900, when he formed the Woodruff Mfg. Co., to build automobile bodies, later becoming connected with the E. R. Thomas Motor Co., later becoming producing manager. In 1912 he became eastern sales manager American Motors Co. and the Lexington-Howard Co. as manager.

Henry Splitdorf Dead

NEW YORK CITY, Oct. 17—Henry Splitdorf, inventor of the magneto bearing his name, died in his home in this city yesterday at the age of eighty-two. His eldest son, C. F. Splitdorf, is head of the Splitdorf Electrical Co., Newark, N. J.

Mr. Splitdorf was a native of Germany. He was the pioneer of telegraph instrument makers, having made them for Professor Morse, the inventor of telegraphy. Mr. Splitdorf was the inventor of the liquid insulation of the magnetic wire.

Agnew Directs Chalmers Advertising

DETROIT, MICH., Oct. 17—W. L. Agnew, who resigned as advertising manager of the Hudson Motor Car Co. some few months ago, to accept the position of assistant manager of the sales promotion department of the Chalmers Motor Co., has been appointed advertising and publicity director of the Chalmers company.

Tisch to Make Dean Knife Timers

DETROIT, MICH., Oct. 13—The Tisch Auto Supply Co., Grand Rapids, has purchased the Dean Knife timer for Ford car rights and will manufacture them under the supervision of W. B. Dean.

Pa. S. A. E. Meets Oct. 26

PHILADELPHIA, PA., Oct. 14—The first meeting of the Pennsylvania Section of the Society of Automobile Engineers for the season of 1916-17 will be held at the Engineers' Club, 1317 Spruce Street, Philadelphia, on Thursday evening, Oct. 26. Herbert Chase, chief engineer, Automobile Club of America, will speak on "The Otto Cycle versus Constant Pressure Cycle For Automobile Engines."

This meeting will be the last of the current administration year and the annual election of officers will be held.

Doble Paper on Steam Automobile

CLEVELAND, OHIO, Oct. 13—Abner Doble, designer of a steam automobile bearing his name, will deliver a paper before the local section of the Society of Automobile Engineers on Oct. 20, covering his work on the steam car.

S. A. E. To Discuss Aluminum

Paper By J. E. Diamond Treats Exhaustively on Use for Automobiles

NEW YORK CITY, Oct. 18—A paper entitled, "Aluminum and Its Use in Modern Aeroplane Motor and Motor Car Construction," will be read by James E. Diamond before the Metropolitan section of the S. A. E. here to-morrow night at its opening session of the season. Mr. Diamond is consulting engineer, Aluminum Castings Co., Cleveland, Ohio.

The introduction to Mr. Diamond's paper touches upon the abundance of aluminum, pointing out that aluminum in nature is more abundant than any other metal and that it constitutes approximately 8 per cent of the earth's crust. The discovery of aluminum is touched upon, this happening shortly after the beginning of the nineteenth century. Mention is made of the progress made in the methods of reduction from time of Woehler to the year 1886, when electricity was first utilized in reducing the ores of aluminum.

The metallurgy involved in the reduction of aluminum by the process invented by Charles M. Hall is briefly sketched.

Some little space is devoted to a discussion of the physical properties of aluminum. The alloy field is covered briefly. The foundry likewise comes in for attention. The very great care necessary in the production of successful castings is touched on at some length. Such factors as furnace temperature, pouring temperatures are touched upon. A statement is made that there is probably no one factor of vital importance than the pouring temperature and "that casting which is barely escaped being a mis-run in the finished section due to a low pouring temperature is the best casting from all standpoints. Explanation for this is given. The need for supervision by technically trained men in every stage in the evolution of a casting is emphasized very strongly.

The employment of aluminum castings in motor car and also aero motor construction is considered. The employment of aluminum castings almost invariably for the larger units in the motor car is mentioned. These parts are, of course, the crank and transmission cases. The employment of the former in all cases where the cylinders and and crankcase are not cast integral is characterized as standard since only in one or two instances is material other than aluminum used for the case.

Regarding the transmission case, cost is cited as the only reason for the non-

(*Continued on page* 651)

Accept Four S. A. E. Standards Reports

Standards Committee Approves Miscellaneous, Tire, Aeronautic Engine and Truck Control Reports—Headlight Glare and Military Truck Specifications Feature Discussions

Special to THE AUTOMOBILE

WASHINGTON, D. C., Oct. 18—Meeting to-day at the Bureau of Standards, the standards committee of the S. A. E. received reports from nine divisions and placed several new standards on the books for presentation to the Society for mail vote.

Conspicuous are recommendations regarding headlamps, the final report of the research division on the standard form for fuel economy and acceleration testing, revised testing forms for use in determining engine performance and standard controls for trucks.

Dr. Stratton, in his address of welcome, urged that the S. A. E. make full use of the facilities of the Bureau of Standards for tests and research and made a strong plea for the adoption of metric standards wherever possible.

Speaking of standardization in general, he congratulated the society on being in a new field and able to profit by experience in older fields. He stated that co-operation between practical and scientific men is necessary in working out standards and emphasized the value of scientific testing to intelligent standards work. He also urged uniform international units of measure in both scientific and practical fields. He considers the metric system best and believes that a change to that system is not so difficult or expensive as many believe. Dr. Stratton cited the Bureau's work on porcelain in spark plugs as an instance of its value to the automobile industry, determining physical properties of porcelain and investigating refractories. He asked for suggestions for co-operative work by bureau.

The Morning's Work

In the morning the reports of those divisions on which little discussion was anticipated were taken up. B. D. Gray, Hess-Bright Mfg. Co., chairman of the ball and roller bearings division, presented a report standardizing medium series, one direction ball thrust and recommending standard stock sizes for aeroplanes instead of special sizes.

Another report presented during the morning was by Henry Souther, chairman of the recently formed aeronautic engine division. This recommended adoption of the European taper propeller soft end which the U. S. Army and Navy has adopted. It is now used on the Hispano-Suiza engine by Simplex. This was opposed by C. M. Manly, Manly Drive Co., on the ground that improvements will be made too soon to make standardization worth while. Mr. Souther proposed standardizing the 18-mm. plug for aeroplane engines as the S. A. E. plug does not stand up under severe punishment for some unknown reason. The matter is now being studied. He also advised the adoption of the electric motor definition of engine rotation and reported progress on horsepower per pound ratings.

Mr. Souther's report was accepted with the amendment that the taper shaft end be held in abeyance.

Colonel Squier, in charge of the aviation section of the U. S. Army, spoke on the advantage of close co-operation between the engineers and the government department, saying that America wanted to avoid Europe's mistakes in aeroplane engines and plane specifications.

Augustus Post, of the Aero Club of America, announced that a Pan-American Aeronautical Exposition will be held at the Grand Central Palace, Feb. 8 to 16.

Standard sizes for battery jars have been under consideration by the electric vehicle division for some time, and agreement is not yet reached, so this division presented only a progress report showing that the subject is likely to be cleared up finally before the Winter meeting.

Chairman Whitney reported progress to reduce battery jar sizes from 200 to 41 with 32 in one height, 9 in another and lamp sizes from a host to nine, all one base type, three sizes, and three voltages. Progress on rubber tire efficiency tests and sizes of charging cables is waiting for reports from other electrical societies on cables.

Miscellaneous Report Accepted

A very excellent report was presented by J. G. Utz, consulting engineer Perfection Spring Co., and chairman of the miscellaneous division. This division has a very full program and a number of difficult subjects before it. The report contains only two new recommendations in final form, one relating to spark plug terminal thread and the other to the extension of rod ends.

The division recommended that 15/16-in. hex size for spark plugs replace ⅞, as many makers now use it because it allows greater porcelain thickness while the same spanners fit it. Terminal threads should be in two sizes, 5-40, Ford size, and 8-32 as the S. A. E. standard, the 8-32 to be the A. S. M. E.

A taper socket and plug for fender irons in thread sizes from 7/16 to ¾, all tapered 4½ in. per foot, was also presented. The division also submitted two standards for steering wheel hubs, straight for those with levers on the top of the wheel and tapered for those not at the top. There are four sizes of each, ⅞, 1¾, 2, 2¼, taper of 1 in. per foot. It was also recommended that no extension of rod ends beyond ½ in. be made, as the larger sizes are not needed for strength, but only for wear, which can be provided on smaller sizes by hardening the pins. Mr. Utz's report was adopted.

Tire Division Recommendations

The tire division recommended straight side tires from 32 by 3½ to 36 by 4½, as the larger straight sides are not practical. The smaller ones are on Fords and therefore the soft bead clinches. J. E. Hale, experimental engineer of Goodrich Tire & Rubber Co., amended this recommendation with a provision that straight sides be of the wide standard. The report was adopted.

Prof. Gallup's report on Proposed Standard Form for a Complete Car Performance Test was presented. This was only a progress report for the research division and will be final in January. The report follows:

Proposed Standard Car Performance Test

1—The entire test shall be made upon an automobile speedway or other course surfaced with wood, brick, concrete, asphalt or an equivalent material. Such speedway or course must have been approved for this purpose by the Council of the S. A. E. or an agent authorized by it.

2—The entire test shall be conducted by a competent and impartial referee approved by the Council of the S. A. E. This referee shall have complete charge of the test and he shall select such assistants as he may deem necessary. The referee shall certify to the results of the test before a notary public, who shall affix his seal thereto.

3—The entire test, including the fuel economy runs and the acceleration runs, shall be performed between sunrise and sunset of the same day.

4—The entire test may only be run at a period during which no appreciable wind exists, i. e., no wind which at any time exceeds a velocity of 15 m.p.h., measured at the nearest U. S. weather bureau station. The average values of humidity and barometer shall be obtained from the same source.

5—During the entire test the car must be run with all tanks full and carrying its full complement of passengers or corresponding ballast. Full complement of passengers shall consist of one passenger or the equivalent for each seat provided, driver included. The average weight for passengers and driver is to be 150 lb. each.

6—During the entire test there must be no change in gear ratio, ignition, carbureter, or any other detail of the car or its equipment. This shall not be interpreted as prohibiting changing spark plugs or manipulation of spark and throttle levers.

7—When a car is stated to be a stock

car it must be stock in every particular. Even though different carbureters, ignition systems, gear ratios or other details are optional on the same stock car, no change shall be made during the entire test.

8—A car fitted with an inclosed body must have all windows and doors closed during the runs.

9—A car fitted with an open body must have the top up and windshield fully erected during the runs. Rear curtains must be fastened down. Side curtains must not be used.

10—The pressure in the tires shall be that recommended by the manufacturer of the tires used, corresponding to the load applied both front and rear.

11—The highest gear only is to be used during the entire series of runs.

12—At no time during the runs shall coasting, declutching or the use of brakes be permitted.

13—Oils and greases used in the engine, transmission, rear axle or other parts of the car must be of usual quantity and quality.

14—The whole of the fuel used during the test must be of one quality. A sample of the fuel shall be taken for the purpose of determining and recording its specific gravity. The trade name of the fuel used shall be given. Wherever possible, information relative to its heat value shall be furnished, also a curve showing the results of a fractional distillation test.

15—All fuel used during the test must be fed from the special tanks placed on the windshield. (See description of apparatus under Fuel Economy Runs.)

16—Previous to beginning any run of the test, the engine is to be operated sufficiently long to bring it to the normal temperature corresponding to the conditions existing during that run.

17—The entire cooling system must be fully operative during the test, both as regards air and water circulation.

18—From the beginning to the conclusion of the entire test (including both the acceleration and economy runs) there shall be no manipulation of any carbureter adjustments or control other than the throttle.

Fuel Economy Runs

19—The fuel economy runs, when conducted upon a speedway, shall be made so as to complete each run at a point identical with that of starting. Each run shall be made without any interruption.

20—When conducted upon a course approximately straight, the runs shall be arranged so that each shall be completed at a point identical with that of starting. In each run there shall be no interruptions except those necessary for turning. Any such course shall have an exact length of 5, 2½ or 1 2/3 miles in one direction.

21—The fuel consumption shall be measured at a series of speeds covering the entire range of the car from the minimum to the maximum, following in general the outline in the table:

Run	M.P.H.
1	Minimum speed
2	9-11
3	14-16
4	19-22
5	26-30
6	35-40
7	47-55
8	63-70
9	Maximum speed

Note: In case the maximum speed is less than that indicated in any of the other runs the latter shall be omitted from the test. In any event, however, a run is to be made at the maximum speed of the car.

22—Fuel shall be fed to the carbureter during the runs by gravity and shall be supplied from a weighing tank mounted so that the actual distance between the top of the float chamber of the carbureter and the bottom of the fuel chamber is not less than 12 in. The tank shall be such that the variation in head during a run shall not exceed 12 in.

23—There shall be two tanks, preferably mounted side by side, as shown in the accompanying sketch. These tanks shall be connected to the carbureter so that by means of two cocks or their equivalent one tank may be "cut in" and the other "cut out" simultaneously. Of these two tanks, one is a reserve tank, used for maneuvering when measurement of the fuel is not being made. This tank may be a fixture if so desired. The other is a weighing tank, to be used during the runs for the measurement of fuel. This must be capable of easy detachment so that it can be weighed and replaced without difficulty. It must be large enough to contain fuel sufficient to enable the car to complete its run at maximum speed without refilling.

24—The procedure relative to the tanks is as follows:

Each tank is to be filled with fuel.

After filling, the weight of the weighing tank with fuel is to be accurately determined and recorded. It is suggested that a carefully calibrated spring balance be used. Following this the weighing tank is to be mounted in position.

The engine and car shall be brought to the normal temperature and speed of the run before crossing the starting line on fuel from the reserve tank. Upon crossing the starting line the reserve tank shall be cut out and the weighing tank cut in.

When the course is such as to necessitate interruptions in the run due to turning, the same procedure shall be repeated at each end of the course.

Upon crossing the finish line at the conclusion of each run, the weighing tank shall be cut out. It shall then be removed from its attachment and with its contents carefully weighed. The weight of the fuel consumed having been recorded, the tank may be refilled and weighed again previous to the commencement of the succeeding run.

25—Before the commencement of each run a setting of the throttle shall be determined which shall give the average speed desired for the run. During the run this setting shall remain fixed. The time for each lap is to be checked by the observer and in no case must the time of the slowest lap exceed that of the fastest lap by more than 10 per cent of the latter.

Acceleration Runs

26—The acceleration runs shall only be made on a straight portion of the course.

27—Each acceleration run shall start from a constant speed equal to the minimum speed obtained in the fuel economy runs and shall continue until the maximum speed of the car is reached.

28—There shall be ten such runs made consecutively over the same course, reversing the direction each time. The data from each of these runs shall be recorded. The final result shall be the average of the ten runs.

29—In determining the acceleration an electrical timing apparatus shall be used. This shall provide means for making or breaking an electrical contact at definite and equal distances on the course.

30—From the record of this apparatus shall be obtained data showing in the form of a curve the relation between acceleration in feet per second per second and speed of the car in miles per hour.

It was pointed out in the discussion that no allowance could be made for pressure or vacuum fuel feed. Owing to the difficulty in determining what a stock car is, Herbert Chase, chief engineer of the Automobile Club of America, suggested the stock car clause to be omitted. B. B. Bachman, Autocar Co.; A. L. Riker, Locomobile Co., and W. H. Conant, Gould Storage Battery Co., strongly objected to the council approving referees or courses, since that would be an indorsement of results of tests which would lead to misuse of the society's name in advertising. Eventually the report was accepted as of progress, with clauses 1 and 2 referred back for reconsideration. A test will be made before the winter meeting to try out the method.

Headlamp Glare

In the afternoon headlight glare and truck standards were the chief subjects discussed.

The matter of headlamps and glare was opened by Chairman Clayden, who read the address given on pages 674 and 675 of this issue. Following it, A. L. Riker, chairman of the electrical equipment division, read the report of the work done since June, which follows:

Electrical Equipment Report

1—Most of the more important work of the electrical equipment division has progressed nearly to the stage at which final reports can be made. A revision of the matter on Data Sheets 38a is presented herewith with the final approval of the division; also a recommendation for taillamp glasses. Recommendations relating to details of headlamps are given in tentative form, final action on the details being withheld to await trial under manufacturing conditions. If no unexpected difficulties arise, final action will be taken by the division within the next 1 or 2 months.

Taillamp Glasses—2—Investigation has shown that practically all makers of taillamps are using glasses having a nominal diameter of 3 in. with tolerance of minus 1/64 and plus 1/32 in. It is recommended that these dimensions be made standard.

3—In view of the different forms of dust-proof devices, as well as the use of flat and convex lenses, it is considered inadvisable to standardize headlamp glasses.

Size and Location of Headlamp Bulb Filaments—4—The tentative recommendations in regard to size and form of filaments for headlamp bulbs are as follows:

5—The vacuum bulb shall have a filament in the form of a helix of 2.5 mm. outside diameter and 4.2 mm. long, the axis of the helix coinciding with the axis of the bulb, as in the sketch.

6—The gas-filled bulb shall have a V-shaped filament (each leg of the V being formed of a fine helix) lying in a plane passing through the axis of the bulb and at 90 deg. from the plane of the locating pins in the base, with the apex of the V pointing away from the receptacle. The

(*Continued on page* 679)

Bad Truck Measures for N. J.?

Recommendations of Special Committee Would Practically Bar Trucks from State

NEW YORK CITY, Oct. 16—It will be commercially impossible to operate a motor truck in New Jersey if the recommendations of the special committee appointed by William L. Dill, Commissioner of Motor Vehicles of that State, are enacted into law.

Among the most glaring of the absurdities with which the committee seeks to burden the motor truck operator is one that each truck driver must carry waybills for each load, these waybills to show the gross weight and net weight carried. Another is that all commercial vehicles shall carry spare wheels, so as to avoid the possibility of any part of the steel rims coming into contact with the surface of the road should the rubber tires become damaged.

Nor were these two recommendations the only ones the committee, which is formed of engineers of several of the counties of the State, seeks to impose.

It also would limit the width of any truck over 4000 lb. weight to 96 in., outside measurement.

Another suggestion is that the extreme length of motor trucks shall not exceed 23 ft. 6 in.

Another suggested statute would make it prohibitory for a motor truck to be equipped with any tire covering of metal, or with any lugs or hobs or other sharp devices which would be in contact with the surface of the road, except non-skid chains.

Still another is that not more than one trailer shall be allowed to any commercial vehicle and that in every case the trailer shall be equipped with rubber tires.

Nor is this all, for the committee seeks to increase the truck registration fees from the present maximum of $25 to a maximum of $125.

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Prest-O-Lite Gets Injunction

INDIANAPOLIS, IND., Oct. 16—Judge A. B. Anderson in Federal Court last week granted a permanent injunction in behalf of the Prest-O-Lite Co., of this city against O. K. Stuart, of the Sun Lite Gas Co., Alexandria, Ind., which forbids the latter from refilling Prest-O-Lite tanks.

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Kent Plant in Belleville

BELLEVILLE, N. J., Oct. 17—The Kent Motors Corp. plans to establish a plant in this city costing more than $500,000 with potential capacity for 50,000 cars a year. The plant will be 125 by 400 ft. Work will soon begin on three structures, a factory, power house and assembly building.

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Pullman Leases Sphinx Plant

YORK, PA., Oct. 12—The Pullman Motor Car Co., this city, has leased the entire plant of the Sphinx Motor Car Co., and will use it for making bodies and other sheet metal parts.

First Photograph of a British War Tank

The above illustration is the first authentic picture of one of the caterpillar armored tractors used by the British Army on the Somme front in France. This machine has been injured by shell fire, or otherwise, as one of the elliptical belts which provide traction is torn out of position as shown at the right. Powerful gears revolve the belts and the weight of the machine is carried on rollers which are set close together on the ground side. The large wheels shown in the rear do the steering and support the weight of the tractor when crossing a shell crater or trench, thus greatly increasing its mobile length. Each machine is fitted with three or four machine guns and can fire 2000 bullets a minute, according to reports from the scene of operations.
Photo by Underwood & Underwood.

Argentine Trade-mark Law—II

Definitions of Trade-marks and Copyright Classifications for the Automobile Industry

BUENOS AIRES, ARGENTINA, Sept. 15—There are several general considerations with regard to automobile trade-marks in the Argentina that should be kept in mind by U. S. A. automobile manufacturers in addition to those mentioned in THE AUTOMOBILE last week.

A trade-mark may consist of names of objects of persons in a special form; portraits, emblems, monographs, designs, borders, fancy words, letters, or numbers of special designs or forming combinations; containers or special form, etc.

Not registrable: Coats of arms, flags or other insignia of the Argentine nation. (By a recent ruling the coats of arms or flags of foreign nations may be registered by consent of the respective legation); the form of the product itself; the color of the same; terms or expressions which have become of general use; designations usually employed to indicate the nature or class of the products; immoral designs or expressions.

Procedure: On filing the application the description in duplicate accompanied by labels and an electroplate of the mark (not to exceed 3⅛ in. by 3⅞ in.) must accompany the petition, unless the mark consists of a "fancy word" only, in which case the electroplate may be omitted at option of applicant. The entire payment of Government fees for the term of 10 years is also paid ($50 Argentine) as well as the power of attorney in case the applicant is non-resident. The above mentioned fee together with the expenses of legalization and translation of power of attorney and $1 for each sheet of paper used during the entire prosecution of the case, including communications of the Office and replies to same, constitute the costs of the case, so that the agent or attorney who makes a fixed price is never sure of the exact amount of his profit, which at usual rates is little enough at the best. In case of rejection the first fee is returned at the cost of some more "stamped paper" and trouble on the part of the agent, or another mark may be substituted at a slight additional expense.

Publication: A few days after filing the mark is published during five consecutive days in the *Boletin Oficial* together with the name of applicant and the class of goods to be covered by the registration. After the last day of publication there is a statutory period of 30 days during which any persons deeming

(*Continued on page* 680)

Princess Cars in Production

Ten Cars a Day Present Output—$50,000 Worth of New Machinery

DETROIT, MICH., Oct. 17—Active production on the new models has started at the factory of the Princess Motor Car Co. The present manufacturing schedule calls for ten cars a day, and the product now being put out is provided in five different color combinations.

The line includes a five-passenger touring, three-passenger chummy roadster, and a raceabout. The cars are equipped with a Golden, Belknap & Swartz engine, with Grant-Lees clutch and gearbox. There is a floating axle of Princess design and 32 by 3½ tires. The bore and stroke is 3¾ by 4¼ and the chassis has a wheelbase of 108 in. Disco lighting and starting is used, this being a two-unit system. For ignition, a Splitdorf-Dixie magneto is fitted. Featuring the equipment is a fuse box on the dash which is unique in a car of this price. Another special point in the fitting of the car is that nothing but genuine leather is used in the upholstery.

The Princess plant has recently been completely overhauled and $50,000 worth of new machinery is just being installed. The new models which sell for $775 are being delivered regularly.

Willard Completes New Building

CLEVELAND, OHIO, Oct. 14—The Willard Storage Battery Co. has just completed the first of its new buildings at the plant located at 274 East 131st Street.

This building will be occupied by the forming rooms which have previously been located at the old plant, corner Marquette and Lakeside. The building contains 90,000 sq. ft. and is of the very latest and most approved type of construction.

Work has been started on the second building, which will be two stories and will contain 75,000 sq. ft. This building will be occupied by the factory office, machine shop and storeroom.

Mickim Heads Liberty Advertising

DETROIT, MICH., Oct. 17—Robert Mickim, formerly advertising manager of the Ford Motor Co. of Canada, has been appointed advertising manager of the Liberty Motor Car Co., to succeed H. L. Buller, whose resignation took effect last week.

Jordan to Double Capacity

CLEVELAND, OHIO, Oct. 16—Plans are now being prepared for the Jordan Motor Car Co. for the erection of a new building, which will double its factory capacity.

The Jordan company started deliveries Aug. 15, and to date have produced and delivered at the average rate of eight daily for the whole period, and the daily production now is ten.

The new building will be of the same size as the original, occupying 30,000 sq. ft. of floor space, and will be erected for occupancy late in the winter or early in the spring.

It is understood the new building will be used for body mounting and final assembling and inspection. At present the Jordan company is using a tent to take care of the overflow.

18,000 Grants for 1917

CLEVELAND, OHIO, Oct. 14—The directors of the Grant Motor Corp. met in Cleveland, yesterday, and declared the regular 1¾ quarterly dividend on preferred stock, payable Nov. 1 to holders of record Oct. 15.

The board passed on and authorized the building of 18,000 cars for the year beginning Feb. 1, and the production is expected to be 20,000 before 1917.

Velie Production Increased 300%

MOLINE, ILL., Oct. 17—The factory production of the Velie Motor Vehicle Co., this city, has increased 300 per cent. Four of the Velie buildings are now occupied by the passenger car department.

The increase in production of the truck department over that of a year ago is 260 per cent.

British Makers Fear U. S. A. Cars

Boycott Suggested—Must Keep Enlarged Car Plants Busy After War

LONDON, ENG., Oct. 7—The recent announcement that the Ford company would establish a plant in England has brought forth proposals to boycott the low-priced American car. It has been suggested that all cars not manufactured in the allied countries be excluded from the British markets after the war.

The war has been the cause for great factory expansion and though the plants at present are busy on munition work and are well equipped with tools and appliances for taking care of a large production, the future use of these immense buildings has been a great source of worry to the country. The British automobile industry is particularly well equipped for rapid production, and so there seems no reason why it should not, in a very short time after the war, produce the desired cheap cars so as to repel the American invasion.

British automobile makers hold that some such agreement should be reached on the ground that as soon as the war is over and freights drop to normal Europe stands a great chance of being flooded with cheap American cars selling from $250 upward.

Up to the present time the British au-

Jitneys Handle Overflow of Hyatt Workers

Jitney buses lined up outside the factories of the Hyatt Roller Bearing Co., Newark, N. J., to take the overflow of workers home. This line-up is a regular occurrence at the plant, morning, noon and night. Fares are 5 cents, and the buses have regular routes designated by signs which they carry. The Hyatt company is one of the units of the United Motors Corp. and employs 5000 persons

tomobile manufacturers have paid scant attention to the little car, for the reason that they have had more orders for their high-priced cars than they could execute. Conditions are changing, however, and the European trade is awakening to the possibilities of the low-priced car in that market.

—

Dividends Declared

Willys-Overland Co.; quarterly of 75 cents a share, payable Nov. 1 to stock of record Oct. 23.

Kelsey Wheel Co.; quarterly 1¾ per cent on preferred, payable Nov. 1 to stock of record Oct. 16.

Pennsylvania Rubber Co.; 1¾ per cent on preferred and 1½ per cent on common, payable Jan. 1 to holders of record Dec. 15.

Fisher Body Corp.; quarterly of 1¾ per cent on preferred payable Nov. 1 to stock of record Oct. 17.

Bower Roller Bearing Co.; quarterly of 15 per cent, making 45 per cent cash dividends so far this year. Also a stock dividend of 100 per cent recommended to be passed on at annual meeting in January.

Globe Rubber Tire Mfg. Co., semi-annual of 3½ per cent on preferred, payable Nov. 1, to stock of record at close of business Oct. 27.

Reo Motor Co., extra of 7½ per cent and quarterly of 2½ per cent, payable Nov. 1 to stock of record Oct. 16.

Nash Motors Co., initial quarterly of $1.75 per share on preferred, payable Nov. 1 to stock of record Oct. 20.

Hood Rubber Co., quarterly of 1¾ per cent on preferred, payable Nov. 1 to stock of record Oct. 27.

—

Bower Recommends 100% Stock Dividend

DETROIT, MICH., Oct. 14—After declaring a quarterly dividend of 15 per cent the directors of the Bower Roller Bearing Co. recommended that a stock dividend of 100 per cent be approved by the stockholders at their annual meeting in January.

Gasoline Pumps Are Inaccurate

—

Over 5,000,000 Gal. Lost in West as Result of Short Measuring

CHICAGO, ILL., Oct. 16—Two matters featured the gasoline situation in the Central West this week, one being a rather general drop in prices, and the other, charges of short-measuring pumps. In Chicago, gasoline is selling at 15.6 cents a gallon, which is a drop of 1 cent since the first week in October. The same price prevails at Milwaukee, the Standard Oil being the first to cut the price 1 cent which was met by the independents.

Reports coming from Bloomington and other Illinois cities indicate that the price of 15½ cents a gallon is rather general throughout the State. The city motorists now have to pay 16½ cents per gallon, whereas they were paying 17½ up to Oct. 10.

Approximately half the gasoline troughs that have been inspected in Chicago since June 12 have been condemned, 956 inspections having been made to date. Government inspectors are working with the city forces.

Results of an investigation of gasoline measuring pumps in Illinois made by the United States Bureau of Standards show that in tests conducted in Chicago and typical suburban and rural communities downstate, the Government inspectors found 82 per cent of the Chicago gasoline pumps, and 83 per cent of those outside Chicago, inaccurate. The average shortage was 3.9 cu. in. per gallon in Chicago, and 7 cu. in. per gallon downstate. It is estimated that this shortage means a loss of more than 5,000,000 gal. per year, or $1,000,000 at the present price of gas in Illinois. A tolerance of 0.1 cu. in. per gallon is allowed. Gasoline users in the Twin Cities are getting full measure according to a recent inspection of pumps in Minneapolis and St. Paul.

The Bureau of Standards of the Department of Commerce recently published a report pertaining to the accuracy of liquid measuring pumps in which it states the principal causes of short delivery are caused by leaks in valves or piping; formation of vapor due to excessive suction lift, or the introduction of air under the pistons; failure to correct for the inertia of a long column of moving liquid; the use of long filling hoses with a low connection at the pump making proper drains of holes an impossibility; operation of pump at less than full stroke; and slippage past valves and pistons.

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New Polack Truck Tire Organization Formed

NEW YORK CITY, Oct. 14—The Polack Truck Tyre Corp. has been organized to take over the assets and business of the Polack Tyre & Rubber Co., Bridgeport, maker of solid rubber tires for commercial vehicles.

The new company is offering through E. B. Eames & Co., this city, 40,000 shares of stock at $12.50 per share out of a total capitalization of the company of 100,000 shares, no par value.

The refinancing plan provides the funds for the erection of a new plant. It is estimated that when the new plant is completed the company will earn about $3.50 a share. The stock, it is stated, will be listed on the New York Curb and the Cleveland Stock Exchange.

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Massnick Mfg. Co. Now

DETROIT, MICH., Oct. 16—The Massnick Mfg. Co. is the new name of the Massnick-Phipps Mfg. Co. There has been no change in the stock ownership or control and the management remains the same.

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Crude Oil Higher

NEW YORK CITY, Oct. 18—The materials markets last week were featured by a gain of 10 cents a barrel in Pennsylvania crude oil, which rose to $2.50. The principal purchasing agencies are continuing their efforts to bring to the refineries the large quantities of crude oil now in the hands of the producers, and as a result have raised prices to induce the holders to sell. It is stated that the producers are hoarding the supplies.

Steel prices still hold at $45 per ton on both Bessemer and open-hearth. Beams and channels quote at $2.87 per 100 lb. Automobile makers are actively in the market for soft steel bars for shipment over the first half of 1917. Much difficulty is experienced in having contracts accepted. Several of the Detroit makers are now in the market for about 50,000 tons of bars in the aggregate. All

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.11¼	.11¼	.11¼	.12¾	.12¾	.12¾	+ .01½
Antimony, lb.	.65	.65	.65	.65	.65	.65	...
Beams and Channels, 100 lb.	2.87	2.87	2.87	2.87	2.87	2.87	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl.	11.65	11.80	11.80	12.15	12.10	12.05	+ .40
Fish Oil, Menhaden, Brown, gal.	.58	.58	.58	.60	.60	.60	+ .02
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.08	1.08	1.08	1.08	1.08	1.08	...
Lead, 100 lb.	7.05	7.05	7.05	7.05	7.05	7.05	...
Linseed Oil, gal.	.82	.82	.82	.82	.82	.82	...
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.50	2.50	2.50	2.50	2.50	2.50	...
Rapeseed Oil, refined, gal.	.95	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb.	.73	.72	.72	.72	.72	.72	— .01
Rubber, Ceylon First Latex, lb.	.64	.63½	.63½	.63½	.62½	.62½	— .01½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	44.00	42.25	42.25	41.75	41.75	41.25	—3.75
Tire Scrap, lb.	.06	.06	.06	.06	.06	.06	...

the steel mills are filled up and can take little additional business except for delivery in the far future.

Crude rubber prices have softened after a temporary stiffening, due to the activities of the German submarine. Trading was light. Up-river is selling at 72 cents a pound, spot, while for November-December delivery the quotation was 68½ cents. The wide margin was said to be due to the fact that only one boat carrying Brazilian rubber is scheduled to arrive here this month.

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Hoover Steel Ball Grows Fast

DETROIT, MICH., Oct. 16—The recent meeting of the directors of the Hoover Steel Ball Co. of Ann Arbor has revealed the phenomenal growth of the company. The capital stock of the concern, which makes steel balls for machinery, was increased from $500,000 to $1,800,000.

The concern came to Ann Arbor in 1913, being the old defunct Flanders company ball bearing department. It started with floorspace of 29,000 ft. and thirty-two employees and annual sales of $163,000 the first year. Floorspace is now 112,506 sq. ft., there are more than 700 employees and the sales record up to July 31 is $1,310,001. Dividends to the amount of $264,975 cash, and stock dividends of $150,770 have been made to-date, and according to the company's report every stockholder has received back his original investment in dividends.

The company has on its books now, orders for 400,000,000 ¼-in. basis balls which are as yet unfilled.

Security Prices Advance

General Motors, Chevrolet and United Motors Rise on Good Market

NEW YORK CITY, Oct. 18—Despite bearish activities, automobile and accessory issues last week held strong, and holders of these issues on margin netted large gains on a number of the stocks. General Motors on the Stock Exchange and United Motors on the Curb featured the week's activities with gains of 40 and 5 points, respectively. Although trading in such an expensive issue as General Motors is necessarily restricted, the behavior of that stock in the last few days seems to indicate that stockholders are inclined to look favorably on the new reorganization plan presented by the directors. On Monday the stock opened at 760 and closed at 779½, and yesterday there was a further advance to 790, the highest price the stock has ever touched; in fact, the highest price any stock listed on the Stock Exchange has ever reached in the regular way of trading.

United Motors has been subjected to much short-selling. Speculators believed that it would decline on account of the submarine scare, but the stock has steadily risen on account of heavy outside buying and as a result those holding the stock on margin were treated to a gain of $5 a share for the week. Rumors state that this stock is slated to go much above 100 before Christmas.

Several of the tire issues were strong and higher. Firestone continued on its skyward movement and reached 1125, a gain of 5 points; Fisk common rose 5 points; Miller Rubber rose 5 points; and the rest of the issues rose fractionally.

Activities on the Detroit Exchange, on the other hand, were mainly subject to short selling. Prices were lower. General Motors dropped 10 points; Maxwell declined 8 points; Studebaker dropped 6½ points; other losses ranged from a fraction to 5 points.

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Kelly Truck Capital $7,000,000

COLUMBUS, OHIO, Oct. 13—The Kelly-Springfield Motor Truck Co., has filed papers with the Secretary of State increasing its stock from $1,740,000 to $7,000,000. The shareholders have ratified the increase. The shares will be divided as follows: Common, $2,000,000, against $900,000, formerly; preferred, $5,000,000, compared with $840,000.

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Republic Rubber Enlarges

YOUNGSTOWN, OHIO, Oct. 14—The Republic Rubber Co., this city, has offered 10,475 shares of its common stock pro rata, at par, to its common stockholders. The proceeds, about $1,000,000, will be used for working capital and extensions.

The members of the executive committee of the board of directors have asked the stockholders to waive their rights to subscribe to an additional 5000 shares of common stock. It is understood that this block of stock will be held for dis-

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.	63	65	— ½
J. I. Case T. M. Co. pfd	82	88	..
Chalmers Motor Co. com	95	105	—35
Chalmers Motor Co. pfd	92	96	+3
*Chandler Motor Car Co.	104	105½	..
Chevrolet Motor Co.	195	198	+5
Fisher Body Corp.	40½	42½	—1½
Fisk Rubber Co. com	95	100	+5
Fisk Rubber Co. 1st pfd	112	115	+2
Fisk Rubber Co. 2d pfd	100	110	..
Firestone Tire & Rubber Co. com	1125	1150	+5
Firestone Tire & Rubber Co. pfd	110	111	..
*General Motors Co. com	730	780	+40
*General Motors Co. pfd	122½	123¾	—3½
*B. F. Goodrich Co. com	73	73⅛	+ ⅜
*B. F. Goodrich Co. pfd	113¾	114	+ ½
Goodyear Tire & Rubber Co. com	296	298	..
Goodyear Tire & Rubber Co. pfd	107¼	108½	+ ¼
Grant Motor Car Corp.	7	10	—1¾
Hupp Motor Car Corp. com	5¼	6	..
Hupp Motor Car Corp. pfd	80	100	..
International Motor Co. com	4	7	+ ½
International Motor Co. pfd	18	22	+3
*Kelly-Springfield Tire Co. com	77	78	—2½
*Kelly-Springfield Tire Co. 1st pfd	97	100	—1
*Lee Rubber & Tire Corp.	43	44	— ½
*Maxwell Motor Co. com	89	89½	—1
*Maxwell Motor Co. 1st pfd	86½	87	+ ⅜
*Maxwell Motor Co. 2d pfd	55	56	—1½
Miller Rubber Co. com	240	250	+10
Miller Rubber Co. pfd	104	106	..
Packard Motor Car Co. com	170	190	+5
Packard Motor Car Co. pfd	98	104	+3
Paige-Detroit Motor Car Co.	38	39	+2
Peerless Truck & Motor Corp.	22½	24½	—1
Portage Rubber Co. com	174	176	+1
Portage Rubber Co. pfd	173	174	..
Regal Motor Car Co. pfd	17	22	..
Reo Motor Car Co.	44½	45¼	..
Saxon Motor Car Corp.	78	79	+ ¼
Springfield Body Corp. com	90	100	..
Springfield Body Corp. pfd	120	130	..
Standard Motor Construction Co.	7½	8	..
Stewart-Warner Speed. Corp. com	115	117	+2
Stewart-Warner Speed. Corp. pfd	..	..	..
*Studebaker Corp. com	131½	132¼	..
*Studebaker Corp. pfd	110½	111½	+1¼
Stutz Motor	65	66½	..
Swinehart Tire & Rubber Co.	85	90	..
United Motors Corp.	67½	69½	+5
*U. S. Rubber Co. com	59	59¼	+ ⅜
*U. S. Rubber Co. pfd	112½	112¾	—1¼
Wbite Motor Co.	56½	57½	+1½
*Willys-Overland Co. com	44¼	45	+1
*Willys-Overland Co. pfd	102½	103	+ ¼

*At close Oct. 16, 1916. Listed New York Stock Exchange.
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	41	43½	..
Cbalmers Motor Co. com	95	106	..
Chalmers Motor Co. pfd	..	95	..
Continental Motor Co. com	36¾	37½	— ¼
Continental Motor Co. pfd	9½	10½	..
Ford Motor Co. of Canada	..	305	..
General Motors Co. com	700	760	—10
General Motors Co. pfd	121	125½	—5
Maxwell Metor Co. com	83½	86½	—8
Maxwell Motor Co. 1st pfd	84	87	—2
Maxwell Motor Co. 2d pfd	53	56	—3½
Packard Motor Car Co. com	..	180	..
Packard Motor Car Co. pfd	..	102	..
Paige-Detroit Motor Car Co.	37½	38½	..
W. K. Prudden Co.	..	50	..
Reo Motor Car Co.	44¼	45¼	+ ¼
Studebaker Corp. com	127	130	—6½
Studebaker Corp. pfd	107	..	..
C. M. Hall Lamp Co.	28½	30	+ ½

INACTIVE STOCKS

Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd	18	..	..

position by the directors in the future development of the company.

The additional stock issue is equivalent to 40 per cent of the present outstanding common stock which is $2,500,000. The outstanding preferred amounts to $3,450,000.

—

Selden Truck Sales Gain 258 Per Cent

ROCHESTER, N. Y., Oct. 14—An increase of 258 per cent was made by the Selden Truck Sales Co., this city, in the period of 8 months, extending from Jan. 1 to Aug. 31. September shipments of 1916 increased 121 per cent over the same month in 1915.

—

Canadian Ford Co. Earns 15.8 Per Cent

DETROIT, MICH., Oct. 13—The net earnings of the Ford Motor Co. of Canada, Ltd., for the fiscal year of 10 months ending July 31, after deduction of $716,136 for special war taxes, were $1,109,322.14. The net earnings are equivalent to 15.8 per cent on the outstanding $7,000,000 of the company's authorized $10,000,000 of capital stock.

The net earnings for the latest year prior to the war tax deductions were $3,202,000 for a full year of 12 months ending in 1915.

Difficulties in obtaining vessels for export business reduced earnings.

—

Everitt Tractor Tried Out

DETROIT, MICH., Oct. 13—B. Everitt has recently given his Everitt tractor a series of tests through Michigan farms. Hundreds of acres have been turned up, and in one test 11 acres were plowed in 9½ hr.

Resta in Lead for Championship

—

Chicago Victory Brings His Total in the Ranking of Drivers to 3200

NEW YORK CITY, Oct. 17—Dario Resta now leads the list in the 1916 racing championship with a total of 3200 points, having pulled himself out of second position by his victory at Chicago last Saturday, which netted him 800 points, enough to nose out Aitken, the former leader. The latter is now second in the standing with 2940 points.

The order of the championship standing is:

Resta	3200	LeCain	120
Aitken	2940	Oldfield	80
Rickenbacher	2210	Taft	75
De Palma	1790	Pullen	70
D'Alene	1120	Haibe	60
Milton	690	Stringer	55
Mulford	620	Adams	55
Lewis	600	Cooper	55
Christiaens	540	Gable	45
Henderson	517	Wilcox	40
Vail	450	Chandler	40
Galvin	385	Watson	35
Devigne	320	Sorensen	35
Hughes	275	Johnson	30
Buzane	210	Devore	30
O'Donnell	185	McCarthy	25
Devlin	140	Muller	20
Klein	125		

—

Cadillac Breaks Record Across Iowa

DES MOINES, Ia., Oct. 14.—H. R. Wells of Des Moines drove a Cadillac eight across Iowa over the River-to-River Road on Oct. 11 in 7 hours and 49 min. The total distance covered was 331.2 miles and the miles per hour elapsed time was 42.37. This new record is 50 min. better than the previous mark made in September by W. J. Barndollar in a Packard twin-six over the same route in 8 hr. and 39 min. The same route was used also by Mulford in his recent runs across Iowa. Wells drove a touring car with top and windshield up and carried three passengers. He left Davenport at 6:37 a. m. and was checked in at Council Bluffs at 2:26 p. m. The last 142 miles of the run was covered at the rate of 44 m. p. h. Wells set a cross-Iowa record of 9 hr. and 14 min. 3 years ago and this stood until the Barndollar record of last month which was over a shorter mileage than that covered by Wells in his old record.

—

Myle-Mayker Gives 26.6 M.P.G. on Ford in A. A. A. Test

CHICAGO, ILL., Oct. 16—In a test held under the supervision of the American Automobile Assn. a Ford car was driven 26.6 m.p.g. after being equipped with a Myle-Mayker, produced by the Myle-Mayker Co., this city. The car, weighing 2267 lb., with four passengers and the top and windshield up, first made 22.5 m.p.g. without the Myle-Mayker. The addition of the Myle-Mayker, which was attached to the standard carbureter in about 1½ min., increased the mileage to 26.6. Acceleration tests without the device gave an increase from 7.5 m.p.h. to 30 m.p.h. in 24 sec. With the Myle-Mayker the same increase was made in 22 sec.

—

Allen Adds Two Closed Models

FOSTORIA, OHIO, Oct. 16—The Allen Motor Co. has added two closed models to its line. These are a coupé, at $1,075,

Brown-Lipe-Chapin Co. Sold to United Motors

(*Continued from page* 641)

wealthy Syracuse capitalists connected with the Smith-Premier typewriter company. The connection of these gentlemen with Brown-Lipe-Chapin has been that they have owned approximately one-half of the stock, the remainder being held by C. W. Mott and his General Motors associates.

This latest purchase gives the United Motors Corp. a strong array of seven large progressive manufacturing organizations, each of which is continued as separate manufacturing concerns. The list to date includes: Hyatt, New Departure, Delco, Remy, Perlman, Klaxon and Brown-Lipe-Chapin. Some conception of the magnitude of these different concerns may be had from detailed figures on each.

The Dayton Engineering Laboratories occupies seven buildings and has 11 acres of floor space. Last year it produced 142,500 Delco installations and aims at 250,000 for next year. On July 15, 500,000 Delco installations were in use.

The Hyatt Roller Bearing Co. occupies twenty-one buildings with a total of 900,000 sq. ft. floor area. It employs 5000 persons and has a daily capacity of 40,000 roller bearings. Over 7,500,000 Hyatt bearings were furnished to the automobile industry in 1916 and it is estimated that 10,000,000 will be furnished for 1917.

The New Departure Mfg. Co. is manufacturing 21,000 bearings per day and by July 1 hopes to have capacity for 30,000 to 35,000 per day. The company is at present operating two factories, the major one at Bristol, Conn., and one for small bearings at Hartford, Conn. Its factory capacity will be doubled by July 1.

The Remy Electric Co. has a plant of twent-nine buildings with a floor area of 169,000 sq. ft. or equivalent to 4¾ acres. The present output is 950 ignition systems per day to which must be added 400 generators and 350 starting motors. This year's production will total 410,000 ignition systems and 125,000 starting and lighting systems.

The Perlman Rim Corp., a recent incorporation, followed the court decision on the Perlman rim patent rendered some months ago. The company secured the plant of the Jackson Rim Co., the capacity of which is being doubled, to give a total floor area of 129,400 ft. Some months ago the factory capacity was 2000 sets of rims or 10,000 individual rims per day. This capacity is being increased by new buildings which are now in course of construction.

The Brown-Lipe-Chapin Co., making differentials entirely, employs upward of 2000 workmen, and is the largest differential making concern in the world.

Lovell-McConnell Mfg. Co., manufacturer of Klaxon horns, was purchased in September, and plans made to double the production schedule.

and a convertible five-passenger sedan at $1,095. The sedan is a convertible type in which the roof is permanent and the windows and door fillers can be removed and put out of sight in a compartment back of the rear seat. Both cars are mounted on the standard Allen chassis.

—

Five Moon Closed Models

ST. LOUIS, MO., Oct. 12—The Moon Motor Car Co., this city, will build five closed body models which will be ready for delivery in November, as follows:

Model 6-43—touring with demountable top, $1,450.
Model 6-43—cabriolet, seats three people abreast and one on drop seat, $1,850.
Model 6-66—cabriolet, seats three people abreast and one on drop seat, $2,150.
Model 6-66—coupe, seats three people abreast and one on drop seat, $2,150.
Model 6-66—sedan, with sloping windshield, single door at each side, and seven-passenger capacity, of Springfield metal body type, $2,250.

—

Firestone Holds Sales Convention

AKRON, OHIO, Oct. 15—The Firestone Tire & Rubber Co., this city, is holding its annual sales convention this week, starting Oct. 17 and continuing for 3 days. About 500 salesmen and agents of the company will be in attendance.

—

Packard Opens Used Truck Department

NEW YORK CITY, Oct. 18—The Packard Motor Car Co. of New York, has opened a used motor truck department at 239-241 West Fifty-sixth Street.

New G. E. Rectifier at Show

—

Small A.C. Device at Electrical Exposition Uses Argon —Other Exhibits

NEW YORK CITY, Oct. 14.—Several new things of interest to automobilists are exhibited at the Electrical Show at Grand Central Palace. One is a new small-capacity alternating current rectifier shown by the General Electric Co. An entirely new principle is used, the gas in the bulb being argon instead of mercury vapor. It has several advantages over the mercury arc rectifier. It is inherently self-starting; 25 per cent cheaper to build and operate; slightly more efficient; more compact; requires less auxiliary apparatus, and most important of all, it can be made in very small sizes, for charging even a single storage battery. At present it is made in two capacitles, 2 and 6 amps. The smaller delivers 1 amp. at 15 volts or 2 amps. at 7.5 volts. The price is $14. The larger is 75 volts and will charge up to thirty cells or ten three-cell batteries. It is equipped with an ammeter and sells for about $100.

Detroit Electric Lowers Price

The price of the Detroit electric has been reduced to $1,775, and a four-passenger body fitted, seating three on the rear seat. In all essential details the machine is the same as its predecessor. It has a forty-two-cell battery, wheelbase is 100 in., tires are 34 by 4½. Standard color is cobalt blue with wire wheels in white, cream, red or blue, as desired by the purchaser.

New 6-Ton G. V. Truck

A 6-ton heavy-duty truck is a new model shown by the General Vehicle Co., L. I. City, N. Y. It has a particularly convenient demountable battery cradle which is so designed that it may be removed either by dropping into place or sliding out to one side. Its speed is 6 m. p. h. and it will operate about 30 miles on a charge, having a forty-four-cell G. V. X. battery. Price is about $5,300 with body. An interesting feature of the body shown, which was for delivering coal, was the use of a Wood hydraulic hoist, driven by an electric motor, permitting the driver to raise the body and discharge its load without leaving the seat.

—

Hupp Tour Reaches Far West

DETROIT, MICH., Oct. 16—The United America Hupmobile is nearing Seattle after traveling over snow-covered mountains on the trail between Billings, Mont. and encountering several heavy storms. After reaching Seattle the tourists will turn southward and travel as far as Los Angeles.

N. Y. S. A. E. To Discuss Aluminum

(*Continued from page* 643)

universal employment of aluminum.

Concerning aviation motors, the employment of aluminum is carried to the limit. A word or two is devoted to the comparison of the aluminum with the pressed steel construction being tried out on a few experimental motors. Mention is made of the trend toward having the crankshaft lie well within the case, that is, with the crankshaft center line well above the plane of the bottom of the case. The advantages of the cast aluminum band over the steel stamping are mentioned.

The next matter considered is the use of aluminum in the rear axle. Prophecy is made that a great deal more attention is going to be devoted to this question of the reduction of unsprung weight within the next 2 or 3 years than ever before.

The balance, and by far the greater part of the paper is devoted to the employment of aluminum for cylinder construction. The matter is considered historically at the outset. It is pointed out that apparently Europe has stolen the march on this country in the actual production in quantity of aluminum motors, the Hispano-Suiza motor being cited.

A paragraph or so is devoted to answering various questions that have in the past been asked regarding the differences in behavior between an aluminum and a cast-iron motor. The discussion of types of motor is then taken up. Practically every conceivable type of motor has been made, poppet valve, rotary valve and sleeve.

Pistons come in for some attention. That the aluminum piston is the ultimate is very strongly emphasized. Troubles which developed with them are characterized as growing pains. The tendency to carry weight saving to the limit in the aluminum alloy piston is deplored and a saving of 100 per cent should be well worth while. The advisability of the employment of a long piston is receiving attention. The rule is laid down that the length should be equal to 1 1/3 the piston diameter proportions which were advocated in a paper given by the author last November before the society. The motor should be built around the piston and the employment of aluminum pistons should not be an afterthought.

Some little space is devoted to the employment of cast aluminum panels in motor car body construction. The advantages that this type of construction possess are touched upon.

The minor aluminum castings used about a motor car are given some consideration, more particularly the aluminum brake shoe is discussed. A paragraph or so is devoted to the comparative machining of aluminum and cast iron together with some allusion to relative costs. The paper is concluded with a few do's and don'ts that the engineer should bear in mind when designing an aluminum structure. Great stress is laid on the wisdom, in fact, necessity that the engineer should at all times be in very close touch with the foundry when designing structures of this sort.

In the concluding paragraph the fact that the output of aluminum is from 283 lb. in 1886 to 136,400,000 lb. in 1914 is mentioned and an analogy is drawn between that and the development of iron. The paper is accompanied by eighty lantern slides emphasizing some of the points brought out in the paper as well as showing some of the typical castings being produced to-day.

The Automobile

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Taxicab Design

SOME years ago there was a prevalent idea that the manufacture of taxicabs was going to be a profitable undertaking, but experience soon showed that this was not the case in a general way. At present there is an immense demand for good cabs, and practically no supply worth talking about.

The taxicab stands half way between the private car and the truck. It must be capable of being handled roughly, yet it has not any great loads to carry. It must have an engine that will be economical of fuel and the chassis and body must be light enough to permit a good tire mileage without being so light that they will give way under the bumps and bangs of taxi chauffering.

More than one taxicab company has tried many sorts of standard touring chassis, and found weaknesses in them all, with the result that it is not uncommon to find these concerns now building their own cabs, using some stock parts and some special ones.

In Europe, much the same state of affairs prevails. The most successful taxicab company in the world is in London. Originally it equipped with French and British chassis costing about $2,000 each, and built special bodies for them. Then, as weakness developed, the repair department was enlarged into a factory, and new parts made to new design, the resulting vehicle being a compromise between the British and French originals with new engineering added.

A taxicab cannot be built cheaply if it is to remain in use for year after year. The service calls for the best workmanship and the best materials, but there should be room in the American industry for a taxicab specialist manufacturer who is not afraid to ask $2,500 for his cab, or even more.

More Standards

THE session of the S. A. E. standards committee, held at the Bureau of Standards, in Washington, on Oct. 18, is not, in many ways, the most important yet, because, for one thing, the number of new proposals to be passed upon is not great. Still, the place of meeting will mark the occasion in the annals of the society.

Engineering standardization began as a thing altogether separate and apart from National standardization. There is a fundamental difference between the standard of money and the S. A. E. carbureter flange standard, for example. However, some engineering standards are national, like the U. S. screw thread, and more will be in the future.

Standards which are law, and hold for all time, are one thing; standards which are custom by agreement, and may have to be changed from time to time, are different; but there is no sharp dividing line. The enormous amount of work done in the past 10 years by engineering societies is obtaining recognition by the governments of the world; governments and the engineering industry are helping each other more than ever before.

Of the total of work done by societies, that belonging exclusively to the S. A. E. stands very high, and lately the S. A. E. and the Bureau have had to consider common subjects simultaneously, and it is probable that the relationship will be much closer in the near future.

The Spotlight

THE use of a spotlight has for many years been forbidden absolutely by the law of Great Britain, because of the power for annoying other road users that it gave a driver. There are signs that similar prohibition may be adopted by several of the States in the Union for the same reason.

The situation is regrettable. The spotlight is really very useful. For reading a sign, for examining a turn in the road, or for driving on a very bad and dangerous highway, where a strong light on the edge of the road is necessary, the spotlight is ideal. If it were only used in this way, in the way its originators intended it to be used, we should hear no complaints; but as things are, the avoidance of a difficult situation appears almost impossible.

The abuse of the spotlight is complicating the glare problem to quite a perceptible extent; it is making the work of those who are really solving the glare matter harder than it needs be. What a pity it is that the abuse of a good thing by a minority of fools should place its existence in jeopardy!

Resta Wins 250-Mile Grand American

Averages 103.99 M.P.H.—Aitken 6.93 Sec. Behind

Aitken, DePalma, Resta and Hughes in a brush early in the race

Prize Winners in the Grand American Race on the Chicago Speedway

Car	Driver	M.P.H.	Prize
Peugeot	Resta	103.99	$6,000
Peugeot	Aitken	103.65	3,000
Maxwell	Rick'bacher	102.08	1,500
Premier	Lewis	98.37	1,000
Maxwell	Henderson	98.34	900
Premier	Galvin	97.81	800
D'senberg	Devore	90.58	600
Ogren	Burt	86.66	500
Erbes	Gable	81.13	400
Hudson	Vail	80.81	300

CHICAGO MOTOR SPEEDWAY, Oct. 14—By the narrow margin of 6.93 sec. Dario Resta continued his unprecedented record of winning every big event on the Chicago Speedway to date. In to-day's 250-mile Grand American race he finished victor with this slender lead over John Aitken, thereby getting back first place in the ranking for the speedway championship of the season. Winning to-day's race, the closest ever witnessed on this speedway, gives Resta 3200 points, while Aitken, who was in the lead up to this afternoon, is now second with 2940. Resta broke his own record of 97.70 m.p.h. for 250 miles on this track.

The race resulted in a three-cornered battle for supremacy between Resta, Aitken and Rickenbacher, who finished third. Resta made but one stop at the pits, changing a right rear tire and taking on gasoline at the 190th mile in 28 sec. This was neither as thrilling nor as costly as Aitken's only pit visit, which occurred shortly after. With a lead of only half a lap over Resta, Aitken blew a right rear and, fearing delay, headed for the pits at terrific speed. Opposite the judges' stand his car started to skid and rocked from side to side till it slid sideways up the track a distance of 100 ft. past the pit, turning completely around. Aitken threw in low gear and shot up to his pit from the wrong direction. Despite the excitement his pit crew changed the tire with the car facing the wrong way and sent him away in 30 sec. But Resta had taken advantage of his opportunity and was well in the lead, a lead which Aitken could not overcome for long though he forged to the front for a brief interval later in the race, the cars running wheel-to-wheel for the last 50 miles.

Rickenbacher's Maxwell was third, 1 min., 29.15 sec. behind Aitken, although his car was not running very well at the start of the race. Lewis, in a Premier, was fourth, with Henderson's Maxwell, Galvin's Premier, Devore's Duesenberg, Burt's Ogren, Gable's Erbes and Vail's Hudson following him across the tape in the order named. Rawlings in the West Duluth was flagged, covering almost the entire distance on three cylinders. Buzane was also flagged.

All track records were smashed up to the end of the first 40 miles by DePalma, who averaged 105 m.p.h.

The race was between the four favorites, Aitken, Resta, DePalma and Rickenbacher, and DePalma led for 120 miles

The Big Four of the race, Rickenbacher, Resta, DePalma and Aitken

Photo by International Film Service
As the race drew near its close, Resta led with Aitken second and Vail third

in one of the most closely fought contests ever seen on an American speedway until he lost first place to Aitken on account of a tire change and then dropped back to third through two stops caused by a broken valve which was the ultimate cause of his withdrawal.

One Serious Accident

One accident marked the day's event and one which may cause the death of Ralph Hetlich, mechanic for Wilfred D'Alene, driving the Crawford. D'Alene came into the pits at the end of his 15th mile for gasoline and the excited pit man spilled gallons of gasoline onto the track under the car and finally some of it, when the funnel was knocked off, was ignited by the exhaust. The car and the gasoline below it burst into flames which rose to 10 ft. in the air. Hetlich's clothing was splattered with burning gasoline and, temporarily crazed by the pain, he ran up the track toward the judges' stand. Here he was headed off by some of the officials who forced him into the dirt under the judges' stand and wrapped coats about him until the burning clothing could be torn off. He was rushed to the hospital and hope for his recovery is held out, although he is very seriously burned.

Billy Chandler, captain of the Crawford team, also was burned about the hands and throat and the back of the head. It was necessary to force him into the ambulance as, in spite of his injuries, he insisted on endeavoring to help Hetlich.

The fire about the Crawford car was put out in 3 min. by the rapid and efficient work of the J-M fire extinguisher crew which, in spite of the fact that it had to run the entire length of the pits to reach the burning car, subdued the flames before great damage had been done to it.

While the car was still hot and smoking from its inundation in flame, D'Alene again took the wheel with a substitute mechanic and resumed the race. He circled the track once but was forced to come in with the brake bands still burning to change one of the rear wheels whose tire had been damaged by fire; also, to make another attempt to fill the gasoline tank. D'Alene was able to make only four laps more before the scorched car was pushed down the track with a broken driveshaft.

DePalma Takes Lead

The actual start after the preliminary lap was a very pretty one, the line being well kept for the getaway. Aitken led at the end of the second lap but DePalma took the lead at the third lap, having passed Hughes, Resta, Henderson, Wilcox and Aitken in a 2-mile spurt that brought the grandstand spectators to their feet. The order at this time was DePalma, Resta, Aitken and Hughes, with a gap beginning to open up between these four leaders and the rest of the field, all of whom were leaving Gable and Buzane some distance in the rear. At the end of the first 10 miles Gable, whose car was missing badly, was lapped in front of the grandstand. Wilcox and Henderson had crawled up until they were respectively second and third to DePalma, with Aitken, Hugher, Resta and Rickenbacher following in order.

D'Alene again began to show among the leaders and at the end of 14 miles was well up to the front. The speed was too fast for him and he did not maintain his position long. Before 20 miles were gone the speed began to tell on some of the cars and they began to come into the pits, Burt's Ogren being docked temporarily first, and followed shortly by Buzane in the Duesenberg and Vail's Hudson.

The pace was a terrific one, DePalma's time for first 20 miles being 11 min. 34 sec., with Resta, Hughes, Aitken, and Rickenbacher all close at his heels. Resta's time was only 2 seconds slower than DePalma's, while Aitken was running half a length behind. Rickenbacher, D'Alene, Hughes and Burt were all very close up.

During the next 10 miles Aitken and Rickenbacher passed Hughes and the order then was DePalma, Resta, Aitken and Rickenbacher. DePalma was being sorely pushed, the three Peugeots running so close together that there was not a car length between DePalma and Aitken. Rickenbacher was 100 yd. behind. All were traveling at better than 103 miles per hour. Hughes went out with a broken valve spring in the 32nd mile. It was this that caused him to lose his position during the few miles previous. Hughes asked of the car more than it would stand, and while he made a wonderful showing for the first 25 miles the mechanism would not stand the speed he called from it.

A Four-Cornered Race

For the next 70 miles the four-cornered race between the leaders continued, with the speed slowly increasing, and lapping car after car as the three blue Peugeots and the white Maxwell fought for the lead. But DePalma was never headed in the first century. At 40 miles the time was 23:3.65, a speed of 105 miles per hour. At 50 miles it was 29:50 sec., approximately the same speed.

After the accident to D'Alene's car the speed dropped somewhat for a time but again picked up. At 70 and 80 miles the speed had dropped to 102 miles per hour. Rickenbacher was the first of the quartette to show the effect of the terrific speed, having to come into the pits at about 76 miles for a right rear tire. His pit work was very fast and his time lost slight, not enough to cause him to lose his fourth position. At 80 miles the order of the first ten was as follows: DePalma, Resta, Aitken, Rickenbacher, Wilcox, Devore, Milton, Henderson, Klein and Lewis. DePalma's time for this distance was 45:25, a speed of little better than 102 m. p. h. At 90 miles the order was practically the same throughout, and the speed increased slightly to 102.5 miles per hour. DePalma was still leading at the 100-mile point and his time was 56:58.41, a speed of 105.2 m. p. h. DePalma came in shortly after this, making his first stop and changing a right rear tire. This caused him to drop back into third place, as Resta and Aitken both passed him.

Rickenbacher was improving his opportunity to make up time lost by his stop and still further increased his speed,

when he saw DePalma at the pit, making laps at 106 m. p. h. as he forced his car to its utmost.

Resta Sets the Pace

With DePalma temporarily out of the lead, Resta set the pace with Aitken close at his heels, so that at the 120-mile mark Resta was leading, Aitken second and DePalma third, with Rickenbacher a bad fourth. The time at this point was 1:08.22, a speed of 105 m. p. h.

The terrific pace brought Resta in to the pits on the next lap for supplies, taking on gas and changing a right rear tire. The pit work was very fast, Resta being held only 28 sec.

Aitken had not stopped as yet and the two halts by the leaders put him in the front. This he held for the next 70 miles. Resta's stop let DePalma overtake him so that the Italian was pushing Aitken for first with Resta and Rickenbacher following. From the 140-mile point until after approximately 190 miles had been covered he came in with his engine missing badly, and after a lap or two withdrew with a broken valve.

Aitken's Narrow Escape

Almost at the same time Aitken very nearly ended his chances for finishing the race when, in coming in with a flat tire for his first stop at the pits, he skidded badly, turning completely around, but by masterly handling kept the car on its four wheels and pulled up at the pits, facing in directly the wrong direction. He was away in 30 sec., but meanwhile Resta had passed him, taking the lead. The old National driver gave the car all it would take when he took up the chase of the Italian and turned several laps in 1:05, a speed of better than 109 m. p. h. At 200 miles Resta was leading, Aitken second, Rickenbacher third, and Wilcox fourth. Resta made the distance in 2:07.01, with Aitken only 2 sec. behind. Rickenbacher was a minute behind the leader and Wilcox was over 2 min. behind having been lapped by Resta and Aitken. Their speed at this point was close to 105 m. p. h.

Resta and Aitken ran neck-and-neck for the 50 miles remaining but Resta was always a nose ahead of the Indianapolis driver, except for one short space, when Aitken succeeded in crowding ahead temporarily. Resta undeniably could have made more speed at this time had it been necessary for him to call upon his car for it.

Slipping Clutches Give Trouble

THE race developed a new ailment. Slipping clutches have seldom held such an important part in speedway races. Ostewig, in the car bearing his name, was in the pits four times, consuming in the neighborhood of 20 min., dosing his clutch with dirt, sand, and finally inserting hack-saw blades to lock it in place. Milton went out entirely with a shredded-clutch facing and it was the claim that Johnny Aitken's speed was reduced throughout the contest by a clutch that persisted in increasing the ratio between the engine and the rear wheels.

There were thirty-nine stops in all, and only eleven of these were for tires. The other twenty-eight went to patch up mechanical difficulties.

As a matter of habit, Resta's one pit stop was made in record time for the meet. He changed a right rear and took on gasoline in 28 sec. This however was a plain slide-in-and-roll-out-again stop, and not as costly or exciting as Aitken's only pit visit, already described, the Hoosier pilot nearly coming to grief as he tried to shoot into his pit at high speed for a new tire. This stop cost him first place.

The Crawford pit, with one of its cars bearing No. 13, suffered about as disheartening a climax as ever occurred in a Speedway race. After D'Alene took his fire-blackened car back into the race with a new mechanic substituted for the one who was nearly cremated and drove a few more laps a connecting-rod let loose and he was out for good.

On the same lap, Klein's Crawford split a crankshaft and the havoc it wrought in the motor is probably beyond repair. The whole crankcase assembly was literally torn to fragments.

The fire in Devore's Duesenberg can also be attributed to carelessness. He stopped for a tire and the motor did too. The mechanic tried to crank the motor again, and as it would not start he opened the hood and attempted to tickle the carbureter. Instead, he knocked off the cap of the float chamber, the float shot out and the explosive fluid poured itself generously over the car and track. When the motor was cranked, the gasoline-loaded cylinders backfired through the carbureter and started the fireworks. Fortunately it all took place directly in front of the J-M extinguisher pit and these overworked fire-fighters made quick work of it.

Ralph DePalma went out with a broken valve. This Peugeot has been a particular offender in valve trouble, Mulford having run up against the same thing when he drove the car. It is getting to be a conventional statement that Ralph goes out with some part of his motor broken and many race fans have ventured to ask "Where is the DePalma of a year ago?" The veteran driver once carried the reputation of humoring his car in the early part of a race and leaving his spurt for the last. His tactics throughout the 1916 season have been just the reverse, and there does not seem to be a car built that will stand his Burman-like driving.

Other Mechanical Troubles

Again Buzane's Duesenberg sprung a leak in the water pump. This car has this particular trouble as regularly as the starting flag is waved. In to-day's race it was even worse than ever and the water which spurted from the leaky pump packing found its way into the carbureter and caused four pit stops.

Wilcox, another of the Peugeotic contenders, experienced a typical DePalma last hour demise when he rolled into the pits with one lap to go with a broken rod. He was then running in fourth place which made the faulty connecting-rod an expensive investment.

Ira Vail, who drove his battery-ignited, starter-equipped

(*Continued on page* 673)

Hetlich, D'Alene's mechanic, in flames on the track

Value of Rating Formula Limited

Can Never Involve Any but Qualities Capable of Mathematical Measurement—May Be Useful to Engineers and a Few Car Buyers—Detroit S. A. E. Discusses Fishleigh's* Paper

By J. Edward Schipper

DETROIT, MICH., Oct. 14—The Detroit section of the S. A. E. is agreed that it is impossible to measure all that is meant by the term "Car Performance" in a single formula. This is perhaps not a new idea, but it was certainly crystalized in the discussion following the reading of Professor Walter T. Fishleigh's paper on Automobile Performance and Methods of Comparison at the monthly meeting of the section last night.

Everyone present agreed that it is possible to get a formula that will act as a very satisfactory basis of comparison. The mathematical factors of comparison—speed range, accelerative ability and fuel economy—are basic and can be so treated, but all other things, such as comfort, either mental or physical, ease of control, etc., cannot be embraced by a mathematical expression.

Eliminating the important comfort factor of course removes a large part of the value of a rating factor as far as the average individual that buys a car is concerned, but it in no wise affects a great many points of value which such a formula may have for the engineer or even a car-educated buyer who carries his investigations further than what he would secure from a demonstration. The mathematical factors which remained unscathed by the discussion and which would be above criticism in the rating or performance comparison were those of speed range, accelerative ability and fuel economy.

Whether or not these should be all combined into one figure was a matter considerably open to debate, as it was pointed out that by combining them the relative value of each term was forgotten and therefore they should be allowed to stand in their original form so that a man who was buying a car by this rating method would be able to give greatest weight to either speed range, acceleration or economy. The three factors were called in Professor Fishleigh's paper, *S*, *A* and *E* respectively, being also the initials of the Society.

Professor Fishleigh is a member of the standards committee of the S. A. E., and since one of the divisions of the committee to which he is attached has in hand the matter of determining a standard S. A. E. rating formula, the paper and its discussion take on considerable significance. The question seems to have two sides: first, what is the rating formula for; and second, the determination of the formula.

Last night's meeting seemed to settle the first point very satisfactorily, and summed up in a nutshell it may be stated that the rating formula is for the purpose of comparing the combined factors of performance which are capable of mathematical measurement.

The second part of the question was not so clearly solved, as there was no general agreement on all the factors that should be involved in the final result. The latter difficulty, though, is certainly more easily overcome than the first seemed to be, and a number of formulæ that were satisfactory to 500 members in attendance were offered, particularly by C. T. Myers of the Timken Co., C. C. Hinkley, chief engineer of the Chalmers company, and K. W. Zimmerschied, engineer of the General Motors Co.

Automobile Performance and Methods of Comparison

By Walter T. Fishleigh*

IN general, factors which make for good car performance have come to be more or less agreed upon. In general, the tests which show the degree of car performance or car ability are pretty well recognized, and there is little doubt that if a new model were to be handed over to any committee of three selected from this meeting to-night with instructions to try it out for general performance, approximately the following tests or their equivalent would be made.

1. The car would be driven upon good pavement to determine its range of operating speed, that is the lowest and highest speed at which and between which the engine and car operate steadily and successfully.

2. The acceleration would be tried out, probably starting at the lowest steady operating speed and determining the time necessary to accelerate to its maximum speed, or perhaps the test would be run between two arbitrarily set limits, as from 5 to 55 m.p.h.

3. The car would be tried out on steep grades or hills. This test would involve both high gear work at different speeds, and operation in the gears.

4. Tests would be made upon the road or upon a speedway to determine fuel economy; that is, miles per gallon of gasoline. Economy runs have often been made and advertised as under "average touring conditions," but upon consideration it will be manifest that economy runs, to be scientific, definite and comparable, should be run at a number of definite speeds, as for example, 10, 15, 20, 25, 30, 40, 50 m.p.h. The results will give an economy curve, which tells the complete story of economy at various speeds. An average fuel economy may be found from this curve, but the detail curve itself is not only desirable but necessary.

5. The car would be run over good, bad and indifferent roads, at various speeds, and going through various maneuvers, for the determination of riding comfort. This factor is the resultant of many items in design, such as weight, wheel base, spring suspension, engine characteristics, body and seat design, etc. If carried to the theoretical limit, it is an exponential function also of the way an engine pumps

*Professor Automobile Engineering, University of Michigan.

oil and soots the spark plugs, the kind of gear shift employed, the number of punctures per tire per mile, and the percentage rise in small-town hotel prices when the driver pulls up with a particular make of car and applies for accommodations. These latter, though important, may be neglected in the present discussion.

Summing up the above, we may assume that for completely trying out car performance, tests would be run for the determination of (1) range of operating speed, (2) acceleration, (3) hill climbing ability, (4) fuel economy in miles per gallon, (5) riding comfort. It is proposed that acceleration tests be agreed upon as the standard factor in car performance for indicating excess draw-bar pull. Complete performance then becomes the resultant of the following four factors:

1. Speed range
2. Acceleration
3. Economy of fuel
4. Riding comfort

The application of each of these factors needs hardly to be argued; whether there should be more or fewer of them is open to argument.

Expressing our discussion mathematically, we may write:

Automobile performance varies directly as speed range, acceleration, economy of fuel and riding comfort.

$$\text{Automobile performance} \propto S.A.E.C.$$

Where S = speed range in high gear, in miles per hour
A = average acceleration of car in feet per second per second over the complete range of its operating speeds.
E = average fuel economy, over the complete range of its operating speeds, in miles per gallon.
C = riding comfort factor, which must be determined by each individual judge.

It is manifest that complete car performance or car ability, on account of the item C, cannot well be determined once for all by rigid tests, nor estimated in any simple and practical way. The one item C must be left to personal judgment, if not to personal eccentricity. In considering car performance, however, the other items ($S.\ A.\ E.$) are each susceptible of scientific determination and measurement, and their combination when obtained, while not giving the complete expression and answer for car performance, still affords a valuable comparison for cars and constitutes what might well be called the Automobile Performance Factor.

$$\text{Automobile Performance Factor} = S.A.E.$$

When considered from the standpoint of this three-fold "Automobile Performance Factor," different cars can be definitely tested, a definite value for each item in the factor obtained, and relative performance quantitatively rated as regards speed range, acceleration and economy of fuel. For the engineer, the manufacturer and the buying public this factor affords a ready and reliable means of comparison of car performance, and an investigation of the three items, which go to make up the complete factor, leads at once to comparative values in the details of performance. Illustrating the application of this automobile performance factor, suppose we have two cars; the first with speed range 10 to 50 m.p.h., acceleration from 10 to 50 m.p.h. in 30 sec., average miles per gallon 20; the second with speed range 5 to 65 m.p.h., accelerating from 5 to 65 m.p.h. in 20 sec., average miles per gallon 10.

$$\text{Automobile Performance Factor} = S.A.E.$$
$$\text{For first car} = 40 \times 20 \times 2 \quad (=1600)$$
$$\text{For second car} = 60 \times 10 \times 4.4 \ (=2640)$$

The value of this factor, or more properly the value of the three items in the factor, coupled with a consideration of item C (riding comfort), leads to accurate estimate of complete car performance or car ability and should form a sound basis upon which to judge the car as an operating unit. Indeed, we may individually go even further, assign a relative percentage value to the comfort factor C, multiply our car performance factor by it, and obtain at once a figure for each car which represents complete car performance or car ability. Some question may rightly be raised as to the relative weight which should be given each of the items S, A and E in the factor, but after extended consideration, it would seem that from the standpoint of importance to the operator, no better than equal weights can be assigned. In this factor, the item "car weight" does not appear separately, but indirectly exerts its influence upon S, A and E. In each case the penalty for increased weight appears in a reduction of the value of acceleration, mileage per gallon of fuel and speed range, the effect upon the final automobile performance factor being marked. It must be clearly emphasized that the items in the performance factor have reference solely to performance of the car as it stands, as an operating unit. The relative advantages of the seven seats of the touring car as compared with three in the roadster, the riding qualities of the heavy car as compared with the light car, the operation of the twin-six engine, as compared to the four or six or eight of equal horsepower, the advantges of the limousine body as compared to the touring car—all these are matters to be settled in a preliminary consideration or to be included with proper weight in the riding comfort, item C. The factor is of particular value in comparing the relative performance of two cars of generally similar characteristics. Nor is it desirable to compare, from the standpoint of performance, widely different structures such as the pleasure car and the truck, vehicles designed for entirely different service, in which the various items which go to make up car performance have entirely different relative values. Indeed, the performance factor for the commercial truck may be quite different and a subject for separate consideration.

A simple and thoroughly accurate acceleration test has been proposed as follows: The car is brought to its lowest successful operating speed and driven at that speed to the starting line of a measured course, where it is accelerated as rapidly as possible to its maximum speed over this course. Measured intervals are laid off along the course, and at each interval a contact point is located which is operated by a small gate carried under the front axle. At the starting line is located a recording drum, revolved by clock mechanism or by electric motor driven by batteries. Writing its record upon this drum is a small marker, which is electrically operated by a calibrated clock and which registers time elapsed in seconds or half seconds. Another marker is electrically operated by each of the various contact points along the course. Thus is obtained an accurate record of the time for traversing each of the measured intervals along the course. From this data, an accurate determination of accelerations at the different speeds can be had, either by means of curve plotting or by calculation. The final acceleration curve will show accelerations in feet per second per second of the car at each speed of its range.

Fig. 1 shows an acceleration curve from a six-cylinder car, total weight 5280 lb., gear ratio 3 10/13 to 1, size of engine 4½ by 5½ in., wheel diameter 37 in. Fig. 2 shows an acceleration curve from an eight-cylinder car, estimated gross weight 4150 lb., gear ratio 5 1/14 to 1, size of engine 3⅛ by 5⅛ in., wheel diameter 36 in.

Typical curves for fuel economy runs at various speeds are shown in Figs. 3 and 4. The curve in Fig. 3 was obtained from tests upon an eight-cylinder car, 3⅛ by 5⅛-in. bore and stroke, gear ratio 4.5 to 1, tires 36 by 4½ in., estimated gross weight 4150 lb. The curve shown in Fig. 4 was obtained from a four-cylinder car, 3⅝ by 4½-in. bore and stroke, gear ratio 3.58 to 1, tires 30 by 3½ in, estimated gross weight 3000 lb.

Other Ability Formulæ

Many formulæ for automobile performance or car ability have been developed. They differ widely in method of ap-

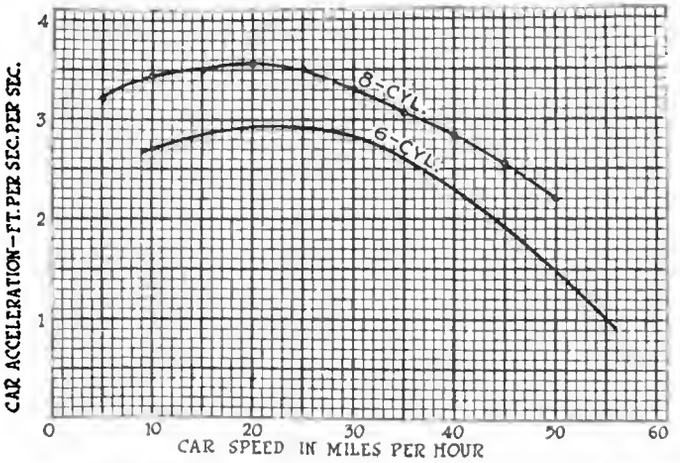


Fig. 1—Acceleration curve for six-cylinder car. Fig. 2—Acceleration curve for eight-cylinder car

proaching the question of performance; they differ in the fundamental factors included; in the majority of cases they are efficiency formulæ strictly, developed for estimating, from engine size, gear ratio, weight, wheel size, etc., what the probable performance or probable performance factors of a car will be; in no cases are they as comprehensive as, in the opinion of the author, they should be to cover the ground of performance; in no case are they based entirely upon accurate, scientific tests which determine at once beyond doubt the true values for the factors which make up performance and, therefore, the true value for performance itself. A consideration of the most important of these formulæ will be of value.

(Symbols used in formulæ):

d = diameter of cylinders in inches
s = stroke in inches
n = number of cylinders
r = gear ratio
D = diameter of wheels in inches
W = gross weight of vehicle in pounds
M = average fuel economy, in miles per gallon
P = horsepower of engine, at a given speed.

1. $\text{Ability} = \dfrac{P r}{W D}$.

This simple formula is one of the oldest and perhaps most widely known for estimating so-called ability. Its mathematical value has a direct physical interpretation, in that at a given speed for cars of equal transmission and rear axle efficiencies, it will be proportional to total draw-bar pull per pound of weight. For cars of different transmission and rear axle efficiencies, the formula becomes more or less inaccurate. Acceleration or hill climbing ability of a certain car at a given speed, however, is proportional to excess draw-bar pull per pound of weight over that necessary to propel the car at the given speed as discussed above, so that even as an estimate of this one factor in automobile performance, this formula is hardly tenable. For two very different cars, such for example as a limousine and a speedster, the total draw-bar pull per pound of weight may be the same, yet the excess drawbar pull per pound of weight (and, therefore acceleration and hill climbing ability) be quite different, especially at comparatively high speeds. The use of this formula as is customary, by the mere substitution of maximum engine brake horsepower for P when two cars are being compared, is of little, if any, value. If maximum torque were used, instead, we should come nearer relative hill climbing and acceleration abilities, but even then the results would not be directly comparable. As a formula for estimating complete automobile performance or ability, it does not include the three factors, speed range, fuel economy and riding comfort. As a formula for use as an automobile performance factor it does not include speed range or fuel economy, and is not strictly correct for acceleration or hill climbing ability.

2. $\text{Vehicle Coefficient} = \dfrac{8 n d^2 s r}{D W}$ —(Myers, 1915).

3. $K = 14550 \dfrac{d^2 s n r}{D W}$ —(Roebuck, 1912).

4. $Q = 3000 \dfrac{d^2 s n r}{D W}$ —(Thomas).

The close similarity of the above three formulæ will be manifest and they may be considered together. Mr. John Younger has pointed out that "these three formulæ represent piston displacement per pound moved 1 ft., and on the reasonable assumption that every cubic inch of piston displacement represents so many foot pounds of energy, these formulæ give a measure of a car's ability. The greater the displacement per pound moved 1 ft., the greater should be the car's ability to speed, to climb and to accelerate on the particular gear reduction considered." From another viewpoint each of these three formulæ represents total drawbar pull per pound of weight. These formulæ like No. 1 may be of value in estimating total draw-bar pull for cars of the same transmission and rear axle efficiencies, providing their engine efficiencies are equal. Considered as formulæ for approximating acceleration or hill climbing ability, practically the same difficulties appear in the use of these formulæ as in the use of No. 1. The constants in these formulæ are the result of a number of assumptions, which in widely different cars do not hold. The constant 8 in formula No. 2, for example, is based upon the assumption that "all motors will develop a torque in pounds at 1 in. radius equivalent to that of their N. A. C. C. horsepower rating," and that the product of engine efficiency by transmission efficiency "for the average well built car will be about 95 per cent." Even aside from these assumptions, these formulæ give us merely an approximate estimate for total draw-bar pull per pound of weight. In no way are speed range, fuel economy or riding comfort taken into account.

5. $\Sigma = \dfrac{1}{10} \dfrac{d^2 s n r M}{D}$ —(Thomas, 1913).

The above so-called "Sigma Formula" differs from the other formulæ considered in that the factor M (average gasoline consumption in miles per gallon) is included. This M is determined by complete tests and is evidently a proper and reliable factor in performance. The remainder of the formula considered alone $\left(\dfrac{d^2 s n r}{D}\right)$ represents piston displacement per foot the entire car is moved, or from another viewpoint it represents total approximate draw-bar pull. In nowise, is acceleration or hill climbing ability proportional to total draw-bar pull, regardless of weight and the draw-bar pull necessary to propel the car at any given speed. The difficulties encountered with this part of this formula are, therefore, as serious as those for formula No. 1, only more so. Only where cars have the same engine, transmission and rear axle efficiencies, will a formula based upon motor dimensions, gear ratio and wheel diameter give a reliable approximation for total draw-bar pull, and this total draw-bar pull is not, in general, a measure of the acceleration or hill climbing abilities of these cars. In this formula, no account is taken of speed range. The curve obtained, however, by plotting values of Sigma for a car at various speeds as shown in Fig. 5, is extremely interesting. This curve was obtained from comprehensive tests upon a six-cylinder car, bore and stroke

5 by 7 in., gear ratio 2.88 to 1, wheel diameter 38 in., estimated total weight 5900 lb.

6. Ability $= \frac{D}{W}$ —(Brush, 1916).

Where D = excess drawbar pull at any speed over that necessary to propel the vehicle at that speed.

This formula, which may be interpreted as representing excess draw-bar pull per pound of weight, gives an accurate measure of hill-climbing ability, an approximate measure of acceleration. It has been proposed that this excess draw-bar pull D at any speed be determined directly by test upon a level course or speedway by attaching a special dynamometer car or attachment to the rear of the car under test and by means of brakes on the special car, control the speeds. If such special car and dynamometer can be devised, and if the dynamometer under the conditions of high speed incident to such tests were to give substantially steady readings which could be relied upon, this method would be direct and acceptable for the determination of that one item, excess draw-bar pull, which in automobile performance is evidenced by hill-climbing ability or acceleration or both. As a complete automobile performance or ability factor, this formula takes no account of fuel economy or of speed range. It is suggested that this $\frac{D}{W}$ value be multiplied by E and then by S, for the complete factor. On the assumption that the proposed tests for $\frac{D}{W}$ values can be successfully carried out, the proposed factor would seem to be satisfactory.

Discussion Full of Suggestions

C. T. Myers, engineer of the Timken company, presided and opened the discussion. He said that Prof. Fishleigh's factor C (comfort) is not susceptible to accurate determination, although the other factors are and the author has accurately analyzed them. There is no attempt to measure the efficiency, but only to indicate it: "A point which will surely be argued," Mr. Myers said, "is the speed range. Another way of looking at this is to use it in a way that will accentuate its effect on the formula by taking the ratio of the highest speed to the lowest. That is instead of subtracting the lower from the highest speed, the highest speed may be divided by the lower."

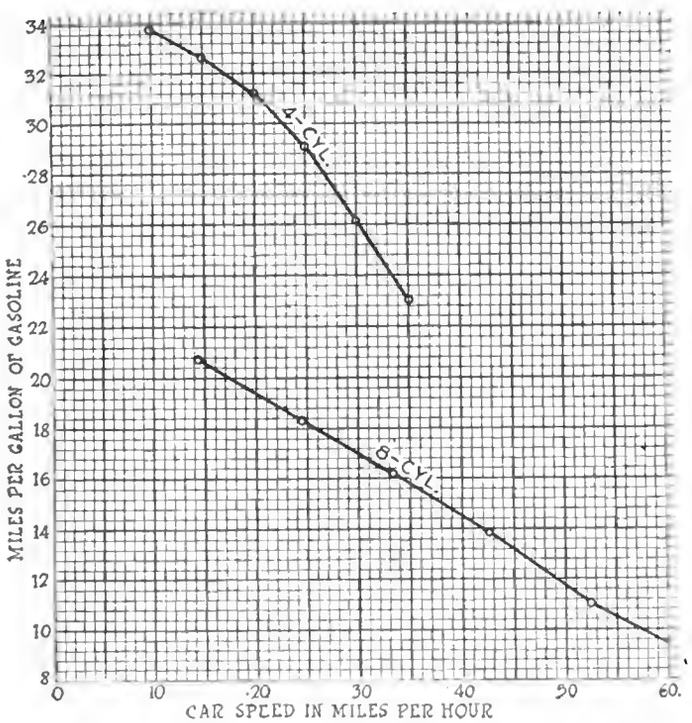


Fig. 3—Fuel economy curve for eight-cylinder car. Fig. 4—Fuel economy curve for four-cylinder car

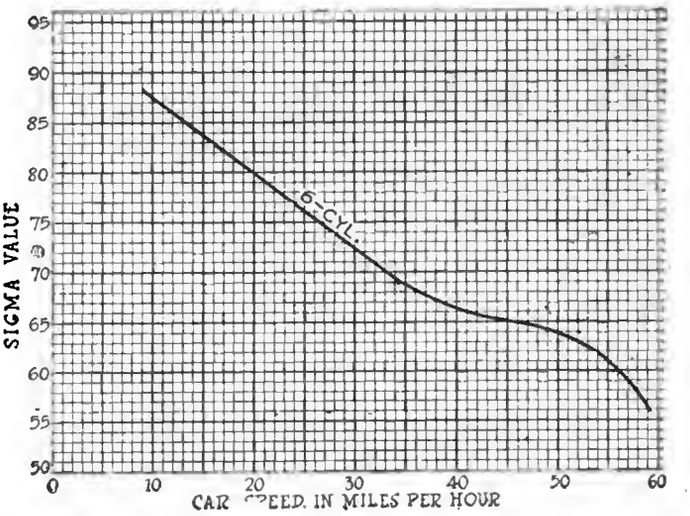


Fig. 5—Sigma values for six-cylinder car sigma formula is $\Sigma = \frac{d^2 s n r M}{10 D}$ in which M is average fuel economy and the remainder of the formula represents displacement per foot of travel

K. W. Zimmerschied, metallurgist of the General Motors Corp., stated that he did not see the necessity for carrying out the multiplication of the factors, as the product does not tell anything. In other words, a man may have an entirely different car and get a product of 2520 in one case and 2500 in another. This is only a small difference in the products, while the cars may be widely different. The real purpose is simply to enumerate the qualities and therefore the product is of no use.

A. P. Brush, consulting motor engineer, said that owing to the efforts of the standards committee to determine a formula, it is necessary that great care be taken in the recommendations. He stated that there are a great many objections to the expression as it stands, i.e., $F = S.A.E.$ "Take miles per gallon," he said. "Is it a factor of performance? It is rather an item in the cost of performance and should be figured with such things as first cost of the car, tire cost and general maintenance expense. Let us also take the speed range factor. According to this method of rating a car that has a range of from 44 to 100 miles an hour on high gear, will be just as satisfactory as one that has a range of from 4 to 60 miles an hour. The object of the high speed engine is to give the user the benefit of low speed performance, and this is important to the average user most of the time.

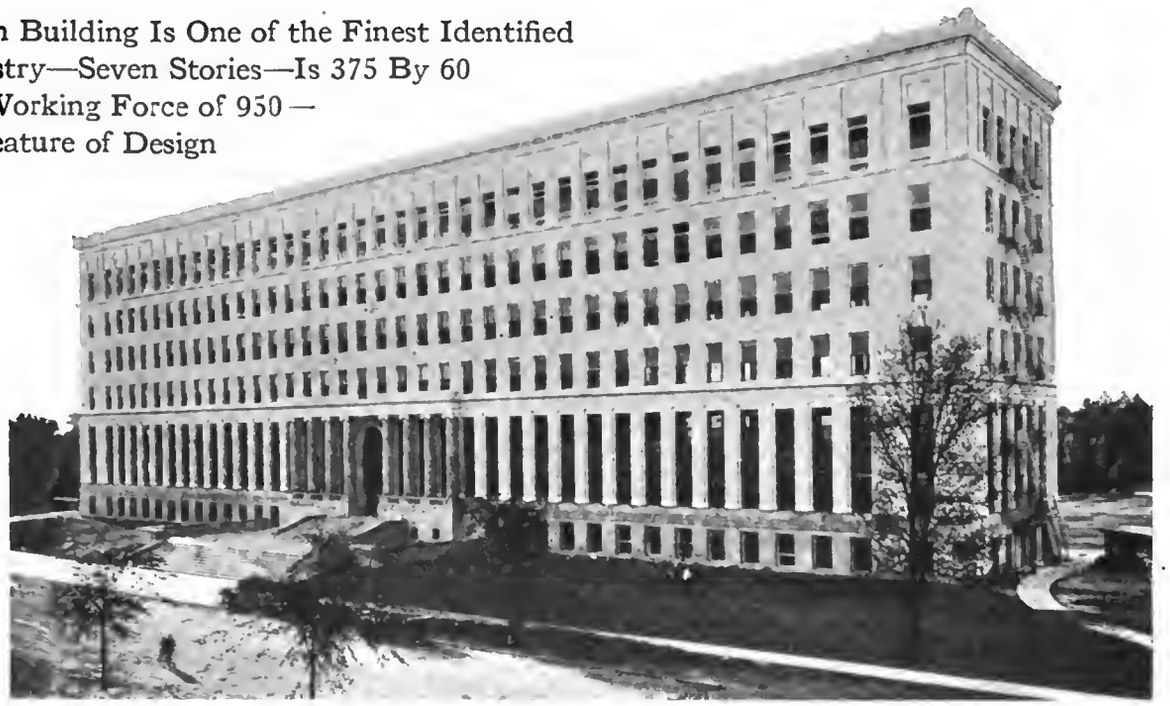
"The $\frac{D}{W}$ (D is excess draw-bar pull at each speer, W, weight) formula is worthy of consideration, as this makes possible the consideration of the speed range as well as the economy.

"Another point that should be settled is what is meant by the lower end of the speed range. You must call the lower end of the speed range that at which the engine will perform smoothly at wide open throttle. The $\frac{D}{W}$ formula is a direct expression of the sine value of the hill that the car can climb."

(*Continued on page* 667)

Willys-Overland's New Headquarters

Administration Building Is One of the Finest Identified with the Industry—Seven Stories—Is 375 By 60 Ft.—Houses Working Force of 950—Economy a Feature of Design



Front of the new administration building just occupied by the Willys-Overland Co., Toledo, Ohio. The building is of steel construction with an equitable brick exterior. There are four passenger elevators and one for freight

TOLEDO, OHIO, Oct. 14—The Willys-Overland Co. has just located in its new administration building, which is one of the finest office buildings connected with the automobile industry. It is a seven-story, brick structure, 375 by 60 ft. and houses a working force of 950 people. All of the administrative offices in connection with the factory are located in the building, which is an architectural model to the industry and well adapted for the work. On entering the building the atmosphere is more that of a huge hotel than an executive building for an automobile concern. On the ground floor is a reception room 100 by 30 ft. resembling the corridor of a large hotel. It is filled with large couches, divans, chairs, etc., and fronting on one side of it are the elevators. The building is served by a system of four Otis passenger elevators, each with a capacity of twenty people, in addition to which is a 5000-lb. freight elevator.

The building is of steel construction with an equitable brick exterior giving a most attractive appearance. It is located directly across the factory from the old offices and fronts on the city boulevard and faces what is known as the Model 75 building, that is, the huge assembly building, 1000 ft. in length, in which the Model 75 is built.

The general layout of the administration building has been worked out with economy in every feature as a foremost requisite. Those departments such as Purchasing, Service, and Traffic are on the main floor, so that the elevator service will not be called upon to serve those departments. These are the departments that have most business visits from outsiders per day.

The second floor is given over entirely to accounting and a novelty is the use of steel furniture throughout. Each clerk sits at a steel table and back of it is a steel cabinet, little higher than the table, in which all of the books, etc., are kept.

The third floor may be described as the middle floor of the building; there are three below it, counting the basement, which is a level ground floor, and three above it. On this middle or central floor are all the central correspondence files for the entire building; the force of forty or more stenographers occupies a department of this floor;

(*Continued on page* 663)

General reception room, more sumptuous than the lobby of many hotels

At the left is the private office of President John N. Willys in the new administration building, at the Toledo factory. At the right is the directors' room, where the weighty problems of the big Willys-Overland organization will be threshed out. The conventional heavy table extends the length of the room, giving it an air of dignified importance typical of the accomplishments of the company

Above at the left is one of the private dining rooms for officers and other executives of the company. At the upper right is a glimpse of the accounting department, showing the steel equipment and filing devices. Below at the left is the general dining room or cafeteria accommodating over 600 at one time. Below at the right is the girls' rest room with its white ivory wicker furniture

Automobile Conditions in Europe

Importations to British Isles and Italy Forbidden—70% Duty Into France—Tires Scarce in Neutral Countries—Better U. S. A. Service Needed on Electric Starters and Generators—More Attention Needed in Export Trade

By Peter Steenstrup

¶Editor's Note:—Peter Steenstrup, representative of the Hupp Motor Car Co. in Europe and Latin-America, has recently returned from a 5-months trip through ten countries in Europe, visiting most of the continent excepting Russia, the Central Powers and Holland. In this article Mr. Steenstrup tells of automobile conditions as he found them.

NEW YORK CITY, Oct. 13—With all the countries in Europe which are not at war, business is generally in excellent shape, and several neutral countries are literally rolling in wealth. With this condition it is not surprising that there is an unprecedented demand for automobiles, and accessories. In filling this demand the U. S. A. is the greatest possible source of supply because scarcely one of the neutral countries can be classed as a manufacturing country. Spain has one or two factories and there are one or two in the Scandinavian countries.

With such a favorable market it is no credit to U. S. A. manufacturers that we are getting the business because there is no other place to buy cars. We are to-day selling our cars cash against document in New York. Generally European dealers are disappointed that our manufacturers have not made active steps toward establishing a more liberal basis of doing business with European neutrals. It would be to our credit to offer more favorable terms of payment now when we are not compelled because of international rivalry to do so. When the war is over international rivalry will require us to give better credit terms, perhaps 90 days. European dealers will then not thank us for giving credit extension because they will realize we will have to do it.

It is further expected by European dealers that we will lay more constructive plans for giving better service throughout Europe. With our highly-developed automobiles using essentially U. S. A. electric starting and lighting systems, a much better service is required. To date our parts manufacturers have done very little to establish that service which is necessary in Europe for their electrical systems. This applies to ignition systems, batteries, starters, generators and horns.

PETER STEENSTRUP
Hupmobile Representative for Europe and Latin-America

This lack of service is bound to react on us as soon as European manufacturers are back in the field. To-day is the time when we should prepare to meet the post-war competition, rather than waiting until terms of peace have been signed.

The question of getting pneumatic tires from neutral countries is one of the greatest obstacles in European car business at present. Norway and Sweden are particularly hampered in this respect to-day. This is due to the fact that during 1915 there was a great deal of smuggling of tires from Sweden to Germany, and now Great Britain, which holds the key to the tire situation for Europe, is getting even and will not ship tires or permit them to be shipped to Sweden. You can ship as many cars without tires as necessary. There is no prohibition of cars, but tires are under the ban. When tires are received they reach these countries in small instalments. In August no licenses for shipping tires into Sweden had been granted for several months.

To-day in Sweden it costs the price of a Ford car in the U. S. A. to buy a set of tires. I saw a dealer in Stockholm on Aug. 10 pay $167 U. S. gold for a 34 by 4 casing. I saw $12 paid for an old 34 by 4 inner tube, with fourteen patches. In addition to tires being very expensive, gasoline is retailing at from 50 to 75 cents per gallon.

There is a possibility that Jan. 1, 1917, may bring some relief in the tire situation with these countries. On that date Great Britain's conventions or arrangements with neutral countries, with regard to automobile tires, expires. It is rumored on good authority that Great Britain by that time will be willing to permit shipments of cars with tires into many neutral countries. If such is permitted it will greatly increase the sale of U. S. A. cars in Scandinavian countries.

The sale of U. S. A. cars in England, France and Italy is practically suspended, except to the governments. The sale of cars in England and Italy, except to the government, is forbidden. You can still sell in France by paying a 70 per cent import duty which is practically equivalent to an embargo.

Among the neutral countries, Switzerland would gladly buy cars but is practically prevented from doing so by the British blockade. Very few outside cars get into the country. What cars Switzerland is building to-day are largely being required by the government.

Business Booms in Spain

Spain is one of the neutral countries where the automobile business is thriving. The country is profiting because of the war and the government is aware of the fact that automobiles and motor trucks are as essential in war as guns and ammunition. The sale of cars in Spain is generally handled from Madrid. Outside of the capital Barcelona is the leading city, and is the greatest manufacturing center in Spain, being known as the Manchester of that country. In the Barcelona zone are more industries than any other part of the country. The city has a population of 560,000 and the streets are well paved.

In Barcelona is the factory of the Spanish automobile company where the Hispano-Suiza car is made. King Alfonso is one of the large stockholders in this concern and the output is largely absorbed by the government. The factory is producing several hundred cars per month, all being four-cylinder models.

Spanish Roads Poor

Spanish roads are generally not good. In the northern country in the summer resort district of San Sebastian are good macadam roads. Outside of large cities macadam roads radiate for upward of 50 miles. Once beyond this zone roads are sandy and rocky. To-day touring in Spain is looked upon as a stunt rather than a pleasure.

U. S. A. cars are selling in good quantities in Spain to-day. Fully 75 per cent of our cars are sold in cities. This is largely due to the fact that city people have profited most by the war. Spain in general wants five-passenger cars. Throughout the country are many body-builders who build closed types as needed. Gasoline is selling at from 50 to 60 cents.

Of neutral countries, perhaps Denmark has profited as much by the war as any other country. It is reported she has made enough to pay off her entire national debt. I was not able to visit Holland, for when I got to England for the second time after traveling through several continental countries, the English government decided I had traveled and seen enough, and would not let me into Holland. I was permitted to go to Norway, Sweden and Denmark, but my passport was stamped "No return to England," so I had to return direct to America from the Scandinavian countries.

The Scandinavian countries, that is Norway and Sweden, including Denmark, have made their money out of various products that have been sold to Allies and Teutons. They let Germany bid against England, and sell to the highest bidder. Some of the products most in demand are foods, fish, minerals and lumber.

Before placing an absolute embargo on the importation of automobiles, England was doing all she could to discourage the use of motor cars for pleasure. Among the emphatic means employed by the British Government in this regard may be mentioned, thousands of huge posters plastered all over London accusing people who used automobiles for pleasure of being "Germans."

Norway a Growing Market

Great Britain is making the best possible use of her sea power to control the movement of all sorts of supplies which might ultimately reach her enemies. Before our automobile exporters complain of Great Britain's efforts to regulate the movement of tires they probably do not know to what extent nearly every line of trade of the small neutral countries are regulated. Norway was prevented for a long time from importing cotton and could obtain it only by agreeing that it would not be used for making fish yarns. In that way Great Britain could regulate the catch of fish and thus indirectly at least prevent this class of foodstuffs reaching Germany in too great quantities. Fish bring high prices in Germany and the unlimited catch and sale of same to Germany would make many more small fortunes in Norway and consequent increased sales of automobiles.

Willys-Overland's New Headquarters

(*Continued from page* 660)

the women's rest room, with a graduate nurse attendant is located here; and other hospital arrangements are on this floor. It is the most convenient, being half way up and down, for the stenographic force which goes up or down to the different offices as required, also for filing, etc.

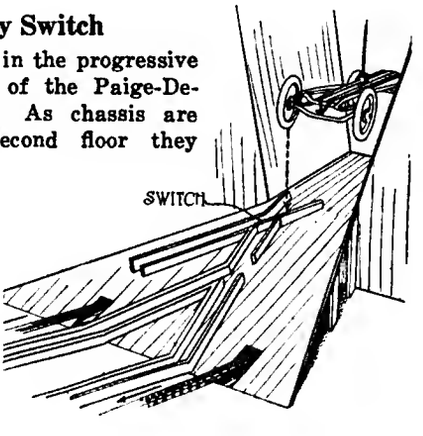
Fourth floor, that is first above the central one, is given over entirely to sales departments, including separate offices for all the departments of sales.

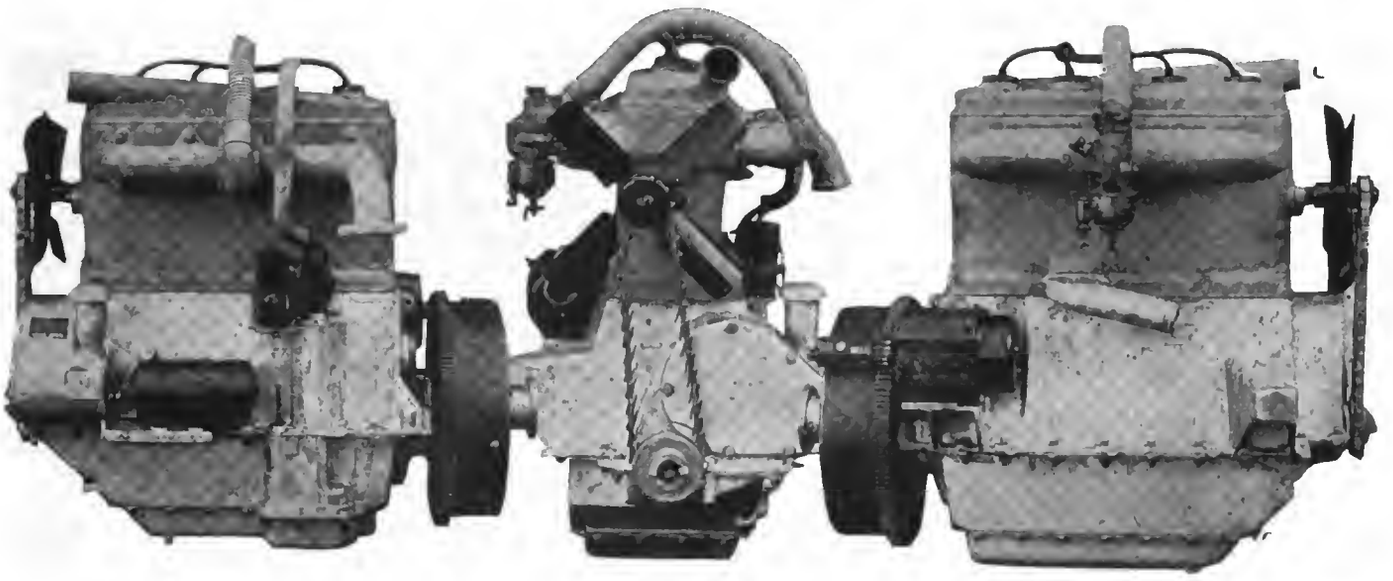
Fifth floor is devoted exclusively to offices of the executives of the firm and board rooms. On this floor the office of President John N. Willys is finished in walnut, and is a model of its kind. The board room, similarly finished, has panelled walnut walls, and the customary ponderous table extending from end to end which carries the atmosphere of a bank board room. All of the vice-presidents and other officers have offices on this floor.

The sixth, or top floor, is a huge cafeteria, with capacity for 200 persons every 30 min. This cafeteria occupies but one-half the floor, the other half being a large auditorium with seating capacity for 600, a stage at one end for moving picture programs, and a dancing floor. The cafeteria has been carefully worked out so as to give efficiency. The luncheon hour ranges from 11:30 to 2 o'clock. It is handled in 30 min. relays. One division of the office takes luncheon 11:30 to 12:30; another 12 to 1; another 12:30 to 1:30; and the fourth 1 to 2. Luncheon prices are very low. The prices are: Meat orders 9 cents; soups 5 cents; vegetables 4 cents; dessert 5 cents; coffee, milk or tea 3 cents. Coupon books worth $2 are used in payment.

An Efficiency Switch

THIS switch is used in the progressive assembly system of the Paige-Detroit Motor Car Co. As chassis are lowered from the second floor they are switched to the right or left track as required. There are two tracks on the lower floor and the switch enables the chassis to be evenly distributed.





Moline-Knight engine, showing mounting of 6-volt Wagner generator with grounded return, which replaces a 12-volt two-wire type. Also Connecticut ignition distributer which supplants a magneto. Note Auto-Lite starting motor and hot air stove for carbureter

Moline Makes Engine Changes

Abandons Oil Pressure Control—Adopts Battery Ignition in Place of Magneto—Front End Chain Layout Rearranged

THE new model G Moline-Knight four, while it follows the lines of the last model, has several changes in detail, especially with respect to the engine. This is, of course, a Knight type, and the dimensions of 4 by 6 in. are unchanged, but the detail has been modified at a good number of points. The most immediately noticeable change is that the magneto has been replaced by Connecticut battery ignition. The distributer is worm-driven off of the eccentric shaft, which actuates the sliding sleeves, and the same shaft which drives the distributer extends into the crankcase and drives a new type of oil pump which is another departure from Moline practice.

Oil pressure in the Moline-Knight is no longer controlled by the carbureter throttle. In the previous models a lever in unit with the throttle lever opened and closed an oil pump throttle with the purpose of giving a uniform addition of oil pressure with the acceleration of the car. In a few instances it was found that owners had difficulty in understanding this arrangement and abused it by mis-adjustment, consequently a gear-pump has been substituted which gives increased oil pressure as its speed increases.

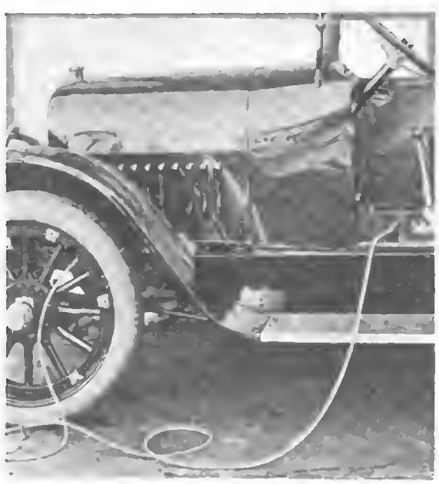
The silent-chain system for the front end is no longer a triangular layout. In the model 50 one chain acted through three sprockets, a drive sprocket, sleeve-actuating sprocket and generator-driving sprocket. The new method is to drive the sleeve shaft by one chain and the generator with another.

The exhaust manifold is now constructed to permit the separate exit of gases from each of the four cylinders, this being accomplished by the use of a casting with ports to each cylinder, which replaces a manifold that took care of two cylinders in one part. Better scavenging is the claim for the new principle.

The new intake assembly embodies a hot-air pipe which reaches over the top of the cylinders and connects on one end with a stove on the exhaust manifold and on the other with the air intake of the carbureter. The stove assembly is purely a cold weather fixture and the makers state that it should be removed for summer driving.

The new crankcase is built in halves instead of one casting as in the 1916 model 50. Maximum accessibility is claimed for this construction because it is only necessary to remove the oil pan to permit the complete removal of all the connecting-rods and pistons.

Another step in the way of accessibility is the new location of the combination oil filler and breather pipe, this having been located on the crankcase arm instead of in the center. With the old design the oil filler came directly under the water pipe, making it somewhat difficult to pour in the oil. The cast-aluminum fan has been discontinued and in its place is a pressed steel fan operating on a swinging bracket which permits ready belt adjustment.



Moline-Knight tire-pump hose may be attached without lifting the floorboards

All the above mentioned features constitute a change of the larger car to comply more nearly with the specifications of design of the model 40, which was the small car of last year. This latter will be continued with a few alterations which will be announced later.

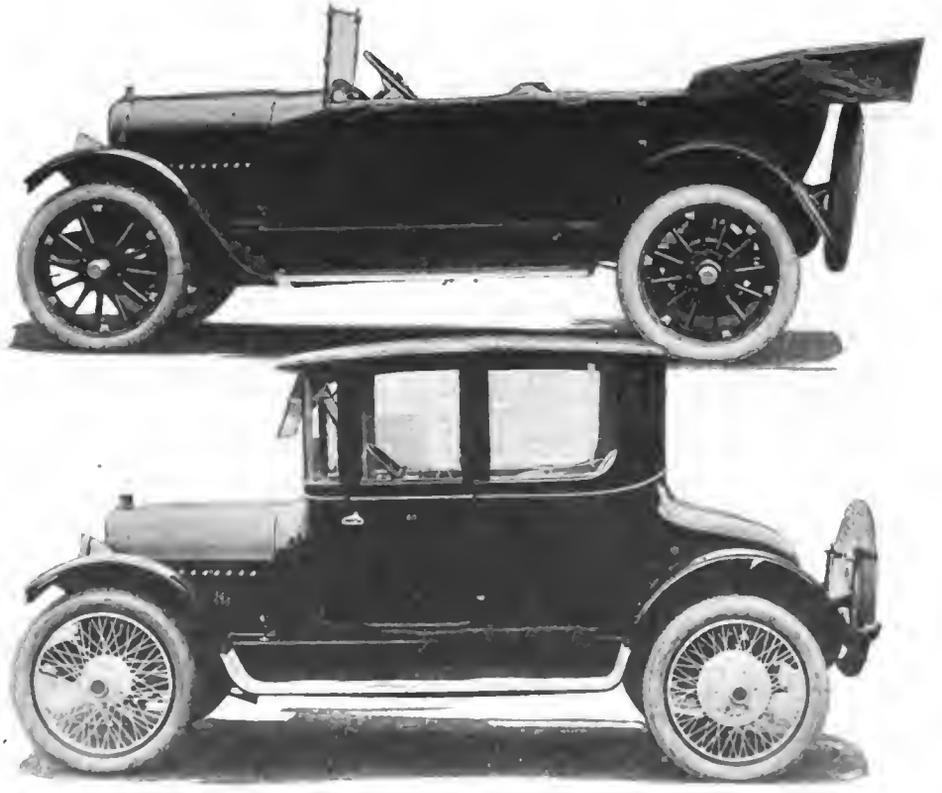
Something entirely new, however, is the adoption of the Bendix system of starting-motor drive in place of the manual shift which has characterized previous models. This was adopted because of its simplicity, there being less parts in the Bendix shaft assembly than in the manual shifting device. In

the electrical system, there is another marked change from the model 50 equipment. The generator is still a Wagner, but it is a 6-volt instead of a 12-volt machine and the wiring has the ground return principle instead of the two-wire system of the previous model. This is another step toward simplicity which has been the goal of the Moline engineering staff in the building up of this new model. The starting motor is an Auto-Lite design.

Moline Universals Used

The Brown-Lipe three-speed selective transmission is still mounted some distance behind the engine and is connected with it through two universals. These universals, however, are of Moline make in this latest model.

The rear axle is a floating type with spiral bevel drive, much the same in construction as on the model 40, but proportionately larger to take care of the additional power and weight in the new car. The gear reduction in the differential is 4 to 1 instead of 4.33 to 1, this higher gearing being made possible by the decreased weight, with an engine of the same size and even higher efficiency. The front axle is a duplicate of the large car of 1916.



Above is the new double-cowl touring body fitted to the new Moline-Knight chassis and below the new coupé with wire wheels

The characteristic double-compounded semi-elliptic spring design is retained in the model G. The springs are transverse and there are two of them, one above the other. They are of slightly different length and so different deflection period. The upper has a shackle attachment to the frame at one end and a pin at the other, and the lower has corresponding attachments to the axle. The effect of these two springs is to provide a very flexible suspension and yet roll and jumping is eliminated by the difference in deflection period. One spring damps the other, so to speak, when a severe shock is encountered.

Stewart Vacuum Fuel Feed

A new accessory which alters another principle of design is the installation of a Stewart vacuum tank which supplants the pressure system of the model 50. Gasoline is contained in a round tank instead of a square one and this tank is ingeniously fitted into the rear frame assembly and held in place by steel straps. The tank is fitted with a magnetic gasoline gage.

The Brush chassis and frame design in which the side members of the frame were extended to form the running boards is not evident in this model. Instead, the running boards are of wood. The shape of the frame, however, is similar to the previous model with the size altered to take care of the new chassis.

The tire pump mounting shows another well-planned effort to bring all accessories within easy reach. This accessory is now mounted on the gearset, so that the hose may be screwed into the nozzle without lifting the floorboards. The pump-operating lever is located at the side of the gear-shifting lever. In previous models the pump was under the hood and driven from the fan gear.

Double-Cowl Body

The new body marks Moline's acceptance of the double cowl. It is by far the best appearing body that these makers have yet produced. With a rolled-in edge sloping into the rear cowl, a rounded back, front cowl blending into the hood, crowned fenders and the characteristic all-curved line Moline-Knight radiator, the new car is entirely lacking in straight lines and has a massive, comfortable appearance. The sides of the body are 1½ in. higher than in the model 50, permitting lower seating of the passengers within the body which is becoming so much in demand. The upholstery is buttonless and deep. A mahogany panel has been fitted on the back of the rear cowl and in this are two flush rear-seat lights, one on each side. The windshield has been given a slight slant, hardly perceptible yet just enough to further carry out the effect of a total absence of right angles.

The spare tire is carried on a ring which serves the same purpose as a rim; that is, the tire and demountable rim are bolted directly onto it. A locking device is fitted, and this same assembly carries the tail lamp and license bracket. Because of its lighter weight the model G is fitted with 35 by 4½ in. tires instead of 36 by 4½, which size was standard on the model 50. With full equipment the model G sells for $1,750.

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Willys-Overland 75-B Delivery Car

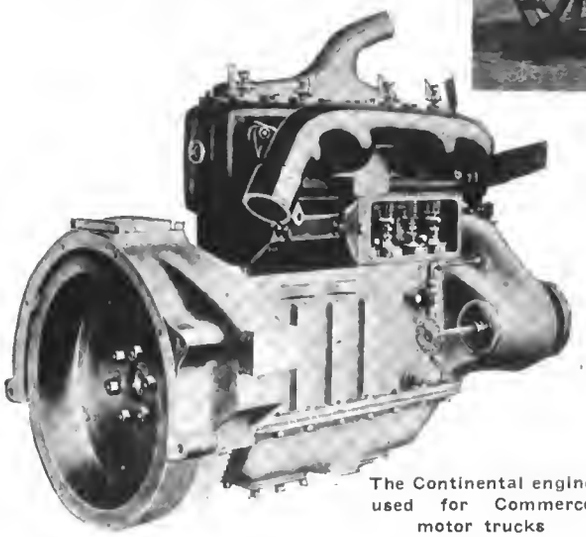
TOLEDO, OHIO, Oct. 16—The Willys-Overland Co. has put on the market the new Overland 75-B chassis fitted with a panel delivery body, selling at $625 f.o.b. Toledo. Features of the chassis which are not commonly found in low-priced delivery cars are the four-cylinder 31½-hp. block engine, electric starting and lighting system and 31 by 4 in. tires.

The panel delivery body fitted provides more than 78 cu. ft. of loading space back of the car. As the driver's seat extends only half way across the car there is additional space available extending to the toe board if required, the entire length of the floor on that side of the car being 97 in. The car is light and compactly built, has a short turning radius, making it easy to handle under all sorts of traffic conditions, and is designed to be economical in operation and maintenance. Tests have shown that it will run in continuous service at a cost of 1 cent or less per mile for gasoline and oil, according to the manufacturer.

Commerce Adds 1-Ton Model

Complete Electric Equipment Includes Starter—1-Ton Has Internal Gear and 1500-lb. Model Uses Bevel Drive—Power Plants Employed Are Identical

A 1-ton Commerce chassis selling at $1,175 with open body costing $60



The Continental engine used for Commerce motor trucks

IN addition to the 1500-lb. wagon, the Commerce Motor Car Co., Detroit, is now marketing a 1-ton truck. This is the first departure of this concern, which has been manufacturing vehicles for 7 years, from a single model policy and marks its entrance into a new field of light commercial car work.

Following the customary practice in light-capacity trucks the Commerce 1-ton model E is sold as a chassis, completely equipped with electric starting and lighting and a governor. This list price is $1,175 for the chassis alone and to this may be fitted a wide range of body styles. As standard the Commerce company is marketing an open body at $60 and a body with a four-post top and storm curtains at $100. Deliveries on this vehicle are scheduled for Nov. 15.

As far as the powerplant is concerned this truck is the same as the 1500-lb. chassis with the Continental unit, having a block of four cylinders 3½ in. by 5 in. This is an L-head design of medium duty characteristics and carries the clutch and gearset as a unit plant. Conventional design is used throughout and a good index to the construction of the engine is given in the main bearing dimensions which are: front, 2 3/16 by 2⅞; center, 2 7/32 by 2½ and rear, 2¼ by 3. This gives a minimum crankshaft diameter at the bearings of 2¼ in.

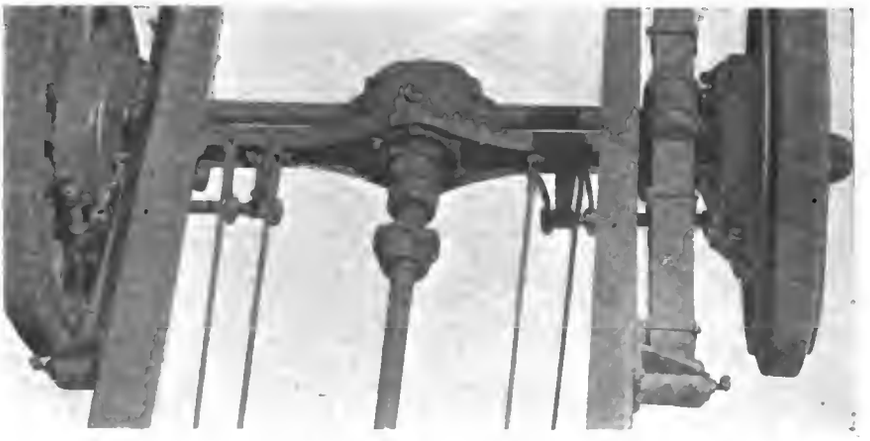
Following the dictates of common-sense in truck motor practice everything about the power plant is as simple as it is possible to make it. The oiling system for instance is a simple splash in which a constant level is maintained by a plunger pump. The only attention that the oiling system requires is to keep it filled with oil to the proper level, and occasionally to flush the crankcase with kerosene. The capacity of the reservoir which is in the lower part of the crankcase is 1 gal.

Fool-proof Ignition System

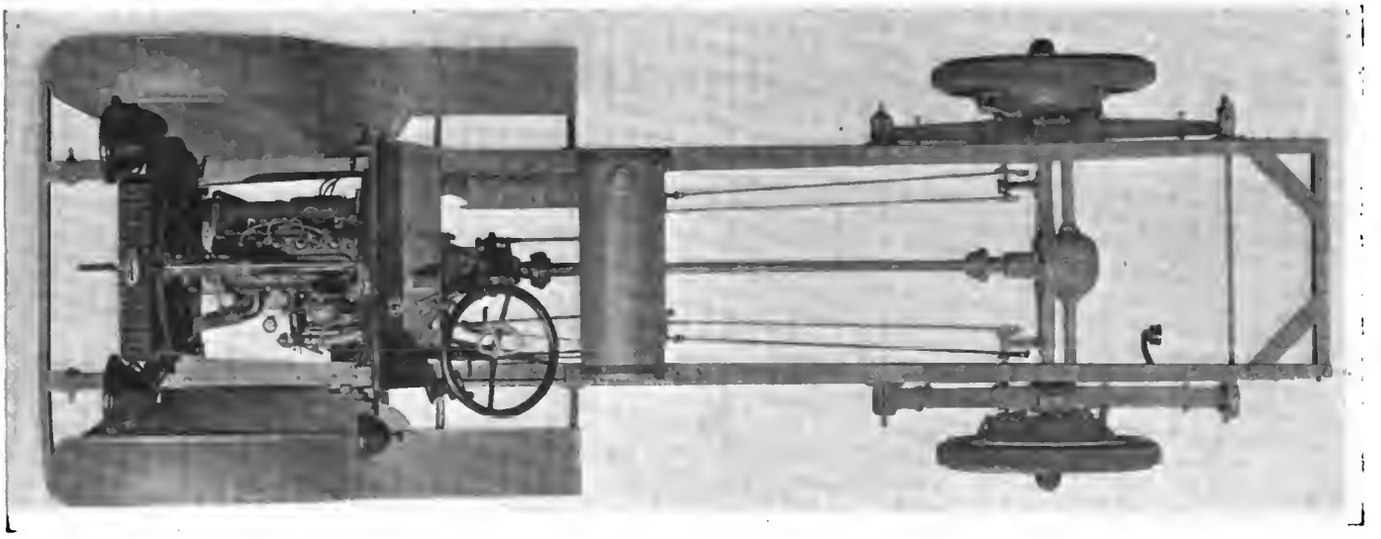
The ignition system is also a fool-proof installation, being a single high-tension Eisemann magneto with even the spark lever removed, as the timing of the ignition is fixed. Cooling is by thermo-syphon in connection with a vertical finned tube radiator with a removable cast top. The radiator construction is qute interesting, being an up-to-date adaptation of the cast tank and side member design. The component parts are illustrated herewith.

Three-Speed Gearset

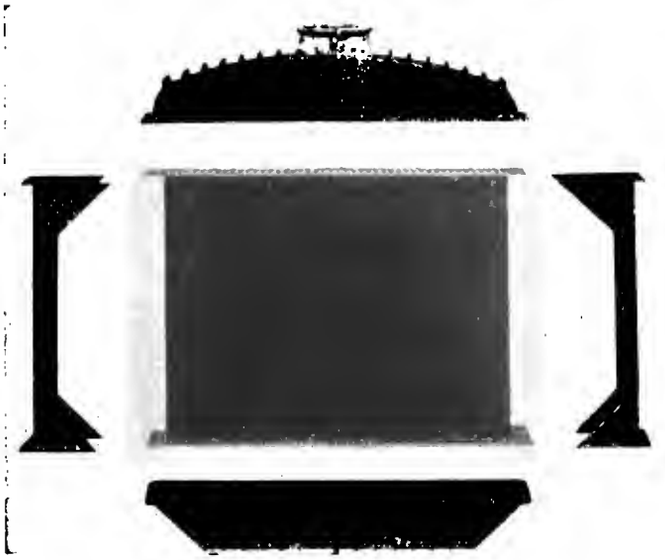
In the bolted-on bell housing are a leather-faced cone clutch and a three-speed selective gearset. From these the drive is transmitted through a propeller shaft and universal joint set manufactured by the Arvac Mfg. Co. The joints are made of drop forgings with felt washers and circular wire springs for retaining the grease. The shaft is hollow, having an outside diameter of 1¾-in. and a wall thickness of 3/16 in. From the rear universal the drive is transmitted to a Torbenson internal gear rear drive carried on roller bearings of Bower and Bock manufacture. A heavy wheel is used with 1¾-in. square spokes and the regular tire equipment is solid rubber of 34 by 3 front and 34 by 4 rear. When pneumatic tires are fitted at an extra cost, the tire



Rear construction of Commerce 1-ton chassis



Showing the substantial simplicity of the Commerce 1-ton chassis



Commerce special form of radiator

sizes are 34 by 4½ front and 35 by 5 rear. The front axle is an I-beam and it is equipped with Bower roller bearings in the hubs.

The frame is a high-carbon steel of channel section. The thickness of the stock is 3/16 in. and, as this material has a tensile strength of from 60,000 to 80,000 lb. per square inch, a high factor of safety is allowed with the depth of 4½ in. The flange width on this frame varies in regards to its position on the car. At the front end it is 2¼ in. at the center 3½ and at the rear 2, giving lateral as well as vertical stiffness.

A double set of concentric brakes is used on the rear wheels. The internal is 15½ by 2¼ in. and the external 16 by 2½ in. These are connected with the brake control mechanism by direct-line linkage and are secured against rattles. The spring eyes and shackles are also secured against wear and looseness by using bronze bushings at all points and protecting these by oil cups.

In the way of fittings and equipment the car is unusually complete for a commercial vehicle. The Remy electric equipment is used for starting and lighting in connection with a Willard storage battery. The carbureter is a Zenith which is also in line with the simplicity of the entire chassis as there are no adjustment points beyond those fixed at the factory. For gasoline feed the Stewart vacuum system is used, operating in connection with a 15-gal. welded steel tank located beneath the driver's seat. The lamp equipment consists of side and tail running lights with a powerful searchlight for picking up house numbers, street signs, etc. The standard bodies have a loading space of 44 by 110 in.

Automobile Performance

(*Continued from page* 659)

J. B. Replogel, director of research, Remy company, asked what we would do with the formula after we got it. The *C* factor must be taken into consideration and therefore we would have to assume units for noise, vibration and endurance.

William B. Stout, sales manager Scripps-Booth, said that in all probability the *C*, or comfort factor, would be the deciding one. It would be impossible to reach the same effect by formula that riding in the car would secure. A formula also leaves out the element of personality, which is largely to be desired and which is a factor in the sales of a car company in the same way as it is of a piano concern. Even the height of the car is responsible for impression in riding and Mr. Stout pointed out that the effect of riding in a car which is too high or too low has the effect of nervous strain which produces mental fatigue that would never be registered in the performance formula.

C. C. Hinkley, engineer of the Chalmers company, stated that when cars are designed they are designed around a formula and for that reason there is no good reason why the same formula could not be used as a rating method. The formula he uses is:

$$\frac{\frac{D \times R}{W \times d}}{T}$$

Where *D*, is displacement, *R* is gear ratio; *W*, weight; *d*, wheel diameter and *T*, the time in seconds necessary to accelerate from 5 to 50 m.p.h.

V. R. Heftler, president of the Zenith Carbureter Co., stated that it may after all be better to give performance rating in the form of a curve rather than in a mathematical expression.

E. M. Planche, chief engineer of the Dort company, stated that he used the $S \times A \times E$ formula divided by *L*, the low, high-gear performance with very good results. The wind resistance factor should also be regarded important.

O. E. Hunt, assistant engineer of the Packard company, said, "No engineer would contend that performance is the sum total of car value. Besides this it is made up of reliability, comfort and appearance. The factors involved in performance are speed range, acceleration and economy, *i.e.*, *S. A.* and *E.* Only the latter can be measured mathematically and can be considered in a formula."

Fuel Feed By New Method

Cylinder Pressure Employed To Fill Supplementary Tank in Turn Feeding Carbureter by Gravity

THE Church fuel feed system is a new method combining gravity and pressure feed in an ingenious way. It involves a supplementary fuel tank which may be mounted on the dash or other convenient point, and from this gasoline is fed directly by gravity to the carbureter. A float level is maintained within the supplementary dash tank.

It differs from one other system in that instead of using the suction of the engine to transfer fuel from the main tank to the auxiliary tank, this is maintained by an automatically regulated pressure caused by the compression and explosion pressure in one cylinder. This pressure is obtained through a very ingenious check valve mounted usually in place of the petcock in the rear cylinder and through which the burned gases maintain pressure on the main fuel tank and force gasoline to the auxiliary tank in the same way that fuel is forced directly to the carbureter in the conventional pressure system.

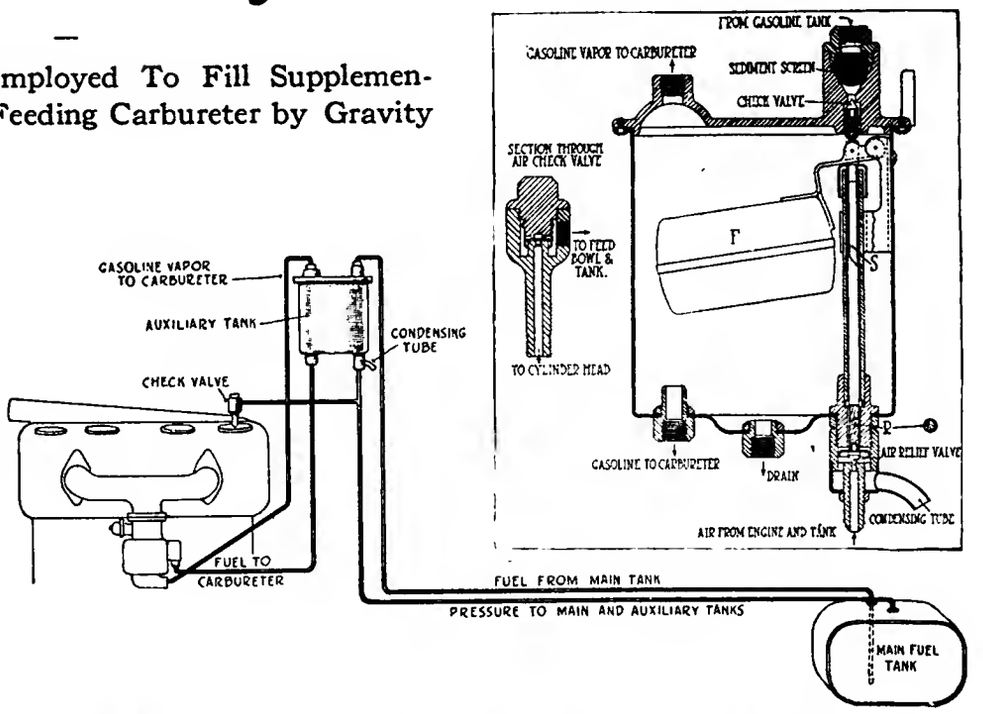
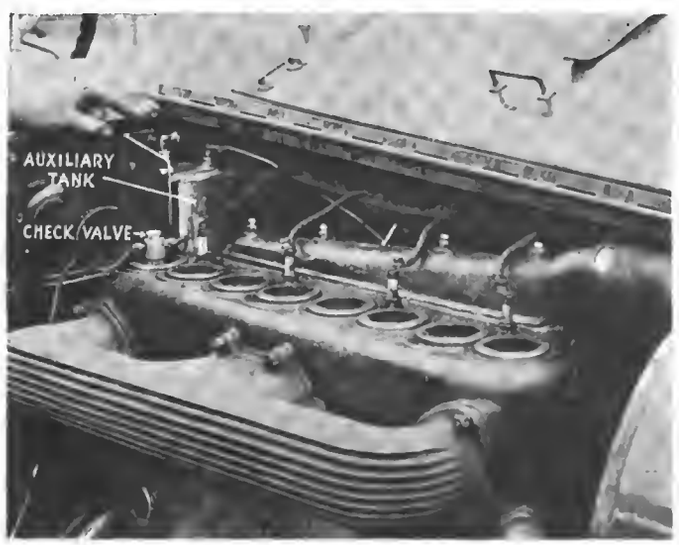


Diagram of Church fuel feed system with a section through the auxiliary tank

It has the distinction, however, that a constant gravity feed is provided to the carbureter and there is no hand-pump required.

A feature of the system, which will have the most general appeal, is the fact that an adequate supply of gasoline is assured to the carbureter, even though the auxiliary tank be empty at the time of start, and even though the main fuel tank may have been open for filling and the pressure thus relieved. This comes about through the fact, first, that the fuel in the carbureter float chamber is more than sufficient to start the gasoline running from the main tank to the auxiliary tank, where it runs by gravity to the carbureter and, second, that in the absence of sufficient fuel in the carbureter float chamber to start the engine, the operation of the starter for 15 sec. or less will generate pressure sufficient to put fuel in the auxiliary tank.



Church fuel feed system on engine, showing auxiliary tank on dash. Note check valve

Flow Is Constant

A point that is considered most important by the inventor is the fact that, being independent of engine suction, the engine can be run indefinitely on wide-open throttle without diminution in the fuel supply, caused by the combined decrease in suction and increase in fuel demand which occurs with wide-open throttle. On the contrary, the system is arranged so that increased demand on the auxiliary tank automatically permits increased pressure in the main tank, thus increasing the flow of fuel to the auxiliary tank.

That the system is capable of supplying fuel under conditions of maximum demand was demonstrated recently in an official A. A. A. test on the Chicago Speedway under the direct supervision of F. E. Edwards of the A. A. A. technical committee, and witnessed by a representative of THE AUTOMOBILE. In this test, a Mercer 22-70 roadster, fitted with the Church system was driven a distance of 10 miles in a total elapsed time of 7 min. and 58.4 sec., an average speed of 75.4 m.p.h., with a maximum speedometer reading of 84 m.p.h. As may be imagined, this required wide-open throttle practically the entire 10 miles, and there was no spitting or other evidence of starvation during the trial. At the end of this distance the auxiliary tank was still full.

The system is arranged so that the ordinary maximum pressure is not over 1½ lb. per square inch, but in the test referred to, the pressure as indicated by a gage on the dash, ran up to nearly 3 lb. indicating the automatic increase in pressure to meet an increased demand. In order to further illustrate this point, a Jeffery six touring car was fitted with a mast, upon the top of which the Church tank was installed, so that the tank was 10 ft. 9 in. above the level of the main

tank. With the auxiliary tank empty, pressure relieved from the main tank and the engine dead, it required 14.4 sec. to get fuel into the auxiliary tank after the starter button was depressed, at the end of which time the pressure indicator showed a pressure of 1⅓ lb. per square inch. In running the car at a speed of 55 m.p.h. a maximum pressure of 3 lb. was registered.

Essentially a Closed System

Another advantage with which the system may be credited comes from the fact that the system is essentially a closed system, and neither the main tank nor the auxiliary tank is open to the air; consequently, there is no chance of taking in road dust. The system is closed in another respect, in that a vent is provided in the top of the auxiliary tank, but this vent is connected to the air intake of the carbureter, so that any gas which evaporates from the system passes directly into the carbureter through the air intake, and thus adds its quota to the fuel supply instead of being wasted. Inasmuch as the evaporation of gasoline over a warm engine is a considerable fraction of the fuel possibility, this feature is an item of economy.

The diagram on the opposite page shows the general layout of the system, together with a cross-section of the Church tank on the right, and the air check valve on the left, while the illustration at the bottom of the page shows the tank installed on a Mercer car. In the sectional view it will be noticed that the pressure line is in the form of an inverted T with the check valve at one end, the main tank at the other and the Church tank at the end of the stem. It is in the Church tank that the pressure regulation occurs, and it is determined by the position of the float *F*. As the float descends with lowering of the gasoline level, the stem *S* moves downward, pushing downward on pushrod *R*. This in turn seats the air relief valve and prevents pressure escaping through the condensing tube, so that, with the float in its lowest position, all of the pressure from the check valve goes into the main tank.

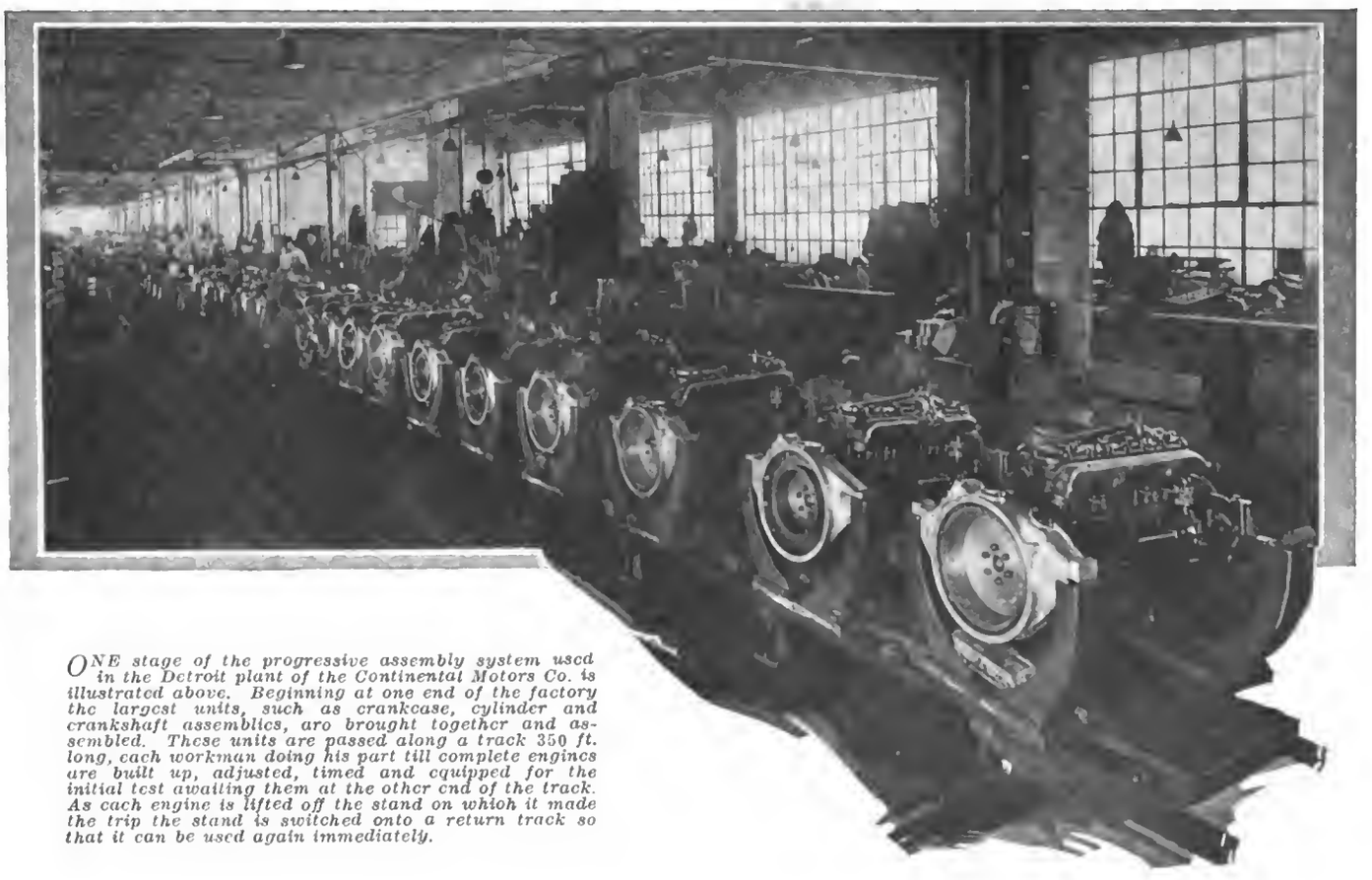
When the float is at its upper position, the air relief valve is forced upward by the pressure, permitting the latter to escape through the condensing tube. The conical form of the air relief valve graduates the amount of pressure being used in proportion to the position of the float; that is, in proportion to the height of the gasoline level in the auxiliary tank. It will be noted that a gasoline check valve is provided at the gasoline intake operating in harmony with the air relief valve. It will also be noted that cleaning arrangements are accessible, for the sediment screen can be removed without disturbing the tank, as can the air relief valve.

The designer attributes the possibility of this system to the design of the check valve. This is a flat nickel disk, 1/32 in. thick, and having a maximum opening of only 0.003 in. It is calculated that the valve takes approximately 0.005 of the cylinder volume.

Sight Feed Furnished

In connection with the system a gasoline sight feed on the dash is supplied if desired, and this has the advantage of giving a warning that the main tank is empty, at which time there is approximately a pint of fuel in the auxiliary tank which serves as a reserve. The system was developed by Edmund S. Church, Automatic Carbureter Co., Chicago, Ill.

Progressive Assembly Used for Continental Engines



ONE stage of the progressive assembly system used in the Detroit plant of the Continental Motors Co. is illustrated above. Beginning at one end of the factory the largest units, such as crankcase, cylinder and crankshaft assemblies, are brought together and assembled. These units are passed along a track 350 ft. long, each workman doing his part till complete engines are built up, adjusted, timed and equipped for the initial test awaiting them at the other end of the track. As each engine is lifted off the stand on which it made the trip the stand is switched onto a return track so that it can be used again immediately.

A corner of the Studebaker custom body department, showing bodies being trimmed

Studebaker Custom Bodies

Demand for Special Styles Leads Factory To Install Custom Department—Represents Saving

BUYERS of Studebaker cars are no longer confined to the limitations of stock bodies. Owing to the increasing demand for individuality in external appearance, as manifested on the part of purchasers of its cars, the Studebaker company has made the departure of incorporating within its plant a custom body department in which the range of ideas of purchasers can be met with a corresponding style of body in both open and closed models.

Heretofore automobile manufacturers who are classed among the big producers have done a relatively small amount of custom business and where it has been done the bodies have been bought from builders outside the organization. In 1913 the Studebaker company started a body department of its own in which the stock bodies were made, but up to the present time the custom-made bodies have been purchased on the outside.

During the last year there has been a rapidly increasing demand for special body design and it has been felt that the expense of organizing the custom body department will be immediately met by the increasing demand for these bodies. This has already proven to be the case.

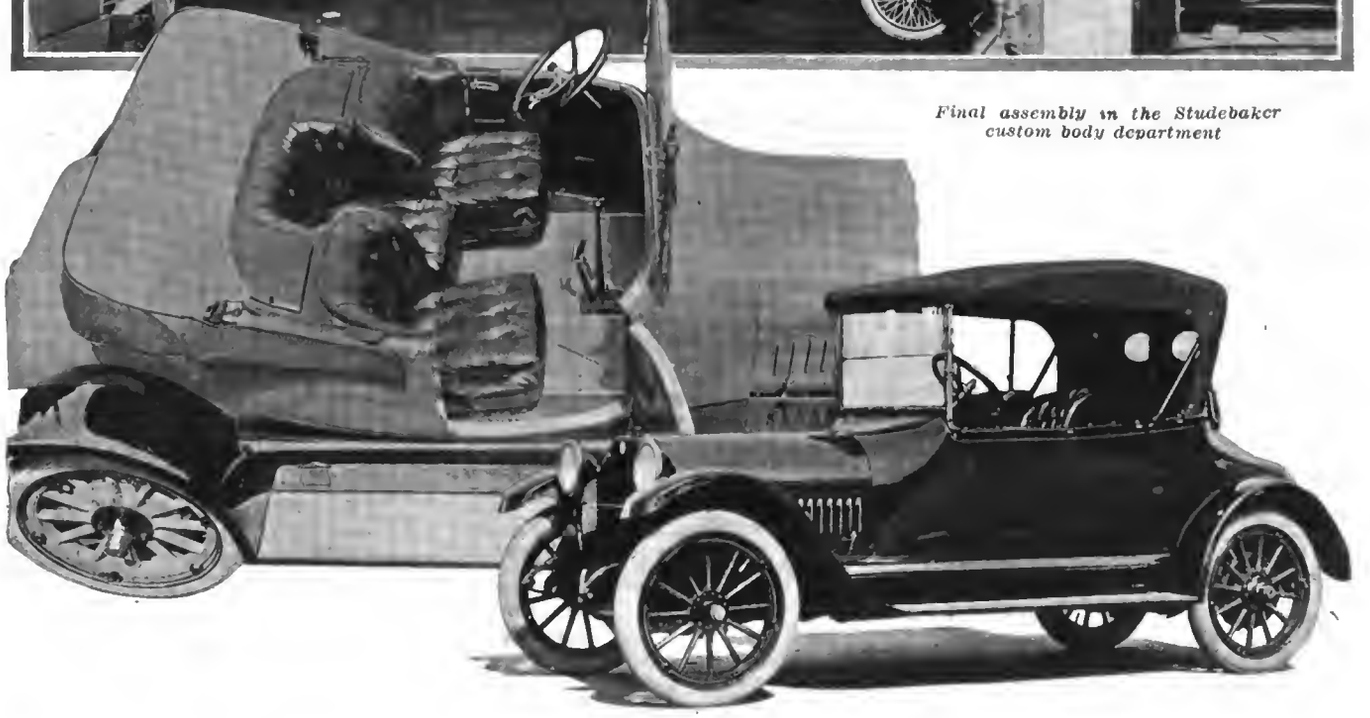
The method of procedure in securing the specially-built bodies is for the purchaser to describe the type he desires. He is then furnished with a rough sketch prepared by the Studebaker designers and when this is approved it is drawn to full size before the structural drawings are made. In carrying out the work of producing these new bodies, several distinctive shapes have been created, and in each case special style tops have been designed to accommodate the body contour.

Of chief interest to the purchasers is the fact that the selling price of the completed product is below the combined price of the chassis and a similar body purchased outside because of the elimination of the middleman's profit. The deviations from the stock body are not only in shape and seating arrangement, but also in color. The standard body is dark blue, while the custom-made bodies are finished in any color scheme that may be desired. The materials used in the construction of these special bodies are carefully selected in the same manner as they are by any of the custom body manufacturers, and although the price of these special jobs will range from $100 to several hundred dollars more than the stock body, there is an ever increasing number of buyers who are willing to pay the difference.

Some of the special bodies which have already been produced are shown in the accompanying illustrations. One of these is a three-passenger cloverleaf roadster which is characterized by the fact that the center seat is not placed as far back as is usual in the three-passenger cloverleafs and hence allows a maximum amount of sociability in seating with the minimum of body length. The small compartments formed on either side of the center seat by its staggered arrangement, which spaces are sometimes allowed to pass entirely unutilized, are utilized for package carriers and can be reached by lids which set

Where the metal-working is done. Bodies are of sheet aluminum

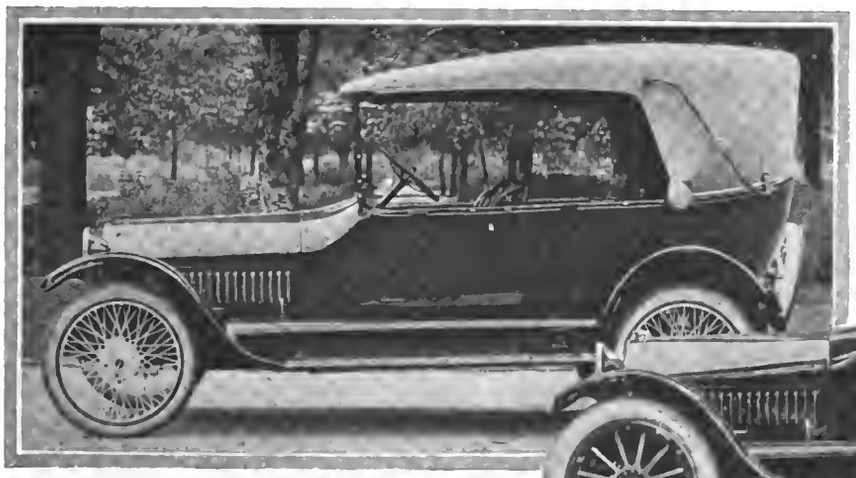
Final assembly in the Studebaker custom body department



Above at the left is a three-passenger cloverleaf type of body made in the Studebaker custom body department and fitted to a standard chassis

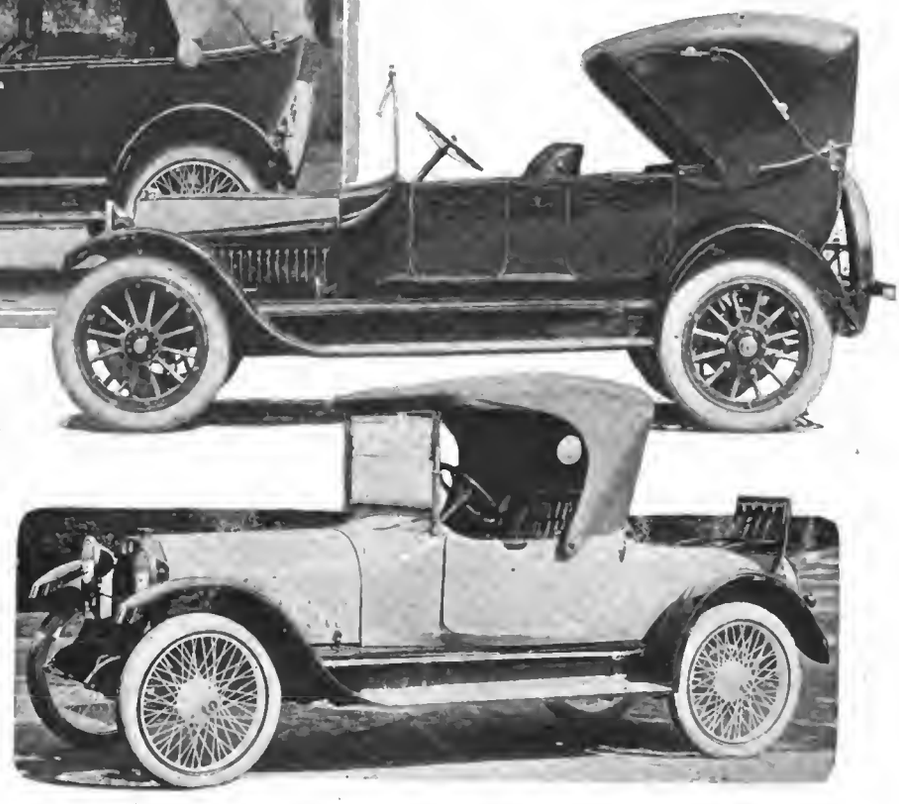
At the right is a custom-built four-passenger roadster design mounted on a Studebaker chassis. This car is entirely a product of the company's factory

At the left is a section of the wood-working shop in the new custom body department of the Studebaker factory. The sheet aluminum bodies are fitted over the wooden frames, parts of which appear in the illustration



The body illustrated at the right is a seven-passenger Studebaker model fitted with a victoria top

At the left is a seven-passenger touring body fitted with a Heaslet top, the latter being named after J. G. Heaslet, vice-president in charge of engineering and production. It is finished in red



A custom-made roadster produced by the Studebaker custom body department. Note the lackey seat in rear for a servant. When not in use this seat folds into the rear deck, leaving the surface smooth

in from the top, a convenient arrangement.

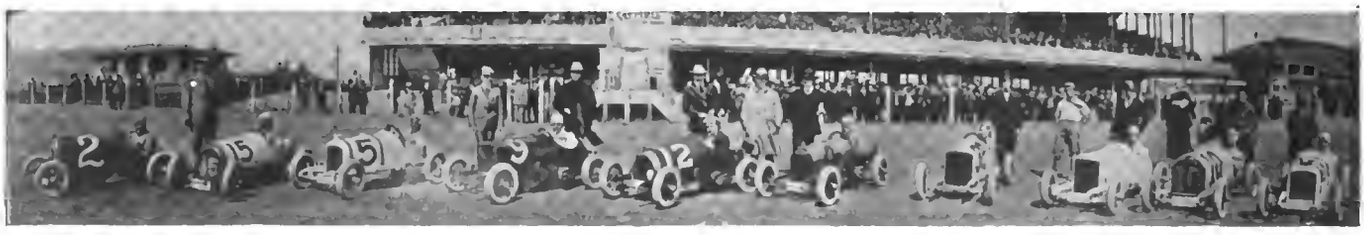
An example of special top construction is shown on a seven-passenger body. This is finished in red and the top itself is what might be called an extended victoria, as it opens with the exterior bows in the same manner as a victoria top, but the peak is extended to the top of the windshield. A top somewhat on this style is shown on a custom-made roadster body which is fitted with a rather novel lackey seat in the rear. The extra seat is primarily intended to accommodate a servant and when not in use it is folded down out of view. The feature of the seat is that the part which folds up uncovering the seat well forms a convenient back rest for the occupant. A particularly wide door is used on this model and the curvature of the side line of the body is also very well worked out.

In the way of special roadsters, the four-passenger design has proved to be quite popular. The type shown in the accompanying illustration is exceptionally roomy and almost approaches a close-coupled touring car with the exception that there are no rear doors, the entrance being through the front and between the divided front seats. No difficulty is found in seating two passengers in the rear seat of this body, as it is of generous width and far enough removed from the back of the front seat to allow the passengers plenty of knee room.

A rather staid and formal type of body is illustrated in the seven-passenger design with victoria top. This is a very popular design with ladies who utilize it for afternoon calls and shopping, giving an effect of an open town car. As will be noted, it is equipped with bumpers both in the front and rear, in order to take care of the minor collisions which often occur under conditions of crowded traffic.

Miniature Racing Cars Make 70 M.P.H.

TEN miniature racing cars, using Indian motorcycle engines and 20 by 4-in. Goodyear cord aeroplane tires on miniature wire wheels, attained a speed of 65 to 70 m.p.h. in a series of races held recently at San Francisco. As can be seen from the illustration published herewith, these little cars were constructed in accordance with the latest dictates of design as adopted in the standard speed creations now breaking records at over 100 m.p.h. on the speedway circuit. While very lightly built, they are made low to keep the center of gravity near the ground and the bodies are built to offer minimum resistance to the wind. Although the tires used were not built for race track service, they stood up excellently under the strains of high speed work, as experienced in the contests fought out by the Lilliputian racing cars.



Ten miniature racing cars which battled for supremacy in a series of races held recently at San Francisco

Resta Wins 250-Mile Grand American Race

(*Continued from page* 655)

Hudson to such an important position in the Sheepshead Bay Race, drove the last 150 miles on five cylinders, and finished in tenth position. He broke a bushing in the valve lifter assembly and after 20 minutes of frantic effort, he and his mechanic removed the lifter guide and re-entered the race with one valve in operation.

Nine Stops for Plugs

Spark plugs again had a hand in swelling the number of pit stops. There were nine stops for plug changes.

To-day was a day for fires at the Maywood track. The Crawford with its unlucky 13 was the only one which was serious, but the other two had possibilities of danger. Devore's Duesenberg caught on fire early in the race at the pit when the driver had flooded things in general in working with his carbureter. When he finally started the engine the gasoline around the engine caught fire from the backfire and a lively conflagration was started. Luckily this was almost in front of the J-M pit and the fire extinguishers had the flames out before they had gained any headway.

The other fire was an incipient conflagration which started from a carelessly thrown match or cigar in the bunting which decorated the front of the grandstand. Attendants had the burning bunting ripped off before any damage was done and there was little excitement in the grandstand. Probably only a few of the spectators, and those immediately behind the place where it occurred, knew anything had happened.

Race Well Handled

Aside from this there were no untoward accidents and no possibilities of any other than the usual risk when a score of cars are traveling at high speed. The race as a whole was very well handled, the track perfectly guarded, the timing seemed perfect, although the scoreboards and announcing were many laps behind the progress of the race. The scoreboards were the worst in this respect, being neither up to date nor always correct.

DePalma was not the only driver who had hard luck after a wonderful showing. Wilcox with only one lap to go to finish in fourth place had to withdraw with a broken connecting-rod. Galvin very nearly had a similar experience, as his car went out while he was making an additional lap after he had been flagged in fourth, and had to push his car part way around the course.

Mulford, who was slated to drive a Duesenberg, did not appear at the starting line and Devore took his place. The Ben Hur, which was a local entry, and fathered by President Reid of the speedway, was not in shape to start. This was to have been driven by Louis Chevrolet. Rickenbacher's Maxwell was not in the best of shape when he started, and much credit is due him for jockeying it into third position.

Attendance Under 10,000

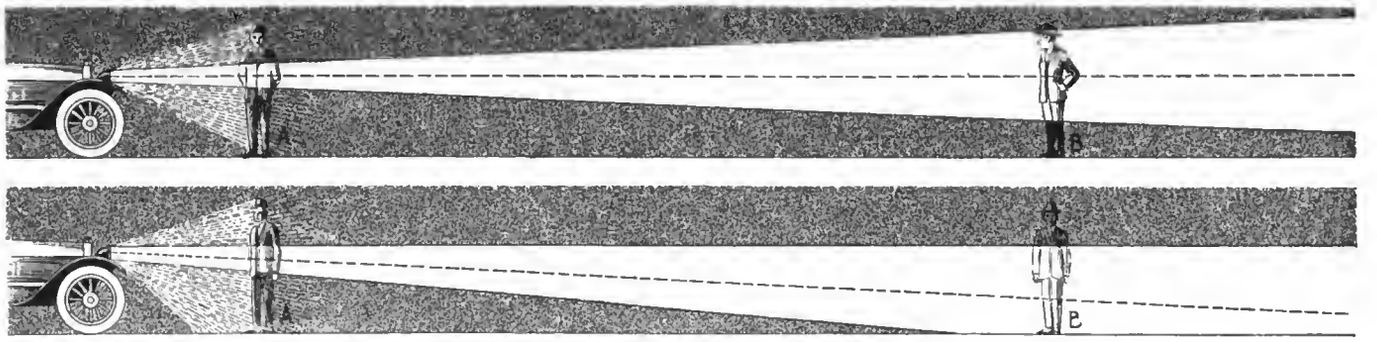
The attendance at the race is judged as below par. It is regretted that more than 8000 to 10,000 did not see the birth of this particular race, the Grand American. But if such another race as this of to-day is ever foreseen in the announcement of an event at the Chicago speedway, the fame of the performance to-day will guarantee a record-breaking gathering.

Everywhere were sportsmen and sportswomen. That is the impression the Grand American would probably give most general observers. Most of the crowd were automobilists, if the parking space can bear witness to it, for back of the stands cars were parked within touch of each other along practically the entire stretch there. Enterprising guardians at the entrance to the speedway reaped dollars for space in vacant fields nearby, vacant fields that were well filled by 2 o'clock. As usual the allotments infield showed many cars.

Resta's car was equipped with Silvertown tires, Miller carbureter, Bosch magneto, K L G plugs, R-W wheels, Levett pistons, and used Oilzum. Aitken's car used a Zenith carbureter, Goodyear tires, Bosch magneto, K L G plugs, R-W wheels, Levett pistons, and used Oilzum.

Times Every 20 Miles of 250-Mile Grand American Race at Chicago

Car	Driver	Miles 20	40	60	80	100	120	140	160	180	200	220	240	250	M.P.H.
Peugeot	Resta	11:36	23:06	34:28	45:56	57:19	1:08:42	1:21:12	1:32:42	1:43:59	1:53:08	2:07:91	2:18:30	2:24:16.68	103.99
Peugeot	Aitken	11:37	23:08	34:29	45:56	57:20	1:08:43	1:20:10	1:31:38	1:43:06	1:54:53	2:07:03	2:18:38	2:24:32.61	103.65
Maxwell	Rickenbacher	11:39	23:09	35:45	47:26	59:55	1:10:20	1:20:48	1:32:29	1:45:25	1:56:57	2:08:29	2:20:05	2:25:52.76	102.08
Premier	Lewis	12:19	23:16	36:30	47:52	1:00:01	1:13:22	1:24:07	1:36:14	1:49:24	2:01:28	2:13:16	2:26:36	2:32:28.93	98.87
Maxwell	Henderson	12:02	24:13	36:22	47:35	1:00:57	1:13:05	1:25:12	1:37:27	1:49:23	2:01:19	2:13:14	2:26:41	2:32:31.39	98.34
Premier	Galvin	12:20	23:24	36:45	47:55	1:00:03	1:13:24	1:25:22	1:37:28	1:49:35	2:01:38	2:13:41	2:27:07	2:33:20.50	97.81
Duesenberg	Devore	12:00	23:09	36:18	50:51	1:02:36	1:17:36	1:32:36	1:47:14	1:59:09	2:11:49	2:23:45	2:35:53	2:45:35.43	90.58
Ogren	Burt	11:38	23:14	37:16	51:00	1:03:39	1:17:25	1:36:08	1:48:41	2:03:40	2:17:35	2:30:08	2:37:44	2:52:05.35	86.66
Erbes	Gable	11:51	24:06	36:19	51:53	1:06:37	1:21:36	1:38:14	1:52:22	2:08:09	2:22:54	2:38:38	2:56:23	3:04:52.23	81.13
Hudson	Vail	12:26	23:08	36:19	48:29	1:23:13	1:37:31	1:50:36	2:06:12	2:20:23	2:32:28	2:46:46	2:58:55	3:05:37.37	80.81
W. Duluth	Rawlings	12:09	24:07	36:12	47:38	1:09:29	1:26:42	1:41:05	1:55:22	2:10:55	2:55:16	2:39:46	3:02:45	Flagged	
Duesenberg	Busanc	12:31	29:04	42:05	54:35	Running a t finish—fla gged									
Peugeot	Wilcox	11:59	23:52	35:33	47:18	58:56	1:10:35	1:22:18	1:34:04	1:45:49	1:57:42	2:09:45	2:21:26	Out, broken c onnect- ing-rod	
Peugeot	DePalma	11:34	23:03	34:23	44:37	55:50	1:07:08	1:19:37	1:33:00	1:43:28	Out at 194t h mile, bro ken valve				
Ostewig	Ostewig	11:53	30:55	52:12	1:21:28	1:37:34	1:50:36	2:10:16	2:23:58	Out 172nd	mile, slippi ng clutch				
Crawford	Kline	12:03	23:09	36:38	47:45	1:00:05	Out 112th	mile, broke n crankshaf t							
Crawford	D'Alene	11:38	23:31	36-17	56:24	Out 90th m ile, broken	shaft								
Duesenberg	Milton	11:45	23:05	Out 42nd	mile, clute h facing tor n out										
Hoskins	Hughes	11:37	.....	Out 40th	mile, broke n connectin g-rod.										



Above—Fig. 1—Diagram of the light cast by a good lamp, the direct rays from the bulb furnishing adequate illumination without glaring to eyes outside the limits inclosed by the heavy lines. Below—Fig. 2—Tilting the lamp downward so that the edge of the beam, instead of its center line, is parallel to the ground, eliminates glare

Eliminating Glare Is Easy

A Simple Language Explanation of What Causes Glare and How to Prevent It—What S. A. E. Is Doing To Assist Manufacture of Non-Glaring Lamps

By A. Ludlow Clayden
Chairman S. A. E. Standards Committee

GLARE from an automobile headlamp is caused by the concentrated rays in the beam of light striking the eye of the observer and preventing the lesser light from illuminated objects close to the lamp from affecting the eye strongly enough to give vision. A headlamp lights up objects on the road. An observer facing the lamp can see those objects as long as the reflected light reaching his eye is not overpowered by the light coming direct from the lamp.

Provided the direct light is kept out of the eyes of the observer, the stronger the light that the lamp casts on the road the better can the road be seen by the observer facing the lamp as well as by the driver of the car behind it.

Thus to make the night use of automobiles safe, it is as requisite to have enough light thrown on the road as it is to prevent too strong a light from being cast into the face of anyone on the road.

Arrangement Is Everything

A properly arranged lamp of great candlepower will be less disconcerting to anyone approaching it than will an improperly arranged one of small candlepower.

The light of a headlamp is a concentrated beam surrounded by a general spread of unconcentrated light. All that we need to do to eliminate glare is to keep that concentrated, central beam so directed that none of its rays reaches the eyes of a person in front of the lamp, the general spread of unconcentrated light will be helpful and not harmful.

This can be done very simply if the lamp is sufficiently well made. If the lamp is badly constructed it is impossible, not merely difficult but impossible in the fullest sense. Just why this is will be shown later.

Fig. 1 is a diagram of the light cast by a good lamp. The direct light from the bulb illuminates objects surrounding the lamp and close to it. The concentrated light does not touch the road for some distance, not till the beam has spread out. The edges of the concentrated beam are shown by heavy lines, and the center line of the beam by a dotted line. The lamp will not glare to anyone whose eye is outside the limits inclosed by the heavy lines.

With the lamp placed square to the car this means that a pedestrian will not notice any glare when the car is close to him, but he will notice it when the the man *B* is unable to see anything except the lamp and suffers extremely. This is because the upper edge of the beam is not as high as *A's* eyes but is higher than *B's*.

All we need to do then, is to so set the lamp, or so construct it that the upper edge of the beam cannot ever rise as high as a man's eyes however far away he may be.

Therefore, if we tilt the lamp downward as in Fig. 2, so that the edge of the beam is parallel to the ground instead of the center line of the beam, we have cured that lamp of glaring so far as any approaching pedestrian or driver is concerned.

This seems too absurdly simple to be true. It is true enough though *if* we have a lamp that really does give a beam with a sharp edge. The bulk of the trouble with headlamps is that they cast irregular beams and it is the purpose of the Society of Automobile Engineers to define limits for lamp manufacture that will make the beam sufficiently accurate to enable simple lamp adjustments to give the upper edge of the beam its proper position without uncertainty.

The lamps as made to-day are not reliable, because while any one lamp may be set to give the correct light distribution with one bulb, when the bulb is changed the light may alter altogether. This is because the position of the beam changes as the filament of the lamp is moved.

Fig. 3 shows the same lamp with the same setting and the sort of light it will give when the bulb is moved so as to put the filament into different positions. At *A* we have the right spread of light. At *B* the filament is too far forward and at *C* it is too far back, the result in either case being to widen the beam so that it is no longer within safe limits; thus converting a non-glaring lamp into one which will glare very badly. If the filament is truly in the central axis of the bulb we can cure this by focussing.

The average man is so helpless when it comes to focussing that he would be better off almost without any focussing device whatever, for he then would not maladjust a good lamp which he is likely to do if the chance is given him.

By adding to the cost of manufacture of bulbs a little they can be produced so that adjustment is not necessary. So that any bulb will go in any one reflector and give the same sort

of light as its predecessor. This means that one reflector or focussing adjustment would last the life of the lamp.

Next comes the reflector itself. If this is pressed accurately to shape the beam of light will be true and handlable, but if the reflector is irregular, of one curvature at one place and another somewhere else, then the beam will throw out odd rays of glaring light. This means that limits of accuracy should be imposed upon reflectors.

Another thing about reflectors is the kind of curvature they have. If a reflector is very deep, then moving the filament of the lamp has less effect on the beam than when the reflector is shallow. Some of the reflectors in use to-day are so shallow that even an expert in a laboratory has difficulty in adjusting the bulb so as to get a proper beam. This means that if we hold the bulb tolerances down to say 1/64 in., the reflector should be deep enough so that a 1/64 in. variation of filament position makes no difference to the light. With a bulb held to tolerances, and a reflector held similarly we can be certain that a lamp once set properly will remain set properly.

So much for keeping down glare. There is something else just as important, however, and this is to insure enough light for driving that will be safe to the car carrying the lamp as well as to other road users. This means that the car must throw a light far enough ahead to make clear any objects on the road within not less than 200 ft. and that the sideways spread of the beam must be enough to illuminate objects at the sides of the road. The man meeting the car wants to see where he is walking just as much as the driver wants to see where he is steering.

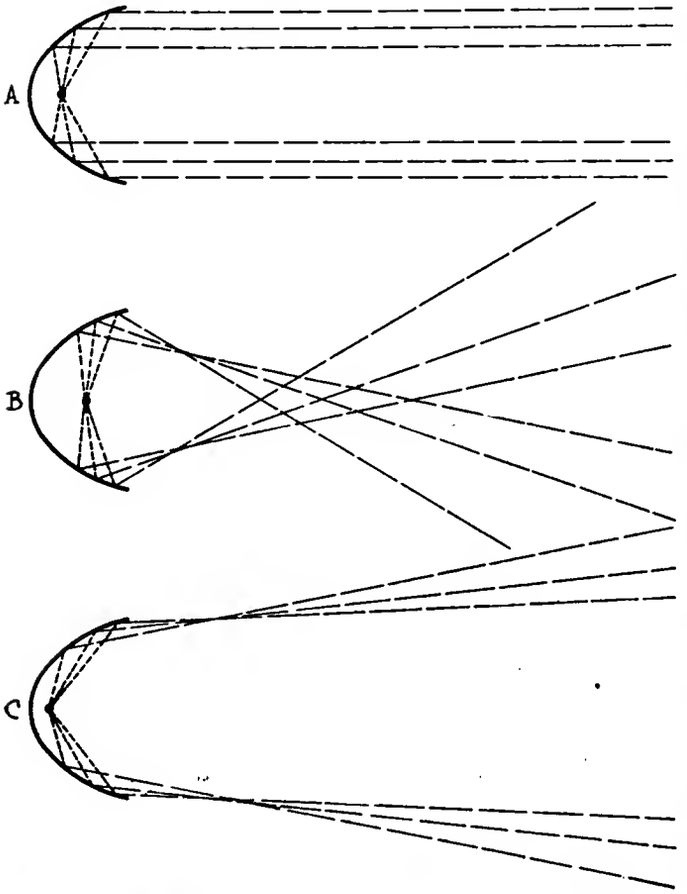


Fig. 3—The same lamp as considered in Figs. 1 and 2 with the same setting and the light it will give when the bulb is moved so as to put the filament in a different position

Adequate Light Required

This means that in making any regulation about lighting it is essential to specify enough light as well as to specify the direction of that light. The idea that glare could be cured by abolishing lamps is good enough as far as it goes, but it would merely substitute worse dangers for present ones.

Herein we find an objection to the simple method of directing light by tilting the lamp, for a tilted lamp will need to be intrinsically more powerful than an untilted one if we are to get the same *desirable* light on the road. Why this is is very easily seen from Fig. 4. This is an exaggerated diagram of the effect of tilting. With the parallel set lamp the beam strikes the road a long way ahead, when we tilt the lamp it hits the ground soon, and after the beam has hit the ground it is used up, it is no longer of much use. The middle of the beam is its brightest part, so we want to have the middle line hit the road as far ahead as we can.

Suppose we want to have it hit the road 200 ft. away and are compelled to tilt the lamp so that it strikes the ground at 150 ft., then to get the same light on the road we must increase the brilliancy so that the ray which does strike the road at 200 ft. with the tilted lamp is as bright as the middle ray of the untilted one. There are ways of overcoming this, but most of them are patented at present. So the simple thing to do is to put up with the loss of efficiency and leave it to the manufacturers to work it out for themselves.

The electrical equipment division feels that by specifying the proper tolerances for bulb manufacture and by specifying those for reflector construction, they can insure the production of lamps that only require to be tilted in order to be non-glaring. The following is an ideal of illumination to insure safety both by the provision of enough light to show the road and things upon it, and to prevent glare:

"A headlamp of an automobile will give an adequate light combined with elimination of glare when:

"1. The light is sufficient to reveal any person, vehicle or substantial object on the road straight ahead at a distance of 150 ft.

"2. There is sufficient side illumination to reveal any person, vehicle or substantial object 10 ft. ahead of and 10 ft. to one side of the lamp.

"3. The headlamp is so arranged that no portion of the reflected beam of light, when measured 75 ft. or more than 75 ft. ahead of the lamp shall rise above 42 in. above the level surface on which the vehicle stands."

This is the ideal, and it is attainable by limiting the tolerances in bulb manufacture, limiting the form and the degree of inaccuracy of the reflector and, finally, by tilting the lamp.

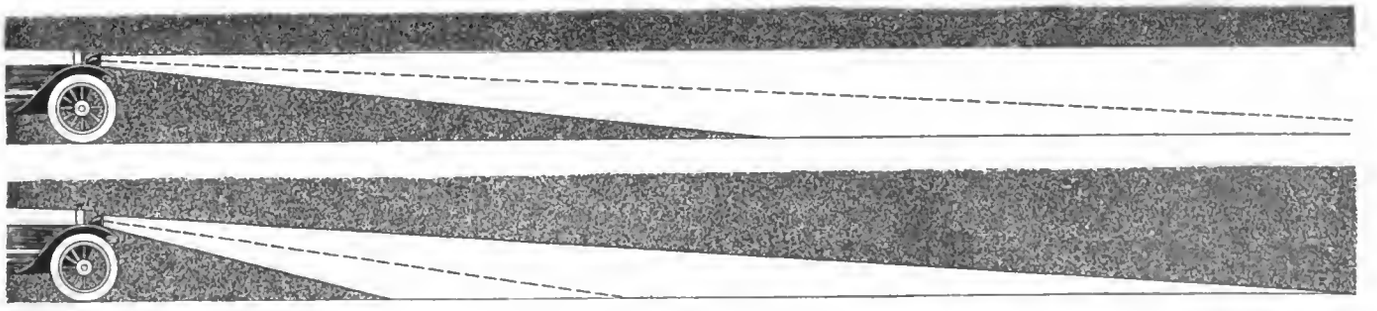


Fig. 4—An exaggerated diagram from the effect of tilting the lamp so that its rays hit the ground too soon

The Rostrum

Finding Differential Gear Ratio

EDITOR THE AUTOMOBILE:—Kindly advise how to find the gear ratio of a differential without disassembling. A Chalmers 6-30 is geared to 5 to 1 on direct. What would be the correct way of ascertaining this ratio without disassembling? If I jack up one rear wheel and put transmission in direct or high, then turn the motor by crank one revolution, and the jacked wheel only turns half way around, why do they say the engine turns one to the rear wheel's five times? Please explain.

West Chester, Pa. W. H. W.

—The gear ratio of 5 to 1 means 5 revolutions of the engine to one of the road wheels. When the differential is operating as it must be with one wheel stationary on the ground and the other turning then the rear axle ratio will only be half what it is when both wheels are turning. If your rear axle ratio is 5 to 1 you will find that with one wheel jacked up it requires 2½ turns of the engine to give you one full turn of the back wheel.

A better way is to turn the back wheel and count the number of turns made by the propeller shaft. You can usually do this by watching the universal joint. Mutiply this number of turns by two and you will have the two ratios.

Engine Needs Thorough Overhauling

Editor THE AUTOMOBILE:—I drive a 1911 Reo that has been run about 16,000 miles and seems to give as good service now as when it was new, with one exception. The third and fourth cylinders pump oil, the fourth one being the worst, so that I have to clean the spark plugs and scrape out the cylinders every 80 to 100 miles, else the engine will develop a very perceptible knock when pulling up grade.

The compression seems as good as when the car was new, but the third cylinder never did have as good compression as the other three. The fourth cylinder has good compression though it is very bad about pumping oil and fouling spark plug, and so far as I can tell, it is the cylinder that produces the knock.

Will you kindly tell me how to remedy this? Would a new set of cylinder rings do the work, and if so, what kind would be best suited for the Reo engine?

Browning, Mo. J. P. B.

—Probably your engine requires a thorough overhauling. If you cannot get equal compression in each cylinder by grinding the valves it will be necessary to examine the pistons and piston rings and also to measure the cylinders to see whether the latter have worn oval shape. If they are out of round it will be necessary to have them reground to fit oversize pistons with new piston rings. If the cylinders are perfectly round the trouble might be reduced by fitting one or two of the special rings of which there are now so many on the market.

The trouble could also be caused by dirt in the oiling system. Make sure that this is quite clean, especially that the oil returns from the crankcase to the oil reservoir are not clogged. You should wash out the whole crankcase very thoroughly with kerosene.

If you find the pistons and cylinders in perfect condition, have the lubricating system absolutely clean and still have not entirely cured your trouble, you could file the dips on the lower ends of the connecting-rods so that while they will still dip into the oil as deeply as before their lesser width will prevent so large a quantity being splashed.

Lubrication Is Provided on Grades

Editor THE AUTOMOBILE:—I have a 1916 Studebaker six-cylinder car which is lubricated by a circulating splash system. A gear pump draws the oil from the rear of the crankcase. If the oil is allowed to become a little low it will not cover the suction end of the pipe when descending steep grades. How long will the supply in the splashed troughs lubricate the engine when the pump is not feeding?

2—When there is a full supply of oil in the crankcase, it is said that there is too much lubrication in the end cylinders. Is it possible for the oil to rise so high at the ends of the crankcase that it will cover either No. 1 or No. 6 splasher troughs on grades? If not, how could a full supply cause excessive lubrication?

Denver, Col. C. E. R.

—Considering that when descending steep grades the engine is not delivering any power there is no need to worry about the condition of the oil. There will be plenty of oil throughout the engine to keep it lubricated for the longest descent.

2—It is practically impossible to design an engine for splash lubrication which will not load the end of the crankcase when the engine is tilted through a large angle. Actually to cover the splasher troughs would require a degree of tilt equivalent to an extremely steep hill.

Continental Engine in 1917 Overland

Editor THE AUTOMOBILE:—Kindly advise me whether the engine in the 1917 Overland six is made by the Continental Motor Co. The model is No. 85-6 and sells for $925.

Franklin, N. J. F. C. H.

—The Willys-Overland Co. will continue to use the Continental engine for its six-cylinder car throughout 1917.

Changing Hudson 33 Into Delivery Car

Editor THE AUTOMOBILE:—I have a 1911 Hudson 33 torpedo body five-passenger car which I wish to change into a commercial body to use for delivery of farm produce. Is there any body made to fit these conditions? The gasoline tank would have to be relocated as it is now under the front seat.

Mansfield, Mass. S. F. F.

—You would have to take this matter up with a carriage builder. There is no stock body made which would suit you. You must be very careful that you do not overload the chassis since the frame, springs and axle are only designed to sustain the weight of five passengers and any dead load which you put on it ought not to be greater than that.

Assuming you convert the body, the useful load it would carry in addition to the driver ought to be limited to 600 lb.

There is no reason why you should not continue to keep the

gasoline tank under the driver's seat. Our advice is that you discuss the matter with someone near you who you think could build a body and get his ideas on it. The usual way to get a reasonable platform space is to build wooden cross pieces which will lift the platform about 1 ft. above the top of the wheel. Possibly you could move the driver's seat forward by setting the steering gear more nearly vertical but it is very likely the position of the gear lever and of the pedals will prevent you gaining much in this way. Probably the cheapest plan would be to leave the front seat as it is and substitute a small platform for the tonneau.

Information on Nitrogen Filled Bulbs

Editor THE AUTOMOBILE:—Do nitrogen-filled bulbs give more light than regular vacuum type with the same amount of feed from battery?

2—What would be proper candlepower nitrogen bulbs to substitute for regular vacuum type 15 cp. bulbs in headlight, would it be 21 cp.?

3—What would be the approximate added burden to 6-volt battery regularly using 15 cp. vacuum type headlights to substitute 36 cp. nitrogen bulbs, the regular vacuum type consuming 2½ amp. and the 36 cp. nitrogen bulbs consuming 4 amp.?

4—Using regular vacuum type 15 cp. bulbs of 2 amp. generator shows battery charge at about 15 m.p.h. when headlights are turned on. At about what speed would battery charge using 36 cp. nitrogen bulbs of 4 amp.?

5—Does a 21 cp. nitrogen bulb, actually give 6 more candlepower than a 15 cp. regular vacuum bulb when each bulb uses 2½ amp.?

Peebles, Ohio. A. C. P.

—Yes.

2—Yes.

3—The addition would be the difference between the current drawn by the small bulb and that needed for the large one.

4—It is not possible to answer this without knowing the exact characteristic curve for the generator.

5—It ought to do so.

Fitting Route Indicator to Speedometer

Editor THE AUTOMOBILE:—I am interested in connecting a route indicator to the Warner speedometer with which my 1916 Cadillac eight is equipped, and I am at a loss how to determine the exact speed of the shaft at the point where it it connects with the speedometer.

2—The closest I can come to it is 690 r.p.m. I am advised by the Stewart people that the speed of the shaft on their old model speedometer was 2523 r.p.m., and on their 1912 model was 1009; but they failed to give me the speed of the later models.

Occoquan, Va. G. A. D.

—The speedometer shaft on your car should turn 680 times in a mile in order to register mileage correctly. It will do this if the car is equipped with standard size tires 36 by 4½ in.

2—When speedometer shaft speeds are given in the revolutions per minute this usually means revolution per minute at some particular number of miles per hour.

Oil Satisfactory in Ford Cups

Editor THE AUTOMOBILE:—Kindly advise me if it is desirable to substitute grease cups for the present oil cups on a Ford car and if they are as satisfactory as concerns lubrication as the oil cups?

2—Where can I secure grease cups for the Ford to replace the oil cups having a large grease capacity? Also cups having a large oil capacity to replace the present system?

3—Is there any power pump that has proven successful on the Ford? What are the merits of the spark plug pumps? I have heard that they are detrimental to the engine.

Hot Springs, Va. R. B. D.

—As long as you keep the oil cups filled lubrication will be just as good as you will get with grease. Many engineers greatly prefer oil to grease, as it flows much more easily in cold weather.

2—You could get greasecups or large oil cups from any good accessory house or your dealer could obtain them for you.

3—Any of several tire pumps will give you satisfaction. The spark plug pumps are very good and cannot possibly damage the engine. If you purchase one of these pumps do not forget that it is most effective when the engine is running slowly. If the engine is speeded up too much the piston in the pump will not draw in a full charge as it does not get time to make its return stroke.

55,000 Wire Wheel Cars in 1916

Editor THE AUTOMOBILE:—Kindly advise the probable number of automobiles equipped with wire wheels during the 1916 season and also the probable number of cars to be equipped with wire wheels in the 1917 season.

Johnstown, Pa. F. H. M.

—At the present time we estimate that about 55,000 new cars have been equipped with wire wheels in 1916 and the manufacturers expect that fully 200,000 will use them in 1917.

Bijur Regulator Wiring Diagram

Editor THE AUTOMOBILE:—Will you kindly give me a wiring diagram of a Bijur regulator, showing how same is connected to a 1913 Packard car generator, replacing the mercury regulator made by the Delco company.

2—Also give a diagram showing the internal circuits of same and any other data you may have explaining its operation.

New York City. B. F. K.

—Fig. 1 shows the connections to a Bijur regulator. Regarding the internal mechanism, this Bijur regulator is a vibrating field voltage controller described on page 741 of THE AUTOMOBILE for Oct. 21, 1915. The diagram of the vibrating type regulator published herewith shows all the essential details of the Bijur instrument.

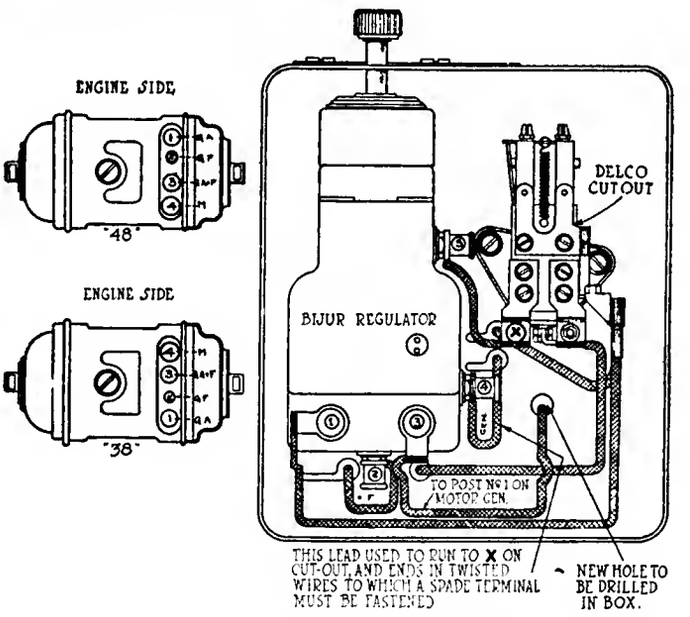


Fig. 1—Wiring diagram of a Bijur regulator, showing connections as used on a 1913 Packard generator

ACCESSORIES

Hercules Auxiliary Bearing

THESE bearings are designed to increase the carrying capacity of Ford cars and to prevent the breakage of axle shafts. The bearings remove the weight of the car and load from the axle shafts and permit the use of solid rubber tires or demountable rims by taking care of the extra weight. The manufacturer states that these bearings also eliminate wobbling of the wheels and side sway. A set consists of two combined radial and thrust bearings capable of carrying a load of 3800 lb. at axle speed. These bearings are mounted on the outer ends of the Ford rear axle housing and engage steel brackets to be fitted in the inside of the brake drums. These brackets are secured by six special bolts, replacing the bolts used for fastening the brake drums and hub flanges to the wheels. When the wheels are in place on the axle shafts, these steel brackets engage the outer race of each auxiliary bearing, bringing these bearings only 1¼ in. from the center of the wheel. Thus they carry the load close to and on the wheels. The bearings can be installed by anyone with a wrench, no machine work or change in the Ford wheels or axles being required. —Hercules Auxiliary Bearings Works, 327 S. La Salle Street, Chicago, Ill.

Superior Spot Lamp

Combining the functions of a spot and trouble light this lamp can be moved in any direction desired and throws a direct beam of light far in advance of the car. It has a silver-plated spun brass reflector and the exterior is finished in dark enamel which the manufacturer states will not peel. The lamp is fitted with an adjustable, removable mirror at the back of the clamp so that the driver can see cars coming up behind. The lamp itself is a 6 volt 21 candlepower nitrogen type with double contact, the switch being on the end of the handle. The windshield attachment is of heavy steel with strong bolts to prevent the lamp from sliding. The lamp is 6¼ in. in diameter over all and the length from the switch to the lens is 7⅞ in. A cord 10 ft. in length is supplied with each lamp for use as a trouble detector. — Pittsburgh Lamp, Brass and Glass Co., Pittsburgh, Pa.

M. and M. rim contractor

M. & M. Rim Contractor

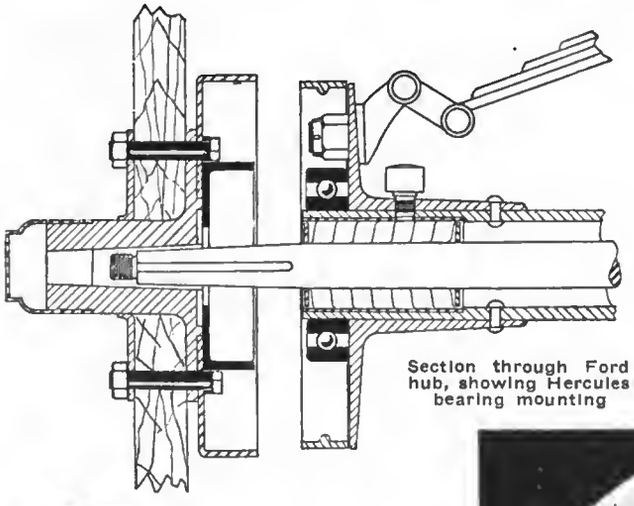
A tool for removing or replacing rims of the Standweld, Baker, Firestone, Detroit or Kelsey type. Clamps connected by a threaded rod are fastened on opposite sides of the rim, and the rim contracted by means of a turnbuckle. Turning the buckle in the opposite direction expands the rim to its original position. Price, $1.—M. & M. Mfg. Co., Bayside, N. Y.

The York Gas Saver

An auxiliary air valve screwed into the intake manifold. It consists of a metal nipple carrying an adjustable nozzle whereby the amount of additional air entering the manifold may be regulated. The installation requires the drilling of a 11/32 in. hole in the intake manifold just below the spread, tapping it to ⅛ in. std., and screwing in the valve. Price, $3.—York Gas Saver Co., 1518 Jefferson Avenue, East, Detroit, Mich.

Name-On Robe

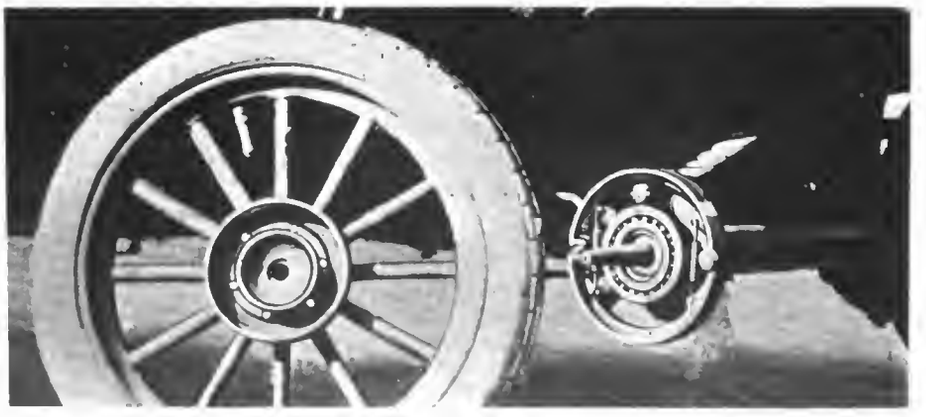
The owner's name is interwoven in the edge of the robe. It is made of long fiber mohair and bound with triple-stitched felt. The robe is reversible, having one color on one side and the other color on the reverse. The name is woven so as to show on both sides. The robe is claimed to be durable and warm without being bulky or heavy. Price, 54 by 72 in., $12.50; 54 by 84 in., $15.—J. & E. Dawson, Palethorp and Somerset Streets, Philadelphia, Pa.



Section through Ford hub, showing Hercules bearing mounting

York Gas Saver which admits additional air intake

Superior spot and trouble light



Ford rear wheel removed, showing Hercules auxiliary bearing in place

Standards Committee Accepts Four S. A. E. Reports

(*Continued from page* 645)

width of the V is to be 3 mm. and its length 2.5 mm., as illustrated.

Location of Filament in Bulb—7—All headlamp bulbs regardless of their diameter are to bave the center of the filament located in the axis of the bulb, 1¼ in. from a plane tangent to the nearer sides of the locating pins in the bulb base, as in the sketcb.

Location of Receptacle in Headlamp—8—All headlamp receptacles are to be located in the reflectors so that a plane passing through the registering points of the bayonet slots is 1¼ in. from the focal point of the reflector when the receptacle is at the mid-point of its adjustment, as illustrated.

Focal Length of Reflector—9—It is tentatively recommended that all headlamp reflectors be made as near as possible to the outline of a true parabola of 1¼ in. focal length, as in the drawing.

Limits on Location of Filaments—10—Investigation is being carried on in regard to the practicability of locating filaments within limits close enough to avoid the necessity of adjustments for focusing, or at least of focusing in replacing bulbs.

11—At the present time, filaments are located in the glass portion of the bulb by eye, and the glass bulb is afterward cemented into the base, its exact position being dependent upon variation in the size of the bulb.

12—Under these conditions it is said that the total variation is held within limits of 1/16 in. plus or minus. One of the largest manufacturers of bulbs has reported that the cost of bulbs would be increased by from 5 to 10 cents each by changes in manufacturing methods which would hold the center of the filaments within 1/64 in. of the bulb axis and within 1/32 in. (plus or minus) of the standard distance from the pins in the base.

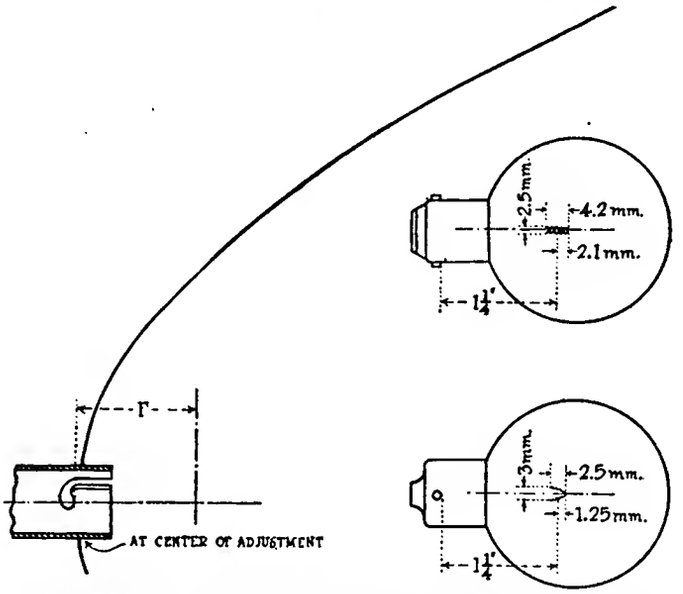
Mounting of Starters, Generators and Ignition Distributers—13—The sub-division on standards for mounting these various electrical units has been doing active work, but is not yet prepared to offer final recommendations. Definite proposals for mounting starting motors and generators have been proposed and criticized. Members of the sub-division are engaged in trying out the proposals on layouts of engines of different make, in order to revise the proposals so as to make them suitable to existing engine designs as far as possible. It is hoped that this work will be completed before the end of the present calendar year.

14—Standard dimensions for ignition distributers have been formulated with the co-operation of interested manufacturers. The dimensions are suitable for mounting the distributer either on the engine or on the generator. The proposal has not yet been submitted to the division.

Storage Battery Subjects—15—A sub-division has been appointed and has done some preliminary work in regard to terminals of storage batteries for gasoline cars. Another subject which this sub-division will consider is dimensions for storage battery compartments.

Among the speakers were A. G. Batchelder, Dr. H. M. Rowe and J. O. Lagorz of the American Automobile Assn. W. E. McKechnie, electrical engineer, Cadillac Motor Car Co., stated that the research of the headlight glare sub-division showed that the problem was very complicated and that no solution could be reached until scientific study revealed certain causes of glare not now known. To this end he proposed that a separate division be created to consist of a few members deeply versed in the subject to co-operate with other engineering bodies in the electrical and illuminating field in collaboratively solving the question. This proposal was enthusiastically received in view of the imminence of much drastic legislation at great variation pending in different states.

The problem first encountered by the sub-division was the variation in filament position on different bulbs which destroyed the focus and caused stray and reflected lights. It is working now to standardize filament position and shape but more research is needed, especially in determining correct focal length for ample illumination without glare and provision for tolerance in filament placing without manual adjustment. Mr. Rowe also supported the suggestion in telling the committee sometbing of the existing legal situation.



Left—Sectional plan diagram of headlamp reflector and receptacle. F is focal length of reflector—1¼ in. Right—Location of filaments in bulbs. Above—Vacuum bulb. Below—Gas filled bulb

Truck Standards

Discussion of military truck standards followed the report of the truck control standards chairman, H. D. Church, Packard Motor Car Co. All the recommendations were approved with the understanding that the standards did not mean to require any segment for spark throttle levers being recognized as advantageous in commercial work and imperative in military application. The report follows:

Truck Control Standards

1—The following recommendations apply to both right and left drive trucks:

Gearshift and Hand Brake Levers—2—It is recommended that the gearshift and hand brake levers be placed at the driver's right, with the hand brake lever to the right of the gearshift lever. The band brake lever is to be pulled back for brake application. The gearshift lever is to be fitted with a latch guarding the reverse position, or the equivalent of a latch, when used with either a three or four-speed transmission.

Gearshift Lever Handle Positions—3—It is recommended that for three-speed transmissions the positions of the gearshift lever handle be the same as recommended by the miscellaneous division for standardization for pleasure cars. Four-speed transmissions are to have the forward speeds so arranged that the gearshift bandle in high speed is in the same position as with the three-speed transmission, low speed occupying the place of reverse. The location of the reverse position is to be left optional. It is further recommended that with either three-speed or four-speed transmissions, the various speeds be clearly indicated, either on the gate or at the base of the gearshift lever.

Clutch and Brake Pedal—4—It is recommended that the clutch pedal be located to the left of and the foot brake pedal to the right of the fore and aft center line of steering column.

Accelerator Pedal—5—It is recommended that the accelerator pedal be placed to the right of the brake pedal.

Spark and Throttle Hand-Levers—6—It is recommended that spark and throttle hand-levers, if used, should be located to the right of the fore and aft center of the steering column. The spark lever should be the shorter of the two and both levers carried on stationary sectors. Both levers should be arranged so that they are pushed forward to advance the spark and to open tbe throttle.

Military Specifications Mangled

The tentative military truck specifications were literally torn to shreds as to detail, Henry Souther maintaining stand-

(*Continued on page* 681)

Details of Argentine Trade-Mark Law—Part II

(*Continued from page* 646)

themselves aggrieved by the mark may file opposition, and the applicant's attorney is notified and given an opportunity to reply. If the opposition is based on a previous registry or is not merely capricious, the Office cannot decide the case, and the proceedings are suspended. Applicant may then ask for the case to be sent to the Federal Courts, where the proceedings take the nature of an ordinary lawsuit.

Renewals: At the end of the 10 years period the registration may be renewed for an equal period, and so on indefinitely. The proceedings are exactly the same as in the original application. The term begins as from the date of grant, although the mark is protected as against subsequent applications from the moment when it is filed.

Secret manner of printing: Applicant may keep secret the manner of printing the mark in certain cases. In such cases the process of printing must be fully described and the description filed together with the application, in a sealed envelope, which may only be opened in open court in case of litigation.

Infringement: All infringement cases are tried in the Federal Courts. The penalty (see previous clause on this subject) consists of a fine of $20 to $500 Argentine and arrest from 1 month to 1 year, not redeemable by payment of money. The goods sold under a mark declared by the court to be an infringement are confiscated and sold for the benefit of the school fund. The sentence of the Federal Court may be carried to the Federal Chamber of Appeals and the winner of the suit may then sue the loser for damages in the common courts, if so declared in the sentence.

Administration: The author would be lacking in gratitude for courteous treatment experienced from the entire staff of the Argentine Patent and Trade Mark Office during many years, if he failed to close this article without a word of commendation for them. Above all he desires to state his sincere conviction that this department is carried on in a spirit of fairness and justice, interpreting the law in so far as it lies within its province to do so, in an able and strictly impartial manner. Although it may seem to some applicants that their cases are unduly delayed, this is entirely due to the great increase in the number of applications without the corresponding increase in staff.

There are twenty-five different classifications for copyright consideration, those quoted below apply to the automobile industry:

Class 12.—Machines, apparatus and elements of transport in general, their various parts and their accessories.

Such as: Locomotives, rolling stock for railways and tramways, telpherage systems, rails, semaphores, cranes and winches, movable bridges, endless carriers, lifts or elevators, freight elevators, endless screws, automobiles, aeroplanes, airships, balloons, motorcycles, bicycles, carts and carriages in general, hydroplanes, ships, motor launches, boats, dredges, floating cranes.

Class 17.—Caoutchouc, rubber and guttapercha, wrought and unwrought and in every state of preparation, and all articles made of that substance, except those used in electricity, surgery or orthopædia.

Such as: Transmission belts, air chambers and covers for vehicle tires, balls and toys, tubes, plate, cord, etc.

Class 19.—Leather furs and skins, wrought and unwrought, not included in other classes. Saddlery and harness, trunks, and traveling goods generally.

Such as: Fur garments, harnesses, trappings, horse furnishings, whips, blankets for animals, buckles, stirrups, bits, spurs, reins, trunks and valises in general, straps, portmanteaux, walking stick cases, hat cases.

Class 20.—Electricity, electrical machinery, supplies, apparatus and accessories for the production of power, heat and light, telephony, telegraphy and wireless telegraphy.

Such as: Dynamos, alternators, resistances, magnetos, telegraphic, telephonic and radiographic apparatus, electric lamps in general; sockets, tulips and globes, motors, commutators, wire and cable for electrical use, transformers, carbons for electric lamps, insulators, voltmeters, ammeters and other measuring and experimental apparatus; insulating fabrics, accumulators, batteries and cells.

Class 14.—Apparatus and articles for heating; ventilation, illumination, refrigeration, hydrotherapy, sanitary articles, machines, apparatus and supplies for cleaning, in general, washing, soaking and cleaning clothes.

Such as: Ranges, braziers, heating devices, stoves, central heating boilers, radiators, thermo-syphons, still worms, ventilators, aspirators, air injectors, gas generators, lamps of all kinds, lighting devices, luminous buoys, chandeliers, lanterns (of all kinds), freezing machines, machines for making ice and ice creams, refrigerators, shower bath apparatus, douches, baths of all kinds, bath-tubs, lavatories, water-closets, bidets, syphons, traps and other sanitary articles, machines, apparatus and articles for washing, wringing, ironing, and drying; carpet, curtain and tapestry cleaners, vacuum cleaners, brooms, feather dusters, brushes, mops, polishing cloths and skins; metal, wood, clothes, and leather cleaning soaps, pomades, powders and liquids; starch, borax, soda, bluing, preparations for polishing and waxing floors, stain erasers, etc.

Class 15.—Fabrics and textures in general; knitted fabrics; table linen, and linens in general.

Such as: Wool, silk, linen, cotton, jute and other vegetable fiber cloths and fabrics, waterproof or not; mixtures of the same; knitted goods, stockings, undershirts, underwear made of these fabrics; table cloths and napkins, sheets, pillow cases, quilts and blankets.

Class 10.—Hardware, cutlery, paints and colors, locksmithery, ironmongery, builders' hardware, house furnishing, bazaar articles and tinmongery; non-electric cable, canvas goods; picture frames and moldings; basketware, etc.

Such as: Tools in general with or without edge or point, not otherwise classified; razors and safety razors; cutlasses; knives, forks and spoons; daggers, colors and paints; varnishes, sealing wax, lacquers, wall paper, brushes, oil and turpentine for paints, rope, twine, and cord of hair or fiber, locks, bolts, hinges, chains, anchors, articles of ironmongery, of tin, brass, and the like; kitchen utensils, iron glazed and enamel ware, nails and screws, tents, flags, canvas awnings, sails, bags of any kind of cloth for any purposes; insulating cloths and papers; damp-proof materials; bottle caps, corks and metallic stoppers, fire kindlers, night tapers, baskets and similar objects in general; chains of all kinds, transmission belts in general; except those of caoutchouc or rubber.

Class 5.—Machines and apparatus of every kind of industry not otherwise classified, parts of the same; accessories and implements for dyeing or filtering. Machines, apparatus and implements of agriculture, aviculture, apiculture, fish culture, dairy, grape, wine culture, forestry, and cooperage.

Such as: Pumps, generators for motors, machines driven by water, gas, naphtha, steam and the like, machine ing machines and needles for same; fire tools, boilers not otherwise classified; motors, sewing, knitting and embroider- extinguishing engines, pumps and apparatus, etc.

(*To Be Continued.*)

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Doehler Moves Brass Dept.

BROOKLYN, N. Y., Oct. 16—The Doehler Die Casting Co. has removed its brass-back bearing department from Brooklyn to its new Toledo, Ohio, plant.

Accessory Spaces Allotted to 87 Concerns

(*Continued from page 642*)

Goods Co.; Lumen Bearing Co.; Parry Mfg. Co.; Wagner-Hoyt Electric Co.; West Side Foundry Co.; Rubber Insulated Metals Corp.; and the Syracuse Malleable Iron Works.

The list of exhibitors follows:

NEW YORK AND CHICAGO

A. B. C. Starter Co.....Detroit, Mich.
American Bronze Co.....Berwyn, Pa.
American Hardware Corp. (Corbin Screw Corp. Division).....New Britain, Conn.
Au-To Compressor Co.....Wilmington, Ohio
Automobile Supply Mfg. Co..Brooklyn, N. Y.
Benford Mfg. Co.....Mt. Vernon, N. Y.
Brown-Lipe Chapin Co.....Syracuse, N. Y.
Brown-Lipe Gear Co.....Syracuse, N. Y.
Brunner Mfg. Co.....Utica, N. Y.
Buda Co.....Harvey, Ill.
Byrne-Kingston & Co.....Kokomo, Ind.
Carr Co., F. S.....Boston, Mass.
Celfor Tool Co.....Buchanan, Mich.
Champion Ignition Co.....Flint, Mich.
Corning Glass Works.....Corning, N. Y.
Cowles & Co., C.....New Haven, Conn.
Corcoran-Victor Co.....Cincinnati, Ohio
Cramp & Sons Ship & Engine Building Co., Wm.....Philadelphia, Pa.
Dann Products Co.....Chicago, Ill.
Detroit Weatherproof Body Co.....
Dixon Crucible Co., Joseph..Jersey City, N. J.
Doehler Die Casting Co.....Brooklyn, N. Y.
Dyneto Electric Co.....Syracuse, N. Y.
E. A. Laboratories Co., Inc...Brooklyn, N. Y.
Eclipse Machine Co.....Elmira, N. Y.
Electric Storage Battery Co., Philadelphia, Pa.
Evapco Mfg. Co.....Detroit, Mich.
Ferro Machine & Fdry. Co..Cleveland, Ohio
Findelsen & Kropf Mfg. Co.....Chicago, Ill.
Gabriel Mfg. Co.....Cleveland, Ohio
Gemco Mfg. Co.....Milwaukee, Wis.
General Electric Co.....Schenectady, N. Y.
Globe Machine & Stamp. Co..Cleveland, Ohio
Gould Storage Battery Co....New York City
Gray & Davis.....Boston, Mass.
Halladay Co., L. P.....Streator, Ill.
Hall-Thompson Co.....Hartford, Conn.
Hartford, Inc., Edward V..Jersey City, N. J.
Hassler, Robert H.....Indianapolis, Ind.
Hayes Mfg. Co.....Detroit, Mich.
Hayes Wheel Co.....Jackson, Mich.
Heinze Co., John O.....Springfield, Ohio
Heinze Electric Co.....Lowell, Mass.
Kellogg Mfg. Co.....Rochester, N. Y.
Kent Mfg. Wks., Atwater...Philadelphia, Pa.
Klaxon Co.....Newark, N. J.
Kokomo Electric Co.....Kokomo, Ind.
Leather Tire Goods Co..Niagara Falls, N. Y.
Leece-Neville Co.....Cleveland, Ohio
Lipman Air Appliance Co.....Beloit, Wis.
Lumen Bearing Co.....Buffalo, N. Y.
Mann Co., F. W.....Milford, Mass.
Master Carbureter Corp.....Detroit, Mich.
Mosler & Co., A. R.....Mt. Vernon, N. Y.
Motometer Co.....Long Island City, N. Y.
New York Coil Co.....New York City
North East Electric Co.....Rochester, N. Y.
Otis Elevator Co.....New York, N. Y.
Pantasote Co.....New York, N. Y.
Parry Mfg. Co.....Indianapolis, Ind.
Perfection Spring Co.....Cleveland, Ohio
Piel Co., The G.....Long Island City, N. Y.
Pest-O-Lite Co.....Indianapolis, Ind.
Royal Equipment Co.....Bridgeport, Conn.
Sager Co., J. H.....Rochester, N. Y.
Schrader's Son, Inc., A.....Brooklyn, N. Y.
Shakespeare Co.....Kalamazoo, Mich.
Shaler Co., C. A.....Waupin, Wis.
Sparks-Withington Co.....Jackson, Mich
Splitdorf Electrical Co.....Newark, N. J.
Springfield Body Co.....Springfield, Mass.
Standard Thermometer Co.....Boston, Mass.
Standard Welding Co.....Cleveland, Ohio
Stewart Warner Speedometer Corp., Chicago, Ill.
Stromberg Motor Devices Co....Chicago, Ill.
U. S. Light & Heat Corp., Niagara Falls, N. Y.
Universal Shock Eliminator, Inc...New York
Vacuum Oil Co.....New York, N. Y.
Van Sicklen Co.....Elgin, Ill.
Veeder Mfg. Co.....Hartford, Conn.
Voorhees Rubber Mfg. Co..Jersey City, N. J.
Wagner-Hoyt Electric Co...New York, N. Y.
Waltham Watch Co.....Waltham, Mass.
Westinghouse Elec. & Mfg. Co. Pittsburgh, Pa.
West Side Fdry. Co.....Troy, N. Y.
Wheeler-Schebler Carbureter Co., Inc., Indianapolis, Ind.
Willard Storage Battery Co...Cleveland, Ohio

NEW YORK ONLY

Blackledge Mfg. Co., J. W.....Chicago, Ill.
Bosch Magneto Co.....New York, N. Y.
Breeze Carbureter Co.....Newark, N. J.
Budd Mfg. Co., Edward G..Philadelphia, Pa.
English & Mersick Co.....New Haven, Conn
General Bakelite Co.....New York, N. Y.
Hale & Kilburn Co.....Philadelphia, Pa.
Hartford Machine Screw Co..Hartford, Conn.
Herz & Co.....New York, N. Y.
Janney-Steinmetz & Co....Philadelphia, Pa.
Light Mfg. & Fdry. Co.....Pottstown, Pa.
Morse Chain Co.....Ithaca, N. Y.
Rubber Insulated Metals Corp., Plainfield, N. J.
Syracuse Malleable Iron Wks., Syracuse, N. Y.
Ward Leonard Elec. Co....Mt. Vernon, N. Y.
Zenith Carbureter Co.....Detroit, Mich.

CHICAGO ONLY

Badger Brass Mfg. Co.....Kenosha, Wis.
Continental Motors Co.....Detroit, Mich.
Edison Storage Battery Co.....Orange, N. J.
Garford Mfg. Co.....Elyria, Ohio
Imperial Brass Mfg. Co.....Chicago, Ill.
Oakes Co.....Indianapolis, Ind.
Remy Electric Co.....Anderson, Ind.
Simms Magneto Co.....East Orange, N. J.
Vesta Accumulator Co.....Chicago, Ill.
Warner Gear Co.....Muncie, Ind.
Waukesha Motor Co.....Waukesha, Wis.
Wilson & Co.....Chicago, Ill.

The complete list of exhibitors last year showed 306 accessory exhibitors at New York and 186 at Chicago.

Stiger Elected President

C. W. Stiger of the Stromberg Motor Devices Co., was yesterday appointed president of the Motor and Accessory Manufacturers, succeeding F. Hallett Lovell, who resigned. L. M. Bradley, prominent in the affairs of the N. A. A. M., and since connected with the automobile and accessory fields, has become manager of the association, succeeding W. M. Sweet, who has resigned to become the assistant to the president of the United Motors Corp. Mr. Sweet was yesterday elected a member of the board of directors to succeed Mr. Lovell and will serve until 1919. Mr. Sweet was also elected chairman of the 1917 banquet committee. Christian Girl of the Perfection Spring Co., was elected as a member of the board to succeed C. E. Whitney, resigned, His term will expire in 1919.

The association also voted to become a member of the Chamber of Commerce of the United States of America.

The following new members were admitted:

A-B-C Starter Co., Detroit, Mich., manufacturer of auto electric starting and lighting systems.

Celfor Tool Co., Buchanan, Mich., manufacturer of internal gear drive motor truck axles and high-speed drills.

Corning Glass Works, Corning, N. Y., manufacturer of technical glassware.

Detroit Weaterproof Body Co., Detroit, Mich., manufacturer of detachable closed tops.

Evapco Mfg. Co., Detroit, Mich., manufacturer of Evapco Gas Savers and Jiffy Starters.

Gillette Motors Co., Mishawaka, Ind., manufacturer of motors, manifolds, piston rings.

The Hall-Thompson Co., Hartford, Conn., manufacturer of polishes, dressings, enamels, chemical compounds.

Lipman Air Appliance Co., Beloit, Wis., manufacturer of air pumps, water and oil calculating pumps and other parts.

Morse Chain Co., Ithaca, N. Y., manufacturer of silent chain and sprocket wheels.

New York Coil Co., 338 Pearl Street, New York City, manufacturer of ignition devices, auto accessories.

Perlman Rim Corp., 1790 Broadway, New York, manufacturer of demountable automobile rims and parts.

Rubber Insulated Metals Corp., Plainfield, N. J., manufacturer of tires, tubes and insulated tools.

Universal Shock Eliminator, Inc., 8 West Sixty-second Street, New York City, manufacturer of shock eliminators, safety buffers.

Wagner-Hoyt Electric Co., 1902 Broadway, New York City, manufacturer of starting, lighting, ignition batteries and switches.

—

Lyons Fair Despite War

NEW YORK CITY, Oct. 12—American manufacturers will have an opportunity of exhibiting their wares in southern France at the annual fair at Lyons which will be held, despite the war, on March 1 to 15, 1917. The State Department has placed $500 at the disposal of the American consul which will enable him to distribute the catalogs, etc.

Catalogs may be forwarded directly to the U. S. Consul at Lyons, and should be printed in French.

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Demountable Top for Buick

NEW YORK CITY, Oct. 17—The Buick Motor Co. is equipping its touring cars with an all-weather top which is demountable. This body will be standard equipment and will cost $212 extra in this city.

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All-Weather Top for Chevrolet

NEW YORK CITY, Oct. 17—The Chevrolet Motor Co. is supplying as standard equipment an all-weather top which is removable. This top, which is made by the Detroit Weather Proof Body Co., will cost $70 extra.

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S. A. E. Reports Accepted

(*Continued from page 679*)

ards should be mainly confined to results, not means, except in cases where conclusive and recognized data are at hand. K. W. Zimmerschied, General Motors Corp., on the contrary, urged that uniformity of war trucks was of greater importance than what construction is best. F. A. Whitten, General Motors Truck Co., held out for more detailed specifications on the plea that safety demands the use of that which is known to be good, regardless of possible merit of unrecognized designs. Mr. Souther suggested a tread to fit railroads, since many will run on rails. Written discussions by John Younger, Pierce-Arrow Motor Car Co., and C. H. Taylor, Republic Motor Truck Co., disagreed with the detail requirements.

All agreed subject too big for hasty action. A. L. Riker said single paragraphs should be whole papers for discussion.

Engine and Transmission

Chairman W. T. Fishleigh of the engine and transmission division, reported progress on valve-timing data with characteristic curves, standards for poppet valves, starting cranks and belts for fans. Engine support arms and fans were delegated to sub-committees, but the division submitted engine test forms for action. Detail changes suggested and extension to cover aero and tractor engines were agreed upon for final submission in January. R. McA. Lloyd, consulting engineer, urged quick action, as standard engine test forms are greatly needed.

Industrial Miscellany

Factory

Stearn's Wear Proof Tire Co., Canada, with W. H. Matthews as president and offices in Toronto, Ont., has secured the Canadian manufacturing rights for the Stearns wear proof inner tubes.

Falls Motors Corp., Sheboygan Falls, Wis., office and shop executives, has organized an association for the promotion of business and industrial efficiency and social welfare.

Ladish-Obenberger Drop Forge Co., Milwaukee, has arranged for considerable extensions of its plant in Cudahy, Milwaukee county. Ground has been broken for a one-story steel and brick addition, 50 by 200 ft. The plant has been operated on a 24-hr. basis for many months.

Waukesha Motor Co., Waukesha, Wis., will award contracts for the erection of its new administration building, which will embody quarters for the engineering department and draughting rooms. The building is to be of brick and steel, 44 by 88 ft., two stories and basement, and cost $25,000.

Geo. P. Meyers Machine Co., Sheboygan, Wis., manufacturing Wisconsin motor trucks, is building its first 5-in. model.

Paige-Detroit Motor Car Co., Detroit, has received an order from the Bigelow-Willey Co. of Philadelphia for $129,000 worth of enclosed cars. This is one of the largest orders for enclosed cars that the company has received.

Federal Rubber Mfg. Co., Cudahy, has started work on the new six-story manufacturing building. It will be 100 x 157 ft. in size and cost $200,000. It is one of the principal units of the $1,000,000 improvement scheme undertaken some time ago, after the Fisk interests bought the controlling interest from the Milwaukee stockholders.

Savage Tire Co., San Diego, Cal., will add a warehouse of brick and steel construction, adjoining its present building.

Minnesota Tire & Rubber Co. will be formed with a capital stock of $200,000 by H. L. Werner, Red Wing, Minn; H. A. Trenholm, Minneapolis, and J. W. Adams, Ellsworth, Wis. Headquarters will be at St. Paul, Minn. The plant location has not been decided on.

Sterling Automobile Mfg. Co. is rushing its plant at Amston, Conn. The company now occupies a plant in Paterson, N. J.

Partridge Rubber Co., Montreal, Ont., will take over the plant of the Standard Tire & Rubber Co., Guelph, Ont.

Star Motor Car Co., Cincinnati, Ohio, has been formed with $200,000 capital and will establish a plant for assembling steam-driven automobiles. R. M. Wallingford, 1003 Race Street, is secretary.

Keystone Tire & Rubber Co., Pittsburgh, Pa., will build a new plant at Penn Station along the Pennsylvania railroad. The plant will consist of a factory building, three stories, 60 by 190 ft., and of brick and steel construction.

Commercial Automobile Co., Lexington, Ky., will equip a plant for assembling automobile running gears and bodies and for the manufacturing of bodies, etc. The equipment will cost $8,000.

Twin City Four Wheel Motor Drive Co., St. Paul, Minn., is building an addition to cost $30,000.

Mohawk Rubber Co., Akron, Ohio, is gradually finishing its $100,000 addition. The new addition consists of a three-story annex to the building recently completed and an additional story on an old building.

F. L. Jacob Co., Detroit, Mich., will build a one-story factory for the manufacture of automobile parts at a cost of $30,000.

E. H. Orersmith, Jonesville, Mich., who is building motor trucks of the front-drive type on a small scale, is negotiating with the business men's association of Waukesha, Wis., with a view to establishing a plant at that point.

American Brass Co., Kenosha, Wis., has awarded contracts for the erection of a new office building, 48 by 100 ft., three stories and basement, and a private garage and service shop, 30 by 120 ft., one story high. Both structures will be of fireproof construction equipped with sprinkler systems.

Personals

N. A. Young has been made sales manager of the Angsten-Koch Co., Chicago. He was formerly assistant sales manager of the Metal Specialties Mfg. Co.

R. V. Lull has been made sales promotion manager of the King Motor Car Co., Detroit. He was formerly in the sales department.

H. A. Harris, formerly of the Hudson agency at Portland, Me., has been appointed manager of the Oldsmobile branch there.

P. W. Runyan has been put in direct charge of publicity by the Westcott Motor Car Co., Springfield, Ohio. He was formerly assistant to sales and advertising manager of the Robbins & Myers Co., Springfield.

The Automobile Calendar

ASSOCIATIONS

Oct. 25-26—Columbus, Ohio, Automobile Trade Assn., second annual meeting, Virginia Hotel.
Oct. 26—Philadelphia, Pa., Section meeting of Society of Automobile Engineers. Paper by Herbert Chase.
Dec. 2-9—Electricians' Country-wide Celebration.
Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.

CONTESTS

Oct. 21 — Kalamazoo, Mich., Track Racee, Kalamazoo, Motor Speedway.
Oct. 22-23—Loe Angeles, Cal., Commercial Car Reliability Tour.
Oct. 28—New York Speedway Race, championship.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.
Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race. Arizona State Fair.

1917

April—Loe Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 14 — Des Moines, Iowa, Speedway Race, Championship.
July 28—Taooma, Wash., Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15 — Providence, R. I., Speedway Race, Championship.
Race, Championship.
Sept. 29—New York, Speedway
Oct. 6—Kansas City Speedway Race.
Oct. 13—Chicago Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Oct. 14 - 21 — Dallas, Texas, Show, State Fair.
Oct. 14-21 — Pitteburgh, Pa., Thirteenth Annual Show, Motor Square Garden. Automobile Dealers' Assn. of Pittsburgh.
Nov. 10-18—Providence, R. I., Show, Rhode Ieland Automobile Dealers' Assn.
Nov. 20-25—Worceeter, Mass., Show, Worcester Casino; Worcester Automobile Dealers Asen.
Dec. 2-9 — Springfield, Mass., Show, Auditorium. H. W. Stacey. Mgr.
Dec. 30-Jan. 6—Cieveland, Ohio, Sixteenth Annual Show, Wigmore Colleeum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 9 - 10 — Fort Dodge, Ia., State Convention, Iowa Retail Automoblie Dealere' Assn.
Jan. 27-Feb. 3, 1917 — Chicago, Ill., Show, Colliseum, National Automobile Chamber of Commerce.
Jan. 26-27—Montreal, Que., Automobile Trade Assn.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 10-18—San Francieco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 18-25—St. Louie, Mo., Show, Auto Manufacturers' and Dealers' Assn.
Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers Asen.
Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.
March 6 - 10 — Boeton, Mass., Show, Mechanics' Bldg., Boeton Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 14-17 — Davenport, Ia., Show, Colleeum Bldg. Tri-City Automobile Trade Asen.

TRACTOR

Oct. 14-29—Dallae, Tex., Demonstration, Texas State Fair.

The Automobile

Vol. XXXV
No. 17

NEW YORK, OCTOBER 26, 1916

Ten cents a copy
Three dollars a year

Editorial Contents—Page 3

Advertisers' Index—Next to last page

Ford Owners—A Cowl Board and Speedometer Combined

This is the latest of all the famous Stewart Products for Ford cars—and already one of the most popular.

The cowl board, beautifully enameled in black, adds undeniable finish and distinction to the Ford dash.

A Stewart Speedometer is mounted flush in the center—right where it is most convenient and easiest to read.

This combination complete costs but little more than the speedometer alone.

No wonder it is selling so fast. Better get yours today.

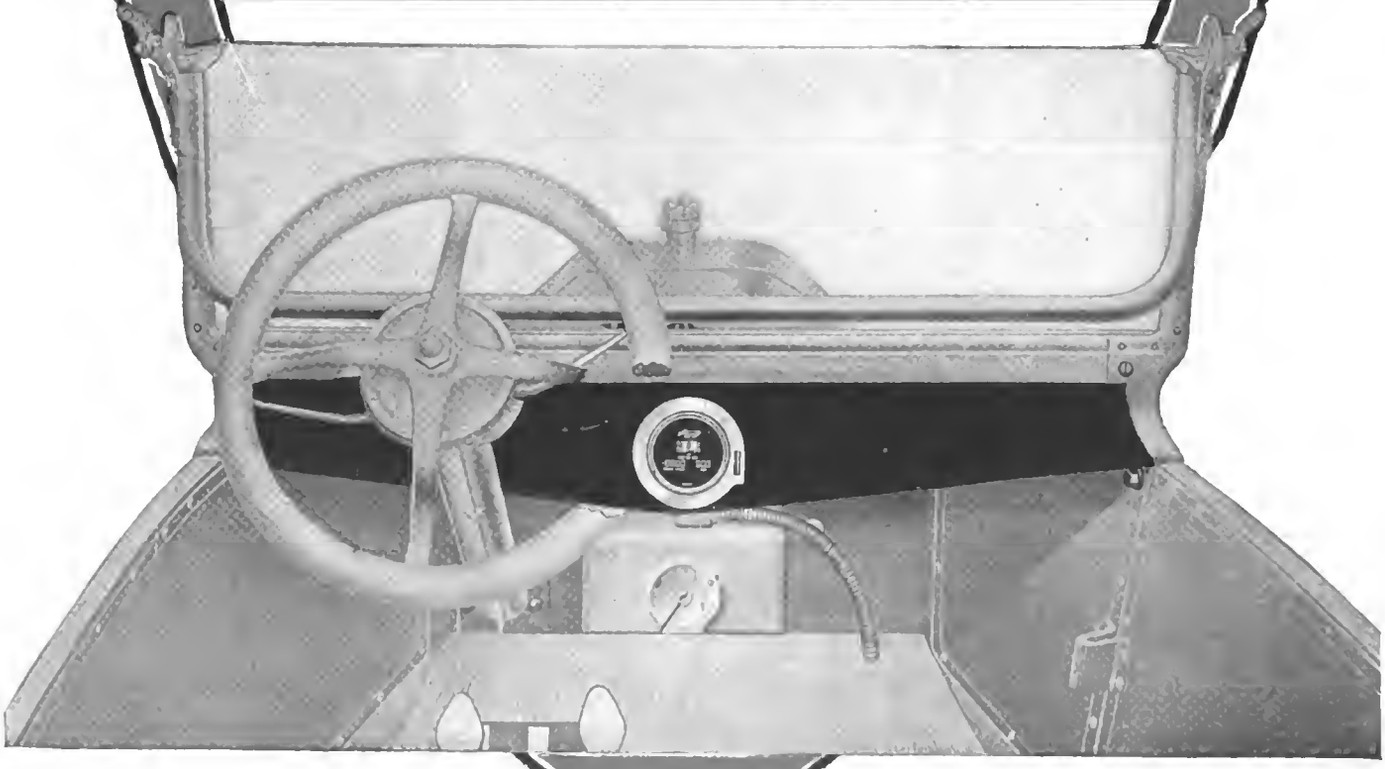
Speedometer Complete with Cowl Board, $11.25

"No car is better than its accessories"

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Stewart

Speedometer and Cowl Board for Fords



The Automobile

VOL. XXXV NEW YORK—THURSDAY, OCTOBER 26, 1916—CHICAGO NO. 17

Kerosene Oil Men's Fuel Choice

Resolution Adopted Recommending Kerosene— Endorse Good and Holley Vaporizers

CHICAGO, ILL., Oct. 24—That the use of kerosene offers the most hopeful solution of the fuel supply difficulty is a resolution accepted by the Independent Oil Men's Assn. and is the result of the report of a committee consisting of Prof. Lucke, head of the engineering department of Columbia University, Prof. Metzler of the same institution and M. J. Byrne, Waterbury, Conn. This committee was called the Gasoline Relief Committee and was appointed last April, since when it has examined a large number of devices and now recommends two specifically. One is the Good kerosene carbureter, the invention of John Good of Brooklyn, and the other the Holley kerosene carbureter.

To Have Fitting Experts

The Independent Oil Men's Assn. will arrange to appoint in each large city a special repairman to convert existing cars from gasoline to kerosene-burning vehicles and it is stated that the association may even go so far as to finance the repairshop for this purpose. This is sufficient proof that the association is absolutely committed to its resolution and will do everything possible to encourage the use of kerosene.

The convention at which this important resolution was passed is the eighth and was the best which the association has ever had, there being over 800 members present.

(*Continued on page* 724)

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Anderson Buys Chicago Electric

DETROIT, MICH., Oct. 20—The Anderson Electric Car Co. has purchased the Chicago Electric interests of the Walker Vehicle Co. and will shortly take over all the new Chicago Electrics completed and those in process of manufacture, together with all parts and service. The Walker Vehicle Co., which is owned by the Commonwealth Edison Co., will devote its efforts to the building and selling of Walker electric trucks. Gail Reed, general sales manager of the Walker company, has been engaged to promote the sale of electrics for the Anderson company.

—

Hackett Resigns Hackett Co. Presidency

JACKSON, MICH., Oct. 24—Mansell Hackett, president of the Hackett Motor Car Co., this city, has resigned the presidency to become the general manager of the company. J. S. Johnston of the Johnston Bros., shipbuilders at Ferrysburg, Mich., is the new president and J. L. Dornbos, cashier of the People's Savings Bank, Grand Haven, Mich., becomes treasurer. Other officers remain the same.

—

Miller Is Inland Sales Head

ST. LOUIS, MO., Oct. 20—L. B. Miller has been appointed sales manager of the Inland Machine Works, this city, maker of the Inland piston ring. He was formerly office manager of the St. Louis branch of the United States Tire Co.

—

Bour-Davis Starts Production

DETROIT, MICH., Oct. 23—The Bour-Davis Motor Car Co. has started production in its new plant, which has been building for nearly a year. The plant is a four-story building and the progressive assembly principle will be used.

—

American Motors Plant Adopts 8-Hr. Day

PLAINFIELD, N. J., Oct. 23—The 8-hr. day will be put into effect at the plant of the American Motors Corp., this city. The plant will employ several hundred men beginning Nov. 1.

Packard Surplus Is $10,823,717

Gains $6,206,419 in Final Year —Total Assets Increase $11,830,505

DETROIT, MICH., Oct. 20—Packard assets have increased $11,830,505 during the past year. More than $6,000,000 have been added to the surplus, and a general prosperous business growth is displayed in the consolidated balance sheet for the fiscal year ending Aug. 31, which was submitted to stockholders of the Packard Motor Car Co. at their annual meeting in the company's general offices Thursday, Oct. 19. The report presents the company's financial statement and several paragraphs of explanation, among which it is stated that plant values amounting to $1,250,000 were written off in excess of regular depreciation, making the total depreciation written off the Detroit plant, $2,847,-648.76 for the fiscal period.

The consolidated sheet of the Detroit and subsidiary companies shows $6,206,-419.61 added to surplus for the year and an increase of $9,094,388.88 in value of inventories comprising raw material, work in progress and finished vehicles. The increase in inventories, it is explained, was not as great as the company's increase in vehicle production which was 186 per cent greater than in the preceding year.

During the year the company's authorized capital stock was increased from $16,000,000 to $21,000,000 by the addition of $5,000,000 par value of common stock, and the issued capital stock was increased from $7,065,300 of common and $5,000,000 of 7 per cent cumulative preferred stock to $11,656,930 of the authorized $13,000,000 of common stock and to the total $8,000,000 of authorized pre-

(*Continued on page* 693)

Red Seal Battery Maker Enlarges

Re-Incorporates with Capital of $5,000,000—To Increase Production and Plant

NEW YORK CITY, Oct. 24—To take care of increased production and factory facilities, the Manhattan Electrical Supply Co. has re-incorporated with a capital of $5,000,000, divided into $1,500,000 7 per cent cumulative first preferred, $500,000 second preferred, also 7 per cent cumulative, and $3,000,000 common. The old capital was $1,500,000, divided into $175,000 preferred and $1,375,000 common. The common paid 14 per cent and the preferred 6 per cent.

This company, which manufactures and sells the Red Seal battery and also deals in a line of electrical appliances at its various stores, was founded in 1889 with a capital of $1,300.

Gross Sales	Year
1901	$902.324
1915	3,644,037
To Aug. 31, 1916	2,812,040

There will be no change in the present officers, who are: J. J. Gorman, president, and B. H. Ellis, vice-president and treasurer. Factory facilities will be added and new machinery installed.

The current net earnings applicable to dividends are estimated at more than five times the first preferred requirements. In the period of 2 years and 8 months to Aug. 31, 1916, the average earnings were more than four times the first preferred dividend requirements.

The net tangible assets, exclusive of good will, patent rights and trade marks, as of Aug. 31, 1916, were over $2,490,000, or $166 for each share of first preferred stock, and net quick assets more than $1,600,000, or $106 per share. Up to Aug. 31, there was $489,847.91 cash in the bank.

The company will have no mortgage or funded debt of any kind. There will be a sinking fund, beginning Oct. 1, 1917, of $30,000 per annum, payable $7,500 quarterly to and including Jan. 1, 1921, and thereafter $40,000 per annum, to be applied to the retirement of the first preferred at not over $112.50 per share.

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Columbia Motors Leases Boat Plant

DETROIT, MICH., Oct. 23—The Columbia Motors Co. has leased the plant of the Michigan Steel Boat Co. and will take possession early in December.

—

Banta Is Premier Vice-President

CHICAGO, ILL., Oct. 23—A. J. Banta, branch manager in Chicago for the Locomobile Co. of America, resigns Nov. 1 to become vice-president of the Premier Motor Corp., Indianapolis. Mr. Banta has held his present position with the Locomobile Co. for the past 12 years. He is succeeded by J. Murray Page, manager of the Los Angeles branch of the Locomobile Co. Mr. Page has been in the service of this concern since 1899, spending part of that time in the Locomobile factory, and a part as branch manager in San Francisco.

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Hal Motor Car Co. Now

DETROIT, MICH., Oct. 20—The H. A. Lozier Co., Cleveland, has brought the name of that company into harmony with the car they manufacture and has reincorporated as the Hal Motor Car Co.

—

Sattley is Standard-Detroit Manager

DETROIT, MICH., Oct. 23—F. L. Sattley has been named general manager of the Standard-Detroit Tractor Co. Mr. Sattley is a member of the well known family of implement manufacturers.

—

Sproat is Olds Works Manager

LANSING, MICH., Oct. 24—H. J. Sproat has been appointed works manager of the Olds Motor Works, this city. His immediate duties will be the enlargement of the factory to provide for an increase of production to more than 20,000 cars next year, almost double that of last.

—

Hughes Resigns from Victor Parts

CINCINNATI, OHIO, Oct. 24—W. R. Hughes has resigned as sales manager of the Victor Auto Parts Co., this city, and is now secretary and treasurer and also manager of sales of the Corcoran Mfg. Co., this city.

—

Raybestos Co. Incorporated for $1,500,000

Will Take Over Royal Equipment Co. and Expand

BRIDGEPORT, CONN., Oct. 24—The Raybestos Co. has been incorporated under Connecticut laws with $1,500,000 capital and will take over the Royal Equipment Co., manufacturer and distributer of Raybestos brake lining, brakes, etc. There will be no change in the policy of the company or the character of its products; dealer and jobber arrangements also remain unchanged. A 15-acre factory site has been purchased in Bridgeport and six new buildings will be erected which will double the capacity of the plant. There will be two buildings 100 by 600 ft., for weaving brake lining; one building 100 by 200 ft., for manufacture of brakes; one building 60 by 200 ft., for treating Raybestos; one building 60 by 300 ft., for manufacturing compressed sheet; one building 60 by 300 ft. for a storehouse and shipping department.

White Surplus Is $1,623,521

Co.'s Total Income for First 6 Months of 1916 Fiscal Year is $2,750,923

NEW YORK CITY, Oct. 21—The White Motor Co., Cleveland, Ohio, reports a surplus of $1,623,521, which is equivalent to 11 per cent on the $16,000,000 capital stock. Net profits from operations were $2,635,784 during the 6 months ending June 30, 1916. Adding $115,208 in other income, brings the total income to $2,750,923. The expenses of the company amounted to $847,472 and the dividends up to the March 31 quarter to $280,000, thus bringing the surplus to $1,623,521.

The company has $16,000,000 capital stock, $50 par value, with no bonds and no preferred stock. The company is paying 7 per cent dividends on the stock. Net profits in the year 1915 were approximately $8,700,000, over 54 per cent on the stock.

The combined balance sheet of this company and subsidiary companies as of June 30, 1916, as reported to the New York Stock Exchange, follows:

ASSETS	
Plant, equipment and real estate	$3,558,547
Good will, patents, etc	5,388,910
Materials and supplies	5,539,025
Accounts receivable	2,112,932
Bills receivable	804,967
Cash	2,022,337
Deferred assets	114,991
Total	$19,541,710
LIABILITIES.	
Capital stock	$16,000,000
Purchase money obligations	390,000
Current accounts, etc	1,282,535
Reserve for depreciation	85,902
Accounts and bills receivable	159,751
Surplus	1,623,521
Total	$19,541,710

—

Auto Specialties Absorbs Mich. Malleable

DETROIT, MICH., Oct. 21—The Auto Specialties Co., which has been located at Joliet, Ill., has absorbed the Michigan Malleable Co., and is opening its factory at St. Joseph, Mich. The company will occupy two buildings with approximately 75,000 ft. of floorspace.

—

N. A. C. C. Banquet Jan. 9

NEW YORK CITY, Oct. 24—The annual banquet of the National Automobile Chamber of Commerce will be held Jan. 9 at the Waldorf-Astoria.

—

Weidely Capital Now $600,000

INDIANAPOLIS, IND., Oct. 23—The Weidely Motors Co. has just increased its capital stock from $350,000 to $600,000.

National Plans for Expansion

Offers 53,000 Shares in New Financing—6000 Cars for 1917

NEW YORK CITY, Oct. 23.—One more company has joined the list of those which have been refinanced to take care of a larger production. The latest is the National Motor Vehicle Co., Indianapolis, Ind., which will be taken over by the National Motor Car & Vehicle Corp., organized under the laws of New York. The new company, which at first will be a holding concern, is offering 53,000 shares of stock to the public at $42.50 per share. Twenty-seven thousand of these have been taken by the present National Motor Vehicle Co. interests. In other words over one-third of the total outstanding stock of the new company is to be taken by the present management and its associates. The company has no mortgage, no bonded indebtedness and no preferred stock. The refinancing is being handled by Pyne, Kendall & Hollister, and Leonard Snider & Co. The total capitalization is 80,000 shares without par value.

Additions Under Way

The company is making several additions to its plant and the minimum output for 1916 has been placed at 6000 cars, as against 2499 cars last year.

The company is completing a new reinforced concrete building, 60 by 380 ft., three stories, which is located between the original buildings and the 400-ft. buildings completed last January. This addition gives a total of 626,000 sq. ft. floor space. Another strip of ground has recently been purchased on the east side of Yandes Street, opposite the present site, on which a further addition of a building is contemplated, 140 by 328 ft., one-story high for the present.

It is estimated that the net earnings for the year ending June 30, 1917, will be from $1,000,000 to $1,100,000 on a maximum output of about 6000 cars. This estimate is based upon orders actually taken and on contracts made by the company for needed materials. This is at the rate of 30 per cent on the subscription price of $42.50 per share. Last year the earnings were $425,000, equal to 12½ per cent on the capitalization of the new company at the issue price.

Management Unchanged

The management remains unchanged. The officers of the existing company are: A. C. Newby, president; W. G. Wall, vice-president; and G. M. Dickson, general manager, secretary and treasurer.

The proposed directorate of the new company includes: A. C. Newby; S. A. Fletcher, president of the Fletcher-American National Bank, Indianapolis; O. J. Thomen, of Redmond & Co., New York; Leonard Snider of Leonard Snider & Co., New York; W. G. Wall; G. M. Dickson, and Buell Hollister of Payne, Kendall & Hollister, New York.

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Ford Co. Raises Probationary Salary

DETROIT, MICH., Oct. 24—The Ford Co. has raised the salaries of workmen laboring under the probation system to 43 cents an hour, an increase of 9 cents over the former rate of 34 cents per hour. Ford employees are placed on a probation basis for 6 months and do not receive the $5 a day salary until they qualify through their probation. As the Ford work day is 8 hr., probationers now receive $3.44 per day in place of $2.72. The raise was made because of the increased cost in living.

All women workers in factories and offices will receive the same wages as the men, $5 per day after probation.

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Standard Motor Parts Buys Newcastle Company

NEWCASTLE, IND., Oct. 23—The Newcastle Auto Parts Co. was sold last week to the Standard Motor Parts Co., this city. The latter company took over more than $3,000 worth of obsolete Maxwell-Briscoe and Everett parts. The Newcastle Auto Parts Co. was incorporated 2 weeks ago with a capitalization of $200,000, and at the time of its organization announced it would occupy 20,000 sq. ft. of floorspace in the manufacture of parts, accessories and appliances for automobiles.

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Pullman Advances Car Price $85

Co. Will Concentrate on Four-Cylinder at $825

YORK, PA., Oct. 24—The Pullman Motor Car Co., this city, has advanced its price to $825 on its 1917 models. The company will concentrate on a four-cylinder model next year with a 32 hp. motor. There will be three types, including a two-passenger roadster, a four-passenger roadster and a five-passenger touring car.

The motor is little changed from last year, the changes covering mainly refinements. The bodies will be streamline and the standard color will be green. Other features include combined force feed and splash with an indicator on the dash; Splitdorf starting and lighting; Carter vacuum tank for carbureter feed; Dixie magneto; and Stromberg carbureter.

Corliss Truck Is Unique

Special Patented Design Combines Frame and Body in Integral Unit

CHICAGO, ILL., Oct. 23—The Corliss Motor Truck Co., Corliss, Wis., is a corporation formed some time ago which is now manufacturing and ready to supply a new type of small truck. It is rated at 1000 lb. capacity and sells for $695, the especial point being the use of an all-steel body, which is combined with the frame in such a way as to make the body a strength factor in the chassis. Because the weight of the body is thus utilized the weight of the complete car can be reduced without losing any strength.

The engine fitted is a four-cylinder 3⅛ by 4½ in. and there is a three-speed gearset with selective shift. The rear axle is bevel-driven, three-quarter floating and has double roller bearings to carry the load. Elliptic springs are used and pneumatic tires 31 by 4 in., the wheelbase being 100 in. The details are of a robust character.

It is stated that the company have excellent factory facilities and will be able to care for a large demand.

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Canadian Ford Passes Dividend

DETROIT, MICH., Oct. 24—The Ford Co. of Canada has passed its dividend on account of large expenditures for additions and a war tax of $750,000. The directors re-elected Henry Ford president; G. M. McGregor, vice-president and treasurer, and W. R. Campbell, secretary.

The Canadian company earned for the fiscal year of 10 months ending July 31, $1,109,322.14, equal to 15.8 per cent on the outstanding $7,000,000 of the company's authorized $10,000,000 of capital stock.

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Gordon Is Hudson Traffic Manager

DETROIT, MICH., Oct. 25—John Gordon has become traffic manager of the Hudson Motor Car Co., this city. Mr. Gordon was formerly with Dodge Bros.

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Fifth Avenue Buses Earn $1,669,726.18

NEW YORK CITY, Oct. 24—The Fifth Avenue Coach Co., this city, during its fiscal year, ending June 30 last, carried 16,223,042 passengers at 10 cents each, in its 132 buses, its revenue from this source amounting to $1,622,304.20, an increase of $217,257.10 over the previous period's operations. The company made 33.10 cents per active bus mile. Revenue from livery service, 19,460 bus miles, amounted to $16,281.66 and advertising

privileges netted $31,140.32, thus bringing the total revenue from operations to $1,669,726.18, an increase of $218,218.08 over the previous period. After deducting total operating expenses of $1,064,690.36, the income was $458,672.90, $94,498.70 more than last year.

A feature brought out in the report of the company is that the 132 buses ran at a cost of only 21 cents per bus mile, each bus using six tires, the rear wheels each having two tires. This is based on a mileage of 4,966,995 and a total operating expense of $1,064,690.36. New tires during 1916 cost $54,533.63.

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Daimler Representative Describes Tanks

DETROIT, MICH., Oct. 23—A. C. Hills of the English Daimler Co. is visiting Detroit on behalf of his company and of the British government. He is making a short trip and will be in the U. S. A. less than 2 weeks. Hills is credited with saying that the famous "tanks" are engined with Daimler power plants and are about 60 ft. long. Their weight, he says, is sufficient to push down a 6-in. tree trunk when the tank is driven direct at the tree. The original report that the tanks are composite vehicles made in different factories is thus confirmed.

A. C. Hills has been a prominent member of the British motor industry for many years and has been with the Daimler company since a short time after the latter's adoption of the Knight engine.

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National and Premier Co.'s In New York

NEW YORK CITY, Oct. 25—The National Motor Car and Vehicle Corp. has been incorporated with 80,000 shares of no par value, to carry on business with $800,000. The incorporators are R. S. Dodge, J. R. Lindemuth.

The Premier Motor Corp. has been formed with a capital of 20,000 shares, $100 each, and 30,000 shares of no par value, to carry on its business with $2,150,000. H. L. Thompson, I. P. Seery and J. C. Flowers, president of the company, are the incorporators.

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Steel Tube Products Co. Formed

DETROIT, MICH., Oct. 21—The Michigan Steel Tube Products Co. has been incorporated for $300,000 by Charles E. Miller, Howard A. Flagg and Frank Kritz, all formerly with the Standard Welding Co. of Cleveland. The new concern will manufacture steel tubing.

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Troy Mfg. Co. Buys Studebaker Building

DETROIT, MICH., Oct. 24—The Troy Mfg. Co. has purchased the factory known as plant 5 of the Studebaker Corp. for $100,000. The Troy company will use the factory for the manufacture of automobile bodies.

Cleveland Considers Steam

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Abner Doble Describes His System to S. A. E. Section —Good Discussion

CLEVELAND, OHIO, Oct. 21—In a long paper tracing the development of the steam automobile in recent years Abner Doble of Detroit held the close attention of the Cleveland S. A. E. section last night. Doble dealt with the main factors which make for steam car success and failure, showed why it was that some of the earlier cars gave trouble and traced different methods by which the troubles had been overcome. He described his own boiler and engine system, already dealt with in THE AUTOMOBILE for Sept. 7, and explained how this came to be created by studying other types. The paper was extremely informative, and will be printed at length next week.

An excellent discussion followed the paper, and, in answering the questions asked, Mr. Doble touched upon both matters which had entered into his paper and others which he had left out in order that the paper might not be of too great a length. In answer to the first question, which was regarding the relative thermal efficiency of his steam power plant and a standard internal combustion engine, Doble pointed out that, at normal running speeds, the thermal efficiency of the steam engine is much nearer its maximum than is that of an internal combustion engine; in other words, that he did not claim a greatly increased thermal efficiency for his own power plant, but rather believed that there had always been a tendency to overestimate the thermal efficiency of internal combustion engines when pulling a heavy load at low speed.

The Weight Question

In regard to the difference in weight distribution caused by the placing of the engine upon the rear axle, Mr. Doble believes it to be a distinct advantage rather than disadvantage. One reason for this, upon which he laid emphasis, was the bringing the center of gravity of the car back to a point somewhat behind the physical center of the car, thereby improving the conditions of traction and lessening the tendency to skid.

When asked about the action which took place when the condensation of steam was allowed to form water in the cylinders, Mr. Doble described a feature of his engine which had not been brought out in his paper; viz.: a special design of valve whose lifting from its seat allowed either water or steam to escape into the steam chest whenever cylinder compression exceeded steam chest pressure.

Various questions were next brought up concerning the fuel used and how it was supplied to the combustion system, to which Doble answered that no gasoline was used either in starting or running, kerosene being the only fuel carried, and that the kerosene was supplied to the combustion system by a pump without the use of air pressure.

The great differences between the lubrication of a steam engine and an internal combustion engine were effectively brought out in the discussion among a number of those present, Doble first bringing up the point of the lubricating qualities of the steam itself which was borne out in an exceedingly interesting way by one who had had considerable experience along this line in connection with locomotive work. Mr. Doble went on to say that the chief advantage of the oil which he did use was to keep the engine from rusting and the inner surfaces of the boiler from accumulating deposits.

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U. S. A. Cars Sunk at Sea

NEW YORK, Oct. 24—The Dutch liner, Blommersdyk, bound for Rotterdam on Oct. 9, had on board twenty-five cases of automobiles and parts, without tires, when it was sunk by the German submarine U-53 off the coast of New England. The boat also carried one truck. The cars, it is stated, were shipped by the Kissel Motor Car Co. to its representative in Amsterdam.

A consignment of Scripps-Booth cars went down with the Lord Treegar when it was recently sunk by a torpedo in the Mediterranean.

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$750,000 Co. Formed in Maine

PORTLAND, ME., Oct. 21—The Pilgrim Motor Co., an organization with a capitalization of $750,000 has been formed here to manufacture and deal in automobiles and accessories. The men behind it are all Maine residents. T. L. Croteau is president; James E. Mantir, secretary; A. B. Farnham, treasurer. These men with George S. Soule comprise the board of directors.

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Doak Joins Ohio Electric

TOLEDO, OHIO, Oct. 21—R. C. Doak has been appointed assistant general sales manager of the Ohio Electric Car Co., this city. Mr. Doak has been in the electric car field since 1910 when he became branch manager of the Woods company. From there he went to the Anderson company and later returned to the Woods company.

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Bowser Buys Site for Addition

FORT WAYNE, IND., Oct. 23—The S. F. Bowser Oil Tank & Pump Co. has bought a large tract of land, occupying an entire square, south of the present factory.

New York Registers 303,223

267,825 Passenger Cars, 32,942 Trucks and 2456 Dealers' Licenses Issued

NEW YORK CITY, Oct. 22.—For the first time in the history of this or any other State in this country, the registration in New York State has exceeded the 300,000 mark, exactly 303,223 cars and 98,203 persons having been licensed to date. There is now one automobile to each thirty-two persons in this State, the last census showing a population of 9,687,744 persons.

The combined total of motor vehicles in New York includes 267,825 passenger cars, 32,942 commercial vehicles and 2456 dealers' automobiles. Of the passenger cars, 139,026 were of 25 hp. or less, 82,191 less than 35 hp., 23,411 less than 50 hp. and 1001 of 50 hp.

The total of 98,203 chauffeurs includes 71,194 persons who were licensed last year and who have renewed their licenses this year for the first time.

The use of motor vehicles in this State has grown more rapidly this year than in any previous one since they became common. Figured upon a percentage basis, however, this increase is not quite so apparent, as the number registered this year has increased 27 per cent. Last year the increase was 31 per cent, the year previous 26 per cent and the year before that 25 per cent. In 1912 the gain was 27 per cent, in 1911 it was 24 per cent over 1910, the first year to require annual registration.

The total number registered has more than doubled since 1913 and is almost twice as much as the total registered in 1914, when there were 169,966. This year's registration is nearly five times that in 1910.

190,000 Cars in Iowa

DES MOINES, IOWA, Oct. 23—Iowa already has over 190,000 automobiles registered for 1916 and the total of registration fees has been $1,636,000 or an average of $8.58 per car. The number of dealers registered is 2641 and the fees from dealers amount to $86,547.

23,033 Cars in Alabama

MONTGOMERY, ALA., Oct. 19—The license year in this State ended Sept. 30 and 23,033 automobile licenses were issued, a gain of 100 per cent. Of these 17,740 were for pleasure cars, 3,888 for commercial trucks and 1,397 for motor cycles.

Cotton Prices Boost Car Sales

ATLANTA, GA., Oct. 19—Automobile licenses are being issued in this State at about the rate of 100 a day since cotton passed 16 cents. Last year 25,000 licenses were issued. Two weeks ago the 45,000 mark was passed for this year and it is expected that the 50,000 mark will be passed. Charles S. Barrett, President of the Farmers' Union, on his return from an extended inspection trip was asked as to the most notable feature of his trip. "The cotton money that is going into automobiles," he said.

115,000 Cars in Wisconsin

MILWAUKEE, WIS., Oct. 21—The first census of motor-propelled vehicles taken in Milwaukee and Wisconsin just 10 years ago to-day, showed that there were 746 cars owned in Milwaukee, and 2578 in the State, including Milwaukee. To-day it is figured that there are 18,000 cars owned in Milwaukee, and approximately 115,000 in Wisconsin.

Discher Patent Held Valid

MILWAUKEE, WIS., Oct. 20.—The Discher patent covering bumper bracket construction has been held valid and infringed by the Auto Parts Mfg. Co., of this city, and a permanent injunction has been granted in favor of Grant F. Discher, president and general manager of the Gemco Mfg. Co., this city, which controls the patent. The patent, No. 1,052,224, relates to a bumper bracket having a lug, which bears against the front end of the automobile frame side member, and an adjustable clamp, using a transverse bolt passing through two vertical slots, one on each side of the frame member.

John F. Harper has been appointed special master to determine damages. The decree was handed down by Judge Geiger in the U. S. district court for the Eastern district of Wisconsin.

The Auto Parts Mfg. Co. petitioned for an appeal to the U. S. circuit court of appeals for a temporary suspension of the injunction. The court granted the suspension on condition that the company file a bond for $15,000 to cover any damages that might be sustained while the appeal was pending, should the higher court confirm the decree of the district court.

Another Injunction for Prest-O-Lite

INDIANAPOLIS, IND., Oct. 22—The Prest-O-Lite Co., Inc., has been granted a permanent injunction against the Power City Sun-Lite Gas Co., Sioux Falls, S. D., putting its gas into Prest-O-Lite tanks without removing the Prest-O-Lite Co. name and trade mark. The decree was issued by the U. S. district court for the district of South Dakota, southern division.

S. A. E. Assets Are $33,000

209 New Members Added During Year—Hunt Succeeds Baton as Tire Chairman

WASHINGTON, D. C., Oct. 18—The strong financial condition of the Society of Automobile Engineers was shown at to-day's meeting of the Council held in this city when the financial statement for the fiscal year was presented. The society has funds approximating $33,000. At the end of the fiscal year, Sept. 30, the assets were: Certificates of deposits $20,000, savings account $2,000, bonds $10,000 and $860 checking account.

During the year 209 new members have been added as a net gain. In all 370 members have been enrolled, but there have been fifty-eight resignations, ninety-four dropped for non-payment of dues, and nine deaths. The new membership shows 150 members, 105 associate members, fifty-two juniors, five affiliates, seven affiliate representatives, and thirty-five student enrollments.

At to-day's meeting eighteen resignations were accepted and twenty-seven members added. H. L. Baton's resignation as chairman of the tire and rim division of the standards committee was accepted and O. E. Hunt appointed in his place.

Exporters to Meet Oct. 31

NEW YORK CITY, Oct. 24—The American Manufacturers' Export Assn. will meet Oct. 31 at the Hotel Biltmore. The session will be the seventh annual one. More than 400 persons are expected to be present. The afternoon will be devoted to a report of the members of the Industrial Commission to France, who will return to this country on Oct. 28.

Humpage Goes to Wilt Drill

SYRACUSE, N. Y., Oct. 23—F. R. Humpage has resigned as manager of the Dyneto Electric Co., this city, to become affiliated with the Wilt Twist Drill Co., Walkersville, Ont., in the capacity of secretary-treasurer and general manager. Mr. Humpage is well known in the automobile trade, having been with the industry since 1903 in executive positions with the Packard, Thomas and other companies.

Carlton Is Bosch 'Frisco Manager

SAN FRANCISCO, CAL., Oct. 23—B. R. Miller has resigned his position as manager of the San Francisco branch of the Bosch Magneto Co. and L. C. Carlton, previously in the engineering department at the main office, New York, succeeds him.

Steel Prices To Be Steady

No Change Expected for 2 Years—Post Bellum Conditions Will Hold Up Prices

NEW YORK CITY, Oct. 23.—That there will be very little if any reduction in price of steel during the next 2 years is the opinion of a large manufacturer who has the reputation of being closer to the steel situation than anybody else connected with automobile and accessory manufacture. Just at the present time, due to the fact that less steel is being shipped abroad, and due to the seasonal slow-up on the part of automobile manufacturers there is plenty of steel to be had. Steel mills that have been very stingy on shipments are now in a position to make better shipments than formerly. The price remains stiff and there is no indication of any softening of the market.

A sales manager of one of the largest producers of steel entering into automobiles is authority for the statement that steel would be at least $5 a ton higher inside of the next 4 months. He further believes that for the next 3 years the steel market will not be any lower than it is at present. So long as the war continues the demand for steel in U. S. A. will be great in response to the foreign and domestic demands. Even when the war stops a great amount of steel will be required from America for reconstruction work abroad so that there is little possibility of any lowering of the market.

Some of the Detroit automobile concerns report getting plenty of steel without much trouble. Representatives of three steel concerns in Detroit state that deliveries have been behind for the past 10 months, but that at the present time there is no indication of any change pointing towards any shortage different than what has existed.

Marion Tire Elects Directors

MARION, OHIO, Oct. 19—The stockholders of the Marion Tire & Rubber Co. held their first annual meeting at the factory recently, at which the directors were elected for the year. The following members were re-elected to the board of directors: W. H. Heverstott, C. W. Fairbanks, J. W. Jacoby, D. H. Lincoln, J. L. Price, C. W. Mapes, A. H. Trout and W. T. Jones. H. L. Gilbert was also elected a director.

Gilbreth Talks on Motion Study

DETROIT, MICH., Oct. 21—Frank B. Gilbreth, efficiency engineer, Providence, R. I., gave an interesting lecture before the Detroit Engineering Society last night in which he discussed motion study as a science of determining methods of least waste in industry and told of his system of straight-line movement, describing how by means of electric lights and clock and other devices he photographed body movements of workers to ascertain waste and to discover means for efficient labor. Mr. Gilbreth told of many instances where his system has produced results amounting to three times as much production with less fatigue of the workers and described his methods in detail, illustrating many of them by moving pictures.

Kjeldsen, Importers' Show Mgr., Dead

NEW YORK CITY, Oct. 25—Stefan Kjeldsen, manager of the Importers' Automobile Show in this city and Chicago, and with the Holbrook Co., body builder here, died yesterday in this city. He was born in Denmark 34 years ago.

Crude Oil Features Materials Market

NEW YORK CITY, Oct. 24—Crude oil prices featured this week's activities in the automobile materials market. Pennsylvania crude has gone up to $2.60 a barrel, its former record price. Refiners state that it is impossible to get the required quantity of different grades of crude, and the price has again been raised in the hope of increasing the supply. Producers were openly talking of $3 for Pennsylvania crude when they heard of the new quotations.

Gasoline prices, it is stated, may soar, on account of the crude shortage. Some authorities state that on account of the large exports of petroleum, the oil production in this country will be inadequate to supply the increased needs of the refineries. Linseed oil has advanced 6 cents a gallon to 88 on account of higher flaxseed prices. Steel prices are holding strong with no changes. The automobile makers are now contributing their quota to the steel industry by coming in with contracts for the first half of 1917 and closing for their needs of forging bars and alloy steel up to July 1, 1917.

100-Point Rise in G. M. Common

Stock Goes to 830 — Rest of Issues Rise on Sympathetic Market

NEW YORK CITY, Oct. 23—The automobile and accessories issues last week were in larger demand and consequently higher. A majority of the rises were large. General Motors, which rose 40 points the previous week, kept up its skyward movement with another rise of 100 points, reaching the record price of 830. This stock leads the motors while Firestone heads the accessories. Firestone has reached $1,130 a share, just $5 more than last week. The General Motors Corp. has made application to list on the Stock Exchange $20,000,000 of 6 per cent cumulative preferred and $82,600,000 common stock.

Hupp, Miller Rubber, Chalmers, Chevrolet, Studebaker, and United Motors featured with substantial rises. Hupp preferred rose 10 points; Miller Rubber, 10 points; Chalmers, 5 points; Chevrolet, 2 points; Studebaker, 3½ points.

Several new stocks were admitted to the Stock Exchange and Curb last week. White Motor has entered the Stock Exchange and the Spicer Mfg. Co., National Motor Car & Vehicle Co., and the Manhattan Electrical Supply Co. have put their stock on the Curb. Initial transactions on the Curb, Thursday, in Spicer first preferred amounted to 3600 shares with the high sale being 101½, or 1½ points above the price at which it was sold by the syndicate. The company's earnings are now running at the rate of $100,000 net a month. The National stock has been offered at $42.50.

Drulard Graham Roller Bearing Inspector

DETROIT, MICH., Oct. 24—Frank Drulard, chief inspector of the Bower Roller Bearing Co., has resigned to accept a similar position with the Graham Roller Bearing Co., of Coudersport, Pa.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.65	.65	.65	.65	.65	.65	...
Antimony, lb.	.12¾	.13	.13	.13	.12¾	.13	.00¼
Beams Channels, 100 lb.	2.87	2.87	2.87	2.87	2.87	2.87	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl.	12.14	12.35	12.00	11.85	12.00	12.40	+ .26
Fish Oil, Menhaden, Brown, gal.	.60	.60	.60	.60	.60	.60	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.08	1.08	1.08	1.08	1.08	1.10	+ .02
Lead, 100 lb.	7.05	7.05	7.05	7.05	7.05	7.05	...
Linseed Oil, gal.	.82	.83	.84	.88	.88	.88	+ .06
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.50	2.50	2.50	2.50	2.50	2.60	+ .10
Rapeseed Oil, refined, gal.	.95	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb.	.73	.73	.73	.73	.73	.75	+ .02
Rubber, Ceylon, First Latex, lb.	.62½	.60½	.61	.61	.61	.61	— .01½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	44.00	42.25	41.00	41.13	41.13	41.25	—3.75
Tire Scrap, lb.	.06	.06	.06	.06	.06	.06	...

I.M.C. Extends Time To Oct. 30

400 Voting Trust Certificate Holders Have Deposited But Others Delay

NEW YORK CITY, Oct. 23—The International Motor Co. is notifying holders of voting trust certificates of the preferred and common stock that the time to make deposits has been extended to Oct. 30. Over 400 holders, owning two-thirds of each class of stock, have deposited their certificates under the plan and reorganization agreement, but a large number of holders have not been heard from.

The company's indebtedness, aggregating nearly $3,000,000, matures Nov. 1 next. Certificates should be deposited either by mail or in person with the Columbia Trust Co., this city.

Stewart-Warner Earns $604,939 in Quarter Ending Sept. 30

CHICAGO, ILL., Oct. 20—The net earnings of the Stewart-Warner Speedometer Corp. for the third quarter show an increase of more than $150,000 over the earnings for the corresponding period of last year. For the quarter ended Sept. 30 the net earnings were $604,939; for the same period last year they were approximately $450,000. This was announced after a meeting of the directors to-day. It has not been the policy of the corporation to make public such production figures, and this new departure is said to be due to the fact that the stock recently has been listed on the Chicago stock exchange.

Other figures available at this time are those for the entire 9 months of 1916 so far. The net earnings for that period are $1,880,072. Although this shows a continued large increase in business, the directors did not increase the dividend rate or vote an extra disbursement at their meeting to-day.

Dividends Declared

Mitchell Motors Co., quarterly of $1.50 a share, payable Nov. 24 to holders of record Nov. 10.

Stewart-Warner Speedometer Co.; quarterly of 1½ per cent on common, payable Nov. 15. Books close Oct. 30 and reopen Nov. 6.

Pyrene Mfg. Co.; quarterly of 2 per cent on common, payable Nov. 1 to stock of record Oct. 25.

Paige Motor Car Co.; monthly of 3 per cent, payable Nov. 30 to stock of record Nov. 1. Action has been deferred on proposed issue of $1,500,000 preferred stock until Nov. 24.

Miami Trailer Adds $10,000

TROY, OHIO, Oct. 25—The Miami Trailer Co. of this city has increased its capital stock $10,000 to take care of factory additions for trailer manufacture. This action was taken at the annual meeting of the stockholders Oct. 11.

Jones Opens Detroit Purchasing Office

DETROIT, MICH., Oct. 20—The Jones Motor Car Co., Wichita, Kan., has opened a permanent office for its purchasing department at the Kresge Building here.

Michigan Stamping Stock Issue

Automobile Parts Concern Started on $200—Capital Increased to $1,500,000

DETROIT, Oct. 21.—Stockholders of the Michigan Stamping Co. were ratified an increase in capital from $500,000 to $1,500,000 at a special meeting held Oct. 20. The proposed increase will take the form of a stock dividend and will involve a reduction of the par value from $100 to $10 a share. The stock recently listed on the Detroit Stock Exchange is held at $500 a share with none offered.

The Michigan Stamping Co. has experienced a remarkable growth. J. H. French, president of the concern and H. P. Cope, vice-president, started the business 12 years ago with a capital of $200 with which they purchased a stamping machine on monthly payments. With the growth of the industry the company became more prosperous and acquired property which now includes several buildings valued at close to $1,000,000. Last year the company purchased additional land and is now erecting a new plant to cover 6 acres.

Runyan Cushion Wheel Co. Formed

OMAHA, NEB., Oct. 23—The Runyan Cushion Wheel Co. has been incorporated with $100,000 capital to manufacture a patent cushion wheel in this city. The incorporators are: A. L. Runyan, F. C. Burlingim, H. O. Wulff, D. R. Sowards, E. J. Conrad and J. E. Von Dorn.

Automobile Securities Quotations on the New York and Detroit Exchanges

Ajax Rubber Co	63	65	..
J. I. Case T. M. Co. pfd	84⅞	86	+2⅞
Chalmers Motor Co. com	100	105	+5
Chalmers Motor Co. pfd	90	95	—2
*Chandler Motor Car Co	106	106½	+2
Chevrolet Motor Co	197	200	+2
Fisher Body Corp	39	41	— ½
Fisk Rubber Co., com	100	105	—12
Fisk Rubber Co. 1st pfd	110	120	—2
Fisk Rubber Co. 2d pfd	100	110	..
Firestone Tire & Rubber Co. com	1130	1150	+5
Firestone Tire & Rubber Co. pfd	110	111	..
*General Motors Co. com	830	875	+100
*General Motors Co. pfd	126⅛	126½	+3⅝
*B. F. Goodrich Co. com	74⅛	74⅜	+1⅛
*B. F. Goodrich Co. pfd	114⅛	114⅜	+ ⅜
Goodyear Tire & Rubber Co. com	296	298	..
Goodyear Tire & Rubber Co. pfd	108	109	+ ¾
Grant Motor Car Corp	8	10	+1
Hupp Motor Car Corp. com	5	5½	— ¼
Hupp Motor Car Corp. pfd	90	100	+10
International Motor Co. com	4½	6	+ ½
International Motor Co. pfd	17	25	—1
*Kelly-Springfield Tire Co. com	78¾	79	+1¾
*Kelly-Springfield Tire Co. 1st pfd	98	100	+1
*Lee Rubber & Tire Corp	42¾	43	— ¼
*Maxwell Motor Co. com	89¾	90	+ ¾
*Maxwell Motor Co. 1st pfd	87	87½	+ ½
*Maxwell Motor Co. 2d pfd	55½	56½	+ ½
Miller Rubber Co. com	250	260	+10
Miller Rubber Co. pfd	105	107	+1
National Motor	42¾	43¾	..
Packard Motor Car Co. com	170	180	..
Packard Motor Car Co. pfd	95	100	—3
Paige-Detroit Motor Car Co	36¾	37¾	—1¼
Peerless Truck & Motor Corp	24	25	+1½
Portage Rubber Co. com	174	176	..
Portage Rubber Co. pfd	173	174	..
Regal Motor Car Co. pfd	17	22	..
Reo Motor Car Co	43¼	†44	—1¼
Saxon Motor Car Corp	80	80¾	+2
Spicer Mfg	101½	101⅞	..
Springfield Body Corp. com	92	95	+2
Springfield Body Corp. pfd	120	130	..
Standard Motor Construction Co	7½	8	..
Stewart-Warner Speed. Corp. com	113	114	—2
Stewart-Warner Speed. Corp. pfd	..	..	..
*Studebaker Corp. com	135	135¼	+3½
*Studebaker Corp. pfd	111	112	+ ½
Stutz Motor	68	69	+3
Swinehart Tire & Rubber Co	86	92	+1
United Motors Corp	66⅝	66⅞	— ⅞
*U. S. Rubber Co. com	61	61¼	+2
*U. S. Rubber Co. pfd	111½	112	—1
White Motor Co	57	59	+ ½
*Willys-Overland Co. com	46⅛	46⅝	+1⅝
*Willys-Overland Co. pfd	103	104	+ ½

*At close Oct. 23, 1916. Listed New York Stock Exchange.
†Ex-div.
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

Auto Body Co	41	43½	..
Chalmers Motor Co. com	100	107½	+5
Chalmers Motor Co. pfd	90	94	..
Continental Motor Co. com	36	37¼	— ¾
Continental Motor Co. pfd	9½	10½	..
Ford Motor Co. of Canada	270	300	..
General Motors Co. com	775	825	+75
General Motors Co. pfd	123	126½	+2
Maxwell Motor Co. com	90	92½	+6½
Maxwell Motor Co. 1st pfd	86	89	+2
Maxwell Motor Co. 2d pfd	55	57½	+2
Packard Motor Car Co. com	..	177½	..
Packard Motor Car Co. pfd	100	102	..
Paige-Detroit Motor Car Co	36	37½	—1½
W. K. Prudden Co	48	50	..
Reo Motor Car Co	43½	..	— ¾
Studebaker Corp. com	134½	137½	+7½
Studebaker Corp. pfd	109	..	+2
C. M. Hall Lamp Co	28½	31	..

INACTIVE STOCKS

Atlas Drop Forge Co	..	33	..
Kelsey Wheel Co	55	60	..
Regal Motor Car Co. pfd	18	..	..

Hudson Engine in Test Runs

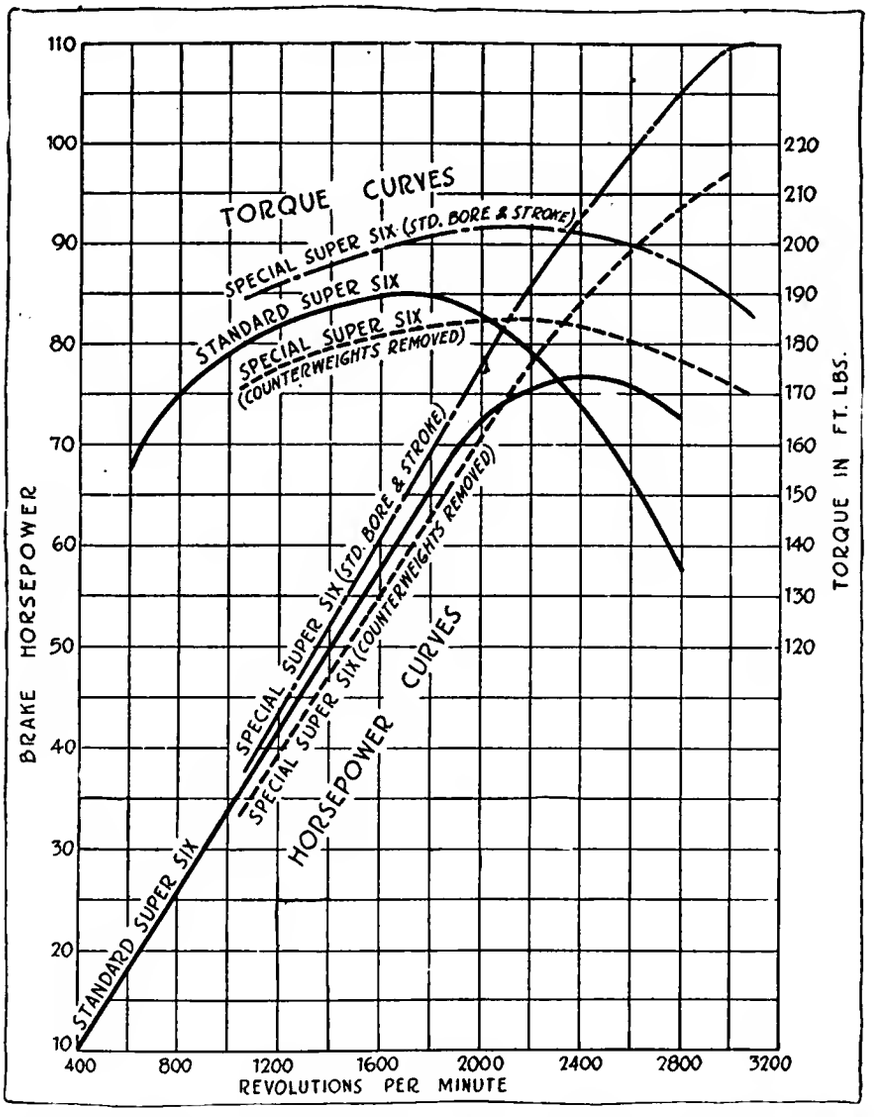
Trials To Prove Counterbalanced Crankshaft Reduces Internal Friction

DETROIT, MICH., Oct. 12—In order to demonstrate the fact that the counterbalanced crankshaft reduces the internal friction of an engine, the Hudson company made to-day a series of runs with the counterbalanced shaft and with the shafting nearly in static balance. The first run was made to obtain maximum power, this being reached at 3100 r.p.m. when 110 hp. was developed. The connecting-rod bearings were then adjusted and a 40-min. run at 3000 r.p.m. was made, the horsepower varying between 100.4 and 103.5. At the conclusion of this second run the weights on the crankshaft were removed and a steel ring attached to the center throw in order to bring the shaft into static balance. This having been done, the test was repeated, first for maximum power and second for endurance. The latter test only lasted for 2 min., 30 sec., as the cap of one of the connecting-rod bearings became loose and was thrown off.

It will be noticed from the curves published herewith that the special engine with which the tests were made both with and without counterweights, gives practically the same reading as the stock Hudson engine up to 2000 r.p.m., but that considerable divergence commences at this point. The similarity between the torque curves of the special Super sixes is characteristic of the kind of difference caused by internal friction.

Double Assessment for Speedway

ST. PAUL, MINN., Oct. 20—Petition for a double liability stock assessment against shareholders in the Twin City Speedway Assn. has been granted Receiver P. W. Herzog, by Judge J. C. Michael, attorney. An informal offer of $180,000 is the best received to date for the plant.



Power curves obtained by Hudson in tests of special and standard Super six engines

Salesmanship Club in New York

Automobile and Accessory Concerns Among Members of Growing Organization

NEW YORK CITY, Oct. 19—The New York Salesmanship Club, which is an outgrowth of the World's Salesmanship Congress held in Detroit in July has been formed and held its initial meeting last evening at the Waldorf-Astoria with about 2000 men present.

The club is one of a number being formed throughout the United States for the "Betterment of Business Through the Betterment of Salesmanship." Its work will include meetings every 2 weeks at which practical sales workers will speak and answer questions in an open forum. The plan is similar to that worked out by the Detroit club, which fathered the Congress, last summer.

It is proposed to have a permanent home for the club as soon as funds are available.

The membership list is growing rapidly. Life sustaining memberships may be purchased now by paying $250. The other memberships are:

Sustaining, $50 a year for 5 years.

Associate, $10 a year until Dec. 31 and $20 a year thereafter.

Initiation wil be $10 after the membership list begins to assume proportions.

This makes it possible for the individual salesman to get in now for $10 and enjoy a year of membership. Thereafter it will cost him $20 a year.

One of the features of the meeting was the variety of businesses represented and the caliber of the men who participated. There were big insurance companies, manufacturing concerns, food products makers and others. A few of those who bought life memberships follow as an indication of the variety of companies:

Packard Motor Car Co. of New York, General Roofing Mfg. Co., Dictaphone Co., Aetna Life Insurance Co., Computing Tabulating Recording Co., Rutherford Rubber Co., Fairchild Advertising Co., Royal Baking Powder Co., Dexter Folder Co., and L. K. Comstock & Co.

Others taking sustaining memberships were: American Fastener Co., Efficiency Engineer John M. Bruce, Cutler Hammer Mfg. Co., Union Central Life Insurance Co., Hodgman Rubber Co., Drummond Detective Agency, Matheson Lead Co., Bowman Automobile Co., Baker Linen Co., and others.

The officers of the New York club are:

President, C. Louis Allen, president of the Pyrene Mfg. Co.

First vice-president, Douglas Barnes, president of the Barnes Knitting Corp.

Second vice-president, George W.

Crouch of the Underwood Typewriter Co.

Treasurer, Oscar Coolican, New York manager of the National Cash Register Co.

Secretary, L. J. Mosness, Barnes Knitting Corp., 303 Fifth Avenue.

At last night's meeting addresses were made on salesmanship, its importance and the need for making it a science, by Norval A. Hawkins, president of the World's Salesmanship Congress and sales manager of the Ford Motor Co.; Hugh Chalmers, Chalmers Motor Co.; C. Louis Allen, Pyrene Mfg. Co.; and Edward A. Wood, president of the National Underwriters' Assn., Pittsburgh.

These men went on to-night to Philadelphia where a meeting of a new but rapidly growing club is being held. The Philadelphia club is said to be the best in the country. To date twenty-seven clubs have been formed and others are planned.

—

Harroun Plans 5-Year Contracts

DETROIT, MICH., Oct. 20—The Harroun Motors Corp. plans to make all contracts with dealers on a 5-year basis instead of the 1-year term now generally in use. The plan is to be operated because the Harroun company does not believe the short term system works to a fair advantage for dealers, since a manufacturer is enabled to transfer his line with another dealer after one year and thus causes the original dealer to lose the efforts made toward the end of the year and all sales on parts for cars he sold.

—

Elkhart and Westcott at Shows

NEW YORK CITY, Oct. 23—The Elkhart Carriage & Motor Car Co., Elkhart, Ind., will exhibit at the National show at the Grand Central Palace, Jan. 6. The Westcott Motor Car Co., Springfield, Ohio, will exhibit at the Chicago national show.

—

Plan Wheel Tax for Minnesota

ST. PAUL, MINN., Oct. 20—The supreme court of Minnesota has upheld the Duluth wheel tax law. A similar law for the State is now planned. The Twin Cities have been waiting for the decision to submit drafts for ordinances. The Duluth ordinance imposes a tax on all vehicles using city streets, the proceeds to be employed in repairing and improving the city streets.

—

Crawford Founder Dies at 70

HAGERSTOWN, MD., Oct. 13—R. S. Crawford, founder of the Crawford Automobile Co., this city, and one of the pioneer bicycle makers in this country, died yesterday in Pittsburgh at the age of seventy. He was a native of Gettysburg, Pa., and a graduate of the Mechanical Engineering School of Glasgow, Scotland.

27 Harkness Trophy Entries

—

Leading Drivers and Fastest Cars for 100-Mile Race

NEW YORK CITY, Oct. 23—Twenty-seven entries have been made for the 100-mile race for the Harkness Trophy at the Sheepshead Bay Speedway, Oct. 28. This trophy was won last year by Resta in his Peugeot in 56:55:71 or at 105.39 m.p.h. As this is practically the final speedway event of the year, the entry list will be a large one and will include all the drivers who have won places in this year's races.

There will be $12,500 in prizes, $10,000 of which will go to the first six cars to finish in the 100-mile race and $2,500 in lap prizes to the leaders of each lap after the 10th mile in a 50-mile special race for non-winners.

The list of entries to date follow:

Car	Driver	Car	Driver
Peugeot	De Palma	Crawford	Klein
Peugeot	Resta	Crawford	Chandler
Peugeot	Aitken	Crawford	D'Alene
Peugeot	Wilcox	Hoskins	Hughes
Maxwell	Rickenbacker	Hudson	Vail
Maxwell	Henderson	Ogren	Burt
Premier	Galvin	Ogren	Henning
Premier	Lewis	Adams	Adams
Duesenberg	Devlin	Benedict	Benedict
Duesenberg	Milton	Weightman	Weight'n
Duesenberg	Devore	Lenten	Lenten
Duesenberg	Buzane	Olson	McBride
Delage	Devigne	Olson	Watson
Delage	LeCain		

—

De Palma Gets 50-Mile Record

NEW YORK CITY, Oct. 20.—Ralph De Palma was granted to-day an official 50-mile speedway record for his performance on the Omaha 1¼-mile speedway in his Mercedes racer July 15. The record for the 50 miles is 29:02.47, or a speed of 103.45 m.p.h. The previous record was held by Dario Resta in his Peugeot and was established by him June 8, 1916. Resta's time was 31:57.40. In addition to granting this record the contest board of the A. A. A. in regular session to-day reinstated driver Hirst; and refused a telegraph application of Eddie Hearne, now driving with an outlaw organization.

—

California Trucks on Desert Ramble

DETROIT, MICH., Oct. 21—Motor trucks in southern California will begin a ramble out of Los Angeles this morning. The trip is promoted by the Motor Truck Dealers' Assn., and is under A. A. A. sanction. It will last 2 days and will cover a course over the desert.

—

Weather Halts Master Driver Run

CHICAGO, ILL., Oct. 20—The second annual run for the title of master driver of the Chicago Automobile Club, which started here Oct. 19, was halted at Peoria this morning after having completed only 1 day of the 3-day drive. It was scheduled to end at Chicago on Oct. 21. Al Schiller, driving a Mercer, was the only one of the six starters to reach Peoria with a perfect score and consequently probably will be awarded the master driver title and the gold medal which were offered to the winner by Barney Oldfield.

Road and weather conditions made it necessary for the officials to curtail the event, so that instead of the 500-mile 3-day run from Chicago to Peoria, to Davenport, Iowa, to Clinton, Iowa, and return to Chicago, the 186 miles to Peoria probably will be considered the complete contest.

—

Two Races for Uniontown Speedway

UNIONTOWN, PA., Oct. 23—Sanction has been granted by the American Automobile Assn. for two races to be held on the 1⅛-mile board speedway here on Thanksgiving Day. The major race will be 112½ miles or 100 laps of the track and will be for cars of 300 cu. in. displacement or under. Prizes for this race will total $3,000, first place carrying $1,000.

A free-for-all race of 54 miles restricted to dealers residing within 150 miles of Uniontown will carry prizes totaling $1,250, first prize being $500.

—

Racing Active on Pacific Coast

LOS ANGELES, CAL., Oct. 18—Racing activities on the Pacific Coast this year will be featured by at least three events in addition to the Vanderbilt Cup and Grand Prize races on the Santa Monica course, Nov. 16 and 18.

According to plans, there will be a 200-mile championship award sweepstakes on Thanksgiving Day at the Ascot speedway with a purse of $5,000. Sanction has been applied for. Races are also planned for on both Christmas and Washington's Birthday, as well as March 17. San Francisco, Fresno and Bakersfield tracks will also hold minor events under the management of the county fairs.

—

Ross Climbs Record Hill

SAN FRANCISCO, CAL., Oct. 20—Fillmore Street hill, a grade running as high as 25½ per cent, has been climbed on high gear by a Ross eight. Never before, it is said, did a car perform that feat.

J. H. Stelling, of Arnold, Stelling & Co., Ross northern California distributors, drove the car and Ed. Rainey, executive secretary of the mayor, acted as official observer. The gear was chained and padlocked in high by L. J. Pinkson, automobile editor of the San Francisco *Chronicle*.

No Simple Test for Gasoline

Bureau of Standards Aims at Definition of Gasoline and Consumers' Protection

WASHINGTON, D. C., Oct. 20—Necessity for a careful and scientific investigation of the properties of various grades of gasoline before any standardization will be possible is emphasized in a statement issued by director Stratton of the Bureau of Standards. The impossibility of formulating a simple test which can be applied by any purchaser to detect at once an inferior gasoline is brought out as follows:

In the first place, no such simple test is known in the present state of the science of petroleum technology. In the early days of the petroleum industry, when all our gasolines, kerosenes, fuel oils, and lubricating oils were derived from one source, viz., Pennsylvania crude petroleum, a simple measurement of the specific gravity, or what amounts to the same thing, the Baumé number, by means of a hydrometer, served as a fairly reliable indication of the qualities of these products. To-day, however, the specific gravity test is practically worthless as a check on the suitability of a gasoline, for example, for a given motor equipment. The reason why this is so is that many new oil fields have been opened up in recent years that yield petroleums of very different physical and chemical properties, and new methods of manufacture have been introduced that yield products having very different properties in no way related to the specific gravities.

Work Is Complicated

It is highly probable that the specification or definition of standard gasoline, and the tests that will be necessary to determine whether the gasoline complies with the specifications, will be quite complicated and will require the services of a trained chemist to make them. It seems most probable that the definition of gasoline will have to be based on the percentage that distills over between specified temperatures, when the distillation is carried out under specified conditions, This distillation test, speaking in non-technical terms, is a measure of the freedom with which the gasoline will vaporize. The gasoline must not vaporize too freely for two reasons, one that it would not be safe, and secondly its loss in storage, by evaporation, would be too great. Hence, the specification may have to contain limitations of the percentage distilling over below a certain temperature, coupled, perhaps, with a proviso that certain percentages shall distill over below other fixed temperatures, in order that requisite amounts of low-boiling constituents shall be present to insure easy starting of an engine. Likewise the specification must contain a provision that all must distill over below a certain maximum temperature, in order to exclude from the gasoline the heavier petroleum distillates, such as kerosene.

Complicated as such a specification as has been briefly outlined above may seem to the layman, it is not at all improbable that other tests must be devised to limit the percentage of so-called aromatic and unsaturated hydrocarbons that may be permitted in a good automobile gasoline.

The question still arises whether or not it may be necessary to define two or more grades of automobile gasoline.

The message which it is particularly desired to convey is that the public should not expect hasty action.

National Legislation Possibilities

National legislation relating to interstate commerce, making it unlawful to sell a product under the name of "gasoline" that does not come within the specifications, with a suitable inspection service, would be an important contributing factor in safeguarding the consumer's interests. Other products, which might be just as good fuels for engines and carbureter equipments adapted to them, could not then be sold in interstate commerce under the name of "gasoline," but would have to be called motor fuels or by some other name which would distinguish them from the standard "gasoline." To protect the interests of the consumer in intrastate commerce it would be necessary for states and municipalities to adopt similar legislation and to increase their inspection service to provide for this new work, just as they have provided for weights and measures and pure food regulations in the past.

—

Molasses as Gasoline Substitute

NATAL, SOUTH AFRICA, Oct. 19—Molasses distillate is the latest gasoline substitute. That its makers are confident of its success as a fuel is assured by the recent organization of a company here under the title of South African Natalite Motor Spirit Co. with a capital of $375,000. This company is expected to build a complete plant large enough to make in the aggregate 2,000,000 gal. of natalite, as it is known, per annum and to do this at the rate of 6000 gal. a day.

Experiments were made in Natal with a 22-hp. car weighing some 3600 lb. The car was tested over several routes, the total distance covered being slightly more than 500 miles. The amount of fuel used was 30.59 gal., or an average of 16.4 m.p.g. The engine on all occasions started easily and the valve cups and valve heads were clean after the trial.

Locomotive Co. Adds Tractors

Milwaukee Concern Will Build Gasoline Truck Tractors for Freight Work

MILWAUKEE, WIS., Oct. 23—The Milwaukee Locomotive Mfg. Co., pioneer builder of gasoline locomotives, is placing on the market a new type of gasoline truck tractor. It is somewhat similar in appearance and uses to the electric industrial trucks at present in use by various large railroads. It is intended for the handling of freight at railway terminals, steamship docks and freight houses. Power is supplied by a four-cylinder, vertical, block engine with a bore and stroke of 3¾ and 4½ in., power being transmitted through a bevel gear differential and external gear-drive axle. The truck will transport 4000 lb. on its platform and will haul a trailer load of 3½ tons.

—

Levy Gets Chalmers Again

DETROIT, MICH., Oct. 21—The James Levy Motor Co., Chicago, has been appointed the sole distributer of Chalmers cars for Chicago and vicinity. James Levy was the original Chalmers dealer in Chicago and sold Chalmers continuously until a few months ago when the agency was given Harry Newman, Inc. Levy is one of the best known dealers in Chicago.

In addition to the Chalmers cars Levy at the present moment is distributor for Scripps-Booth, Hal, Saxon, Marion-Handley and Premier. Whether or not all of these lines will be continued has not been determined as yet.

—

Accessories Branch of Hardware Assn.

ATLANTIC CITY, N. J., Oct. 20—The automobile accessory jobbers in the National Hardware Assn. at the annual convention here this week formed an Automobile Accessories Branch. The chairman of the division is Edward Rose, of Barker, Rose & Clinton, hardware and accessory jobbers, Elmira, N. Y. In the hardware associations are about 400 jobbers and about twice as many manufacturers. Between 600 and 700 men attended the convention.

—

Illinois Automobile Trade Assn. Now

ROCKFORD, ILL., Oct. 18—The Illinois Automobile Trade Assn. is now the name of the Illinois Garage Owners' Assn., which closed its 2-day convention here last night. The organization will constitute the Illinois division of the National Automobile Trade Assn.

The association now has 350 members divided among ten or twelve local or-

ganizations. About 100 attended the convention, thirty of these being delegates.

The association decided to ask for a conference with the National Automobile Chamber of Commerce before formulating a standard service warranty.

Gail Reed, general sales manager, Walker Vehicle Co., Chicago, read a paper on Measured Garage Service vs. Flat Rate. He contended that the garage business is turning to the measured rate and that within another year it will be hard to find a garage charging the flat rate for service.

N. E. Jobbers to Meet Nov. 22

BOSTON, MASS., Oct. 23—The jobbing trade in New England is to be more closely affiliated with the National Assn. of Automobile Accessory Jobbers, according to the object announced for a meeting to be held in this city Nov. 22. The ways and means committee of the association is to hold a meeting here Nov. 20 and 21 and following its sessions, a general meeting of the whole New England trade will be held.

Deutsch & Bell Factory Representatives

CINCINNATI, OHIO, Oct. 23—Norman Bell, sales engineer of the motor accessory department of the Lunkenheimer Co., Cincinnati, has resigned. With S. Deutsch he has formed the firm of Deutsch & Bell with offices at 650 Woodward Avenue, Detroit. The firm will operate as factory representatives.

Studebaker Occupies New Texas Building

DETROIT, MICH., Oct. 20—The Studebaker Corp. is now occupying its new building at Fort Worth. L. B. Alford is district manager for Texas. The new structure is 150 by 265 ft., two stories high and cost $60,000.

F. H. CLARKE

Mr. Clarke is president of the Kent Motors Corp., which plans to establish a $500,000 plant in Belleville, N. J., with potential capacity for 50,000 cars a year. The line will comprise four-cylinder touring and roadster models, selling at $985

Standard Service Policy in Canada

MONTREAL, QUE., Oct. 23—A standard service policy will probably shortly be adopted in this country, following the adoption of standardization in the United States by automobile manufacturers. A standard policy has been drawn up and sent to the manufacturers for approval, and already have endorsed the policy, and its general use by manufacturers is thought to be assured. A framed copy of the policy will be hung in the salesroom so that buyers will have an opportunity of seeing just what to expect in the way of service.

K. C. Dealer's Tour Brings Sales

KANSAS CITY, MO., Oct. 23—The Motor Car Dealers Assn. made a week's tour of northeastern Kansas costing $15,000, including the expenses and time of two or more men from each of thirty-five companies and a band of fourteen pieces.

The direct result to dealers making the trip was sales of from $750 to $15,000; the indirect result will be many times that, judging from the effects in stimulation of business of previous similar trips.

Atlanta Show a Success

ATLANTA, GA., Oct. 19—A tent covering more than 34,000 sq. ft. proved inadequate to house the automobile exhibits at the Southeastern fair here this week. Thirty-five local automobile selling companies had exhibits and numerous tire and accessory concerns were represented. Southern automobile men said it was the largest display ever offered south of the Mason & Dixon line.

38 Liberty Cars in 1 Day

DETROIT, MICH., Oct. 20—Production at the plant of the Liberty Motor Car Co., this city, is increasing each day. The company reports a single day's production on Oct. 13 of thirty-eight cars. The first car built was shipped but 3 months ago on July 4.

Packard Surplus Gains $6,206,419 in Fiscal Year

(*Continued from page* 683)

ferred stock. Of the new stock issued, $4,591,630 of common stock was put out in the form of stock dividends. Proceeds from the sale of the $3,000,000 of preferred stock issued during the year provided part of the increase in working capital necessitated by the company's large expansion in business and enlargement of plant facilities.

The liabilities include $3,000,000 of 5 per cent gold debenture notes due Dec. 1, 1916. Since the close of the fiscal year arrangements have been completed for retirement of these notes and the acquisition of $2,000,000 additional working capital through the sale of $5,000,000 of 5 per cent gold notes to William A. Reid & Co., New York banker. The new notes will be dated Oct. 15, 1916, and will be due Oct. 15, 1919.

Though no statement of the company's gross sales has been included in the report, the total for the year is said to have been $35,000,000. Officers and directors were re-elected in the annual meeting and in the directors' meeting which followed it.

FINANCIAL STATEMENT OF THE PACKARD MOTOR CAR CO. FOR THE FISCAL YEAR ENDING AUGUST 31, 1916

ASSETS

Plant: Real estate, buildings, equipment and machinery at cost, less depreciation		$12,251,123.68
Rights, privileges, franchises and inventions		1.00
Inventories: Raw materials, work in process and finished vehicles		16,518,264.81
Stock option contracts with employees		138,000.00
Investments: Stocks, bonds and short time securities		533,080.94
Current: Cash		1,202,730.79
Vehicles in transit to dealers covered by drafts		527,326.66
Accounts receivable		2,040,496.01
Bills receivable		328,788.86
Expenses paid in advance		104,846.04
Total assets		$33,644,658.79

LIABILITIES

Capital stock—authorized and issued Common—total outstanding 116,569 3/10 shares of $100 each	$11,656,930.00	$11,656,930.00
Unissued 13,430 7/10 shares of $100 each.	1,343,070.00	
Total authorized issue of 130,000 shares of $100 each	$13,000,000.00	
Preferred—7 per cent cumulative—authorized and issue, 80,000 shares of $100 each		8,000,000.00
Five per cent Gold Debenture notes due Dec. 1, 1916		3,000,000.00
Deferred payments on real estate purchased for retail selling agencies		408,985.58
Notes payable		1,550,000.00
Accounts payable—current invoices, accrued payroll, vouchers not due, deposits on vehicle orders		3,182,078.83
Reserves for general purposes		465,178.34
Surplus as at Aug. 31, 1915	$4,617,297.93	
Additions this year	6,206,419.61	
Total surplus	$10,823,717.54	
Deduct dividends paid this year:		
Preferred—in cash	$455,000.00	
Common—in cash	395,601.50	
Common—in stock	4,591,630.00	
	$5,442,231.50	
Net surplus as at Aug. 31, 1916		$5,381,486.04
Total liabilities		$33,644,658.79

The Automobile

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Prices Up

ALREADY we have seen a number of instances this year where manufacturers who lowered prices last year have put them back to their former level, or even made an increase over the 1916 model schedule. This was anticipated, and is the best possible thing for the industry, because many of the price cuts made last year were neither necessary nor good business.

At the end of 1914 the automobile industry was distinctly scared. It had planned great extensions and the general state of business looked bad for 1915 trade. So the price cuts were decided upon as an essential to the increase of production.

By the time factory extensions were completed and the new models and new prices were in force, amazing things had happened to the prosperity of the country and to the prices of raw materials, so that the manufacturers found that their extensions and their increased outputs were not enabling them to make cars as good as before with the same profit margin; in other words, the cuts had been made before a proper appreciation of the conditions. The industry is now repairing its mistake, seeing that it is far better to raise the price than to cut the quality. There is much more demand to-day for better cars than for cheaper ones, and there is every indication that this condition will persist for some time to come.

Aero Caution

THE fact that the U. S. government is buying aeronautic engines in some quantity and that Europe has been doing so for a long time has led certain of the leading automobile manufacturers to look into the business with respect to its possibilities. At present more than one of our foremost automobile engineers is giving the bulk of his time to aviation work, and next year will certainly see half a dozen good aeroplane motors ready for production in automobile plants.

When one automobile firm makes a break there is a strong tendency for all the rest to follow, but this is a situation where the greatest caution should be observed. Firstly, there is comparatively little money in the business. There will be no European orders after the war, and the U. S. air departments will not want engines in thousands. To produce a satisfactory aeroplane motor, not a good one but merely a satisfactory one, needs experimental work that can easily run to $100,000 or more, so the automobile manufacturer who adds an aviation section is likely to gain more honors than riches from his venture.

There is room next year for perhaps six, perhaps a dozen, builders of good aviation engines, but it is doubtful if there will be room for many more.

Truly Progressive Assembly

PROGRESSIVE assembly is not a new thing in itself, though it is fairly new to the automobile industry which is just finding out upon how small an output it pays to install the necessary equipment, but the equipment is only half the battle. Studying the chain assembly systems which have been put in during the last year or so makes clear the fact that some have been installed and are being run "progressively," while others are not. There is a tendency noticeable in some plants to neglect the petty detail that is life or death to the efficiency of a chain assembly line.

If the operations are not divided up properly the result will be that some jobs will be done at an extravagant waste of time, while others will not be done properly owing to lack of time. Also the feeding of a chain assembly needs as much study as the assembly itself. It is little use assembling a part in 10 sec. if 5 min. are wasted in bringing it to the desired spot first. In most of the recent installations there is room for improving the supply of parts to the assembly line and in many bad work is getting past owing to an inefficient splitting up of the time into its various sections. The hospital section at the end of the line where the assembly shortcomings are corrected is often kept pretty busy, and the need for it is a confession that there is something wrong with the assembly itself. Time will effect a cure, of course, but there is at present so surprising a difference between factories that it seems insufficient knowledge is being circulated.

It will pay our manufacturers to look into this detail of operation and perhaps some changes may be made to advantage in the layout of the system.

URUGUAY

One of the main streets in Montevideo, showing the double line of modern trolley cars with ample room on each side for two rows of motor traffic abreast. The streets are generally well paved. While Montevideo has several narrow Spanish type streets in the older sections of the city, there are many of these wide modern streets. The city is the great tourist center for the east coast. Because of this there are many good hotels for tourist trade, good city and beach motor drives, in fact there is no other city in South America so ambitious for automobile trade as Montevideo

By David Beecroft

¶ EDITOR'S NOTE:—This is the first of a series of articles embodying the close observations of automobile and general trade conditions in Uruguay made by Mr. Beecroft, Directing Editor of THE AUTOMOBILE, during a 10-weeks' trip through Argentina, Uruguay and Southern Brazil as a delegate of the United States Government and member of the Argentine Return Visit Committee. Subsequent articles will further analyze the possibilities of selling cars, trucks, tractors and accessories in Uruguay.

ALTHOUGH the smallest country in South America, Uruguay is of much greater importance to the motor industry than its area or its population would lead you to believe. Uruguay as a country equal in area to the six New England States, with New Jersey added, and measuring only 355 miles from north to south, occupies a position in South America similar to Belgium. As Belgium was the buffer State between Germany and France, so Uruguay is a buffer country between Brazil, to the north and east and Argentina. Brazil and Argentina are great rivals. Their navies are approximately of equal strength. When one adds a large battleship the other follows suit. They watch army figures; in fact, the development of one is always carefully watched by the other.

Uruguay, like other South American countries, is not a manufacturing country, although it is perhaps a leader in this regard. It does not manufacture anything for the automobile or motor truck business and is of interest to us only as a consumer market.

Car and Truck Field Small

With the population of only 1,300,000, not so much as the city of Buenos Aires alone, there is naturally a limited automobile and motor truck market. Australia has a population of 5,000,000 which is a high potential buying population. Canada has a population of 8,000,000, which is also a high potential buying population. Argentina, with a population of 8,000,000, is not so potential a buying population as Canada. Brazil with 25,000,000 has a still lower potential buying factor. It is questionable if Uruguay with its 1,300,000 has not a higher potential buying factor than any other South American country.

Imported 183 Cars in 1915

At present it is almost impossible to get a correct estimate on the number of automobiles in this country. The old reliable dealers differ in their estimates, and as there is no registration for the entire country, but only in departments, it is impossible to get up-to-date reports. One dealer estimates from 3500 to 3800 cars in the country. Another equally reliable dealer places the figure at 3000 to 6000. All agree that there are scarcely 100 motor trucks in the country.

During 1915 a total of 183 automobiles were imported into Uruguay, according to the figures of Herman L. Spahr, American consul at Montevideo, the capital city. In addition there were fifteen motorcycles and forty-six bicycles. Our

U. S. consular reports show that in 1914 we shipped from the U. S. A. 183 automobiles and one truck to Uruguay. The figures for 1916 are not yet available.

Montevideo the Center

In the capital city, Montevideo, with a population of 375,000, the automobile industry for the entire country centers. Montevideo is one of the most modern cities in South America, being the only one at present supporting a motor bus line on its city streets in addition to an up-to-date trolley system. The motor buses are similar to those operated by the Fifth Avenue Bus Co., New York City. The city of Montevideo is essentially a rolling city built on and around a series of reasonably low hills, and has an excellent water frontage on the ocean. It is 104 miles from Buenos Aires by boat.

Here in this city you find as modern automobile salesrooms, garages, etc., as in Buenos Aires, but of course on a smaller scale, much in the ratio of the population of the two cities. Here on the streets you see long lines of European cars of the closed type, the same as in all South American cities. There are rows of taxicabs along the sides of the city plazas and the streets are generally well paved. Montevideo has the advantage also, as an automobile city, of having several very modern macadam highways radiating out of the city. There is no other city in South America with the possible exception of Cordoba, in the heart of Argentina, where such excellent motoring roads exist. The national government of Uruguay has been building a series of national roads for some years and to-day Uruguay, although the smallest country in South America, has more modern automobile highways than any other country on the continent. It has more modern highways than Brazil, which in area equals the U. S. A. It has more modern highways than Argentina, which in area equals the U. S. A. east of the Mississippi River.

In Montevideo you find salesrooms just as modern in some cases as on Broadway, N. Y., or Michigan Avenue, Chicago, although not so elaborate. They remind you of the salesrooms in cities of the Mississippi Valley. Here you find such U. S. A. cars as Overland, Ford, Studebaker, Chevrolet, Hudson, Buick, Haynes, King, Scripps-Booth, Dodge, Maxwell, and others. Very frequently they are sold in salesrooms all their own, but in other cases are alongside of expensive European cars that have not been selling for 2 or 3 years.

Statistics Are Meager

It is almost impossible to get a definite idea of the number of different makes of U. S. A. cars that have been sold in Uruguay. A canvass of the different dealers furnished information as follows: There have been approximately 800 Fords sold in the country, and last June the local dealer in Montevideo was 7 months behind in deliveries. The Ford dealer employs two traveling men who are constantly going throughout the country. In 1915, there were 180 Fords sold, and it is expected that in 1916, some 280 or 300 will be marketed in that country. In addition to the head office in Montevideo there are nine Ford sub-dealers throughout the country. Over 90 per cent of the Fords are sold in the country districts.

Studebaker has perhaps one of the best salesrooms in Montevideo and from it the entire country is served. Upward of 100 Studebakers were reported in Uruguay in June. Seventy-five per cent of these have been sold to the farmers, or camp people as they term them in Uruguay. In addition to the Montevideo salesroom there are ten other Studebaker dealers throughout the country.

Reports show approximately 75 Buicks in Uruguay and two dealers in addition to the representation in Montevideo. Over 75 per cent of the Buicks have been sold in the camp, or country.

Information which was collected in the circuit of the dealers at Montevideo estimated the following numbers of other cars in the country: Chevrolets, forty-six; King, eight; Pierce, four; Haynes, five; R. C. H., six; Case, fifteen; Overland, 100; and Dodge, twenty-five. There were other makes on which it was impossible to get figures.

Camp the Main Market

It is the general consensus of opinion that the great percentage of U. S. A. automobiles will have to be sold in the camp. Dealers agree that over 75 per cent are already sold in the camps and that the cities of which there are very few outside of Montevideo are stocked with European cars. The development of the U. S. A. automobile in Uruguay is thus destined to follow the same lines of introduction as in Argentina, Brazil, and other South American countries, namely, from the country or camp to the city.

The country of Uruguay is essentially a rolling pampa, almost treeless. It is not level like Argentina, but constantly rolling and getting rugged as the northern part is approached.. The country lacks population, as the figures of 1,300,000 for a territory as large as New England with New Jersey added, would indicate. Naturally the population centers around the south and up the west coast along the Parana River. In the country are 25,000 estancieros or farmers. It is to this class that the Montevideo dealers are selling automobiles to-day. These estancieros make Montevideo their business headquarters, which naturally allows the automobile dealers an opportunity of demonstrating their cars and closing sales. When the car is delivered the dealer sends a driver to make delivery to the home of the estancerio. It may require 1 or 2 days to reach his home, as the roads are deplorable in wet weather when you get off the modern system of highways radiating out of the capital.

500 Cars in Soriano

There are several departments, or we might call them States, in Uruguay, which are good purchasers of automobiles. One of the richest of these is Soriano, the capital of which is Mercedes. It is estimated that there are 500 cars in this department. The department of Salto, further north, has 250 cars. These are the two most important departments, but in the others there is a good scattering of motor cars. The buying population of these interior towns and cities can scarcely be estimated from population figures. Very frequently the majority of the wealthy farmers will live in these cities, thus greatly increasing their potential buying capacity. The population of some of the cities of the country follows:

Paysandu	35,000
Mercedes	25,000
Salto	25,000
Fray Bentos	15,000
Rivera	10,000
Guadalupe	10 000
Minas	10,000
Florida	10,000
Colonia	10,000

The people of Uruguay look favorably upon the U. S. A. automobile industry largely because a good deal of U. S. A. money is being invested in the country and also because large U. S. A. firms are fulfilling contracts of one nature or another in Uruguay. This work has naturally been facilitated by a branch of the National City Bank in Montevideo. This bank contains a large credit department, as do the other branches of this bank in South America. U. S. A. automobile manufacturers can get any information desired regarding credit of dealers or others through this bank. The manager hails from Texas and has had years of experience in U. S. A. and is consequently well qualified to give whatever information the automobile manufacturer requires. He has been particularly active in interesting Montevideo dealers in U. S. A. automobiles and one of the recent agencies which he was directly responsible for negotiating is proving very successful. The bank is interested in this work and the

Glimpses of Farm and Factory in Uruguay

Upper—General view of the treeless pampas which stretch for miles upon miles of rolling country in Uruguay. The large estancia or farmhouse in the foreground is the property of a French company. This view is taken in Florida, one of the states in Uruguay

Middle—One of the large packing houses in Montevideo, the capital city of the Republic of Uruguay. Establishments such as this are operated by Swift or Morris & Co. and other big packing firms

Lower—View of the sugar factory of La Sierra, one of the leading industries in the State of Maldonado, one of the departments, or states, of Uruguay. Note the peculiar flat cars on the railroad siding

General view of country adjacent to Montevideo, Uruguay. It is essentially rolling and treeless in a large percentage. Naturally, where settlements have been made trees have been planted, which give the country an attractive appearance. The home of the estancerio is shown, but unfortunately for each estancerio there are scores of mud huts the same as in Argentina

manufacturers should not hesitate getting all information desired.

Several large U. S. A. firms are operating in Montevideo. McArthur Bros., large railroad construction people, have $12,000,000 contracts. The Uhlen Co. is doing much municipal improvement work in Paysandu, Mercedes, Salto, and other interior cities. Other firms have similar construction work. In Montevideo are large packing houses, one controlled by Swift of Chicago, and the other by Morris and Armour interests. Thus U. S. A. manufacturers are not foreign to Uruguayans. They are already familiar with our large corporations and our methods of doing business.

In the accessory field the business in Uruguay is largely the same as in any other South American country. Where our cars are sold there is a demand for accessories. Montevideo has one very large modern accessory and supply house which distributes to the entire country. In addition the garages carry lines of accessories, parts, etc., much as in Argentina and Brazil. Our largest tire concerns are nearly all represented in Montevideo. Some of them are handled through agencies and others through dealers appointed from Buenos Aires. There is a good demand for U. S. A. tires, largely due to the inability to get tires from Europe, with the possible exception of Italy.

High freight rates constitute one of the drawbacks to the automobile business in Uruguay. Freight rates from New York to Montevideo are practically the same as from New York to Buenos Aires. In June it was costing $130 ocean freight from New York to Montevideo on a Ford. Some of the Chevrolets were shipped at $1.05 per cubic foot. It was costing $200 to send an Overland Model 75 from Toledo to Montevideo.

Because of these high freight rates, to which must be added the import tax 31 per cent ad valorem prices on cars are much higher than in U. S. A. The Ford sells for $850, Uruguay currency. Uruguay is the only country in South America where a dollar is worth less than the U. S. A. dollar. They will only allow you approximately 95 cents Uruguay coin for a U. S. A. dollar, so that the price of $850 means considerably more in our currency.

The duty on tires entering Uruguay is largely based on tire value. Thus a tire is valued at $10 and the duty is $4.50 U. S. A. gold. A tube is valued at $5 and pays a duty of 45 per cent, which is $2.25 U. S. A. gold. A steel-studded tire is valued at $15 and paying a 45 per cent duty means $6.75 U. S. A. gold duty. There is no duty on tires shipped into the country on a car, so naturally all Montevideo dealers purchase cars equipped with a set of five tires. Tire chains are used in Montevideo much the same as in any U. S. A. city.

Uruguay's Highways

Uruguay aims to be the leading pleasure-ground for the countries of South America and with that end in view has given great attention to the development of its roads.

These ambitions are not day-dreams, and they are fast becoming realities. To-day Uruguay has more improved highways for motoring than Argentina, Brazil, Chile or any other South American country. So far is her great dream of being the Riviera beneath the Southern Cross already realized. The wealthy Argentines ship their motor cars by boats, a night's trip of 90 miles, from Buenos Aires to Montevideo to enjoy the fine system of roads now under construction by the Uruguayan national government. Brazil's wealth also seeks the highways of Uruguay for recreation and motoring joys.

Further details of Uruguay's highway development will be taken up in a future issue.

(To be continued)

A semi-suburban street corner in Montevideo, showing how the wide modern street movement has permeated the city. These streets are ideal for passenger and truck traffic

One of the large packing houses of Uruguay. This is Liebig's establishment in Fray Bentos, in the State of Rio Negro

S. A. E. Standards Committee Widens Scope

THE meeting of the Standards Committee at Washington last week seems, when its results are analyzed, to have added very little to the recommended practice of the society. This undoubtedly is correct, but there are a number of very vital subjects which have previously been matters for very vigorous discussion and which are now brought for the first time within definite sight of final agreement.

A Trial Scheduled

The first of these is the fuel economy and acceleration testing schedule on which the research division has been working for nearly 2 years. This has been before the committee many times and has constantly been referred back to the division. It has now been provisionally accepted by the committee and a trial is to be made on the Sheepshead Bay speedway to check up the working of the system, so that the absolutely final documents may be placed before the winter meeting of the society.

The research division also reported that it had reached the conclusion that no simple formula for stating the ability of a car in mathematical terms could be devised, owing to the very large number of factors which enter into and affect the indefinable thing usually described as car performance. While a formula can deal with piston displacement, gear ratio, etc., it cannot express the delicacy of the springs, softness of the upholstery or the easy control which, together with many other similar matters, are of great importance in giving a car its character.

The acceptance of the testing form in January will clean the slate of the research division which will then have nothing left before it until some new assignment is made by the Council.

Aeroplanes Not Easy to Standardize

With Henry Souther as its chairman, a good deal of activity was naturally expected from the aeronautical division. This presented a report and suggested the fact that this division had done more actual work during the Summer months than any other committee.

The aeronautic position is a somewhat peculiar one because the science of aeroplanes and aeroplane engine building is developing so rapidly that some new thing appears every day. This means that if any standards adopted in the light of the best knowledge which we possess to-day, then 6 months hence we may find it essential to change those standards. On the other hand, the need of standards is very great. One of the speakers in the discussion said there were in Europe as many different methods of attaching propellers to their hubs as there had been chief engineers in the outgoing industry. The adoption of the standard hub and propeller mounting will mean that the U. S. Government will order its supplies accordingly. This will mean that everyone doing government work will use the S. A. E. standard hub, and if any change is found desirable 6 months or a year hence everyone will have to change and the inconvenience will be no greater for one manufacturer than for another.

Supposing two different standards are used during a single year. At the end of that year the government will have to carry stock for the old and the new standard. In other words, for two series of sizes, probably about six sizes in all. If, on the other hand, they use no standard at the end of the year they may have to carry sixty sizes or more. Thus it is obvious that it is well worth while setting up a standard even if this be in use only for a brief time.

Truck Standards Valuable

Regarding the military truck specifications on which the truck standards division is working, the situation is extremely satisfactory. The quartermaster's department of the army is engaged upon an examination of the evidence derived from the trucks in use on the border and from some informal discussions which took place during the Washington meeting, it is obvious that the work of the truck standards division is going to be very valuable. There is some need for speed, and it is hoped that the S. A. E. ideal specification may be agreed upon completely during the Winter.

With the establishment of a special small committee to deal with, the electrical equipment division has one of the most troublesome subjects taken from its program, although this still leaves it plenty to do. The elaboration of the generator and starting motor mounting standards is the principal item. This should be in final form by January.

Practical Engine Rating

Errors in Developing Rating Formula and Incorrect Use of Piston Speed—Variation in Power Efficiency with Different Sized Cylinders*

By Edward G. Ingram

ALMOST from the birth of the automobile industry the development of a suitable horsepower rating formula has been a subject of discussion, though of late it has not received so much attention.

One of the first real investigations on this subject was made by the horsepower committee of the Institution of Automobile Engineers, in Great Britain, yet the results were not satisfactory. The committee set out to find a formula that would give the approximate horsepower of engines from a knowledge of the bore, stroke and number of cylinders. For obvious reasons, nothing more than a general idea of the horsepower that various makes of engines will develop can be obtained from these dimensions alone, but the error that the committee made in deriving a formula was that it attempted to make use of piston speed instead of the frequency ("speed") of revolution. It is practically impossible to use piston speed in developing a rating formula, for several reasons.

Piston Speed Wrong Basis

To illustrate why this is, let it be assumed temporarily that all engines have the same volumetric and thermal efficiency. Then maximum power will be obtained at the same number of revolutions per minute in all cases, no matter what the stroke-bore ratio or piston displacement of the engine may be. Under the same conditions, however, the piston speed at maximum power will not be the same for two reasons:

1. Because in engines of the same piston displacement the piston speed will vary with the stroke-bore ratio.

2. Because even if all engines had the same stroke-bore ratio the piston speed would vary with the displacement, or in other words the size, of the engine in each case.

Of course, actually, the thermal and volumetric efficiency will vary considerably with the design of the engine and this will cause some variation in the revolutions per minute at maximum power, and a further variation in the piston speed. However, since but two factors affect revolutions per minute while four affect the piston speed, it is obvious that the speed of revolution and not the linear piston speed should be considered in developing a horsepower formula.

The brake horsepower of a four-cycle engine in terms of the revolutions per minute is equal to the following value:

$$(1) \qquad \frac{Nn\pi b^2 l \eta p}{3{,}168{,}000}$$

Where N equals the number of cylinders,
n " " revolutions per minute
b " " bore
l " " stroke
Where η equals the mechanical efficiency,
p " " m. e. p.

Here n, η and p are the unknown quantities, approximate values for which must be determined by obtaining the average figures from the performance of actual engines.

The linear piston speed s equals

$$\frac{2nl}{12} = \frac{nl}{6} \text{ feet per minute}$$

Substituting this value in (1) and incorporating the value of π in the constant, the brake horsepower in terms of the piston speed is

$$(2) \qquad \frac{N s b^2 \eta p}{168{,}000}$$

This second formula was the one used by the British horsepower committee in their investigation. It necessitated the determination of the piston-speed in ft. per min. at maximum output instead of the r. p. m. While the formula is satisfactory when the piston speed is already known, as in the case of an engine under actual test, it is practically useless where the piston speed is unknown and must be determined for engines of various displacements and stroke-bore ratios.

In its attempt to find the piston speed at maximum power of engines of different stroke-bore ratio, the British Committee made tests on 101 engines, after which it decided that it would be represented by the equation $s = 600\ (r + 1)$ feet per minute, which gives a piston speed of 1200 ft. per minute when $r = 1$, and 1800 feet per minute when $r = 2$. This was a most remarkable decision because the formula gives excessively different speeds of revolutions to engines having the same stroke-bore ratio but different displacements.

For example, a 3 by 3-in. engine according to this formula would develop its maximum power at 2400 r. p. m. while a 6 by 6-in. engine would reach maximum power at 1200 r. p. m. Again, assuming equal efficiency in engines of the same displacement, maximum power should be reached at the same

TABLE I—STANDARD CAR ENGINES

Engine	Bore and Stroke	Max. Hp.	R.p.m.	Piston Disp.	Disp. Per Cyl.	Hp. Per Cu. In. of Disp.
Mercer, 4*.....	3¾ x 6¾	87.	2,020	298	74.5	.292
Continental, 4*....	2¾ x 4	25.7	2,700	95	23.7	.271
Hudson, 6*.....	3½ x 5	77.	2,500	289	48.1	.267
Stearns-Knight, 4*.	3¾ x 5⅝	60.	2,400	248	62.1	.242
Herrmann, 8*.....	2½ x 4	31.	2,350	157	19.6	.234
National, 12.....	2¾ x 4¾	77.5	2,900	338	28.2	.229
Ferro, 8.....	3¼ x 4	60.7	2,300	266	33.2	.228
Packard, 12*.....	3 x 5	93.	2,760	424	35.3	.220
Marmon, 6*.....	3⅜ x 5⅛	73.	2,450	340	56.6	.215
Cole, 8.....	3½ x 4½	73.	2,800	346	43.2	.211
Moline-Knight, 4*..	3½ x 5	40.4	2,100	192	48.1	.210
Willys-Knight, 4*..	4⅛ x 4½	50.5	1,950	240	60.1	.210
Moon, 6.....	3½ x 5¼	62.	2,080	303	50.5	.204
Le Roi, 4.....	3⅛ x 4½	28.	2,250	138	34.5	.203
Chalmers, 6.....	3¼ x 4½	45.	2,600	224	37.3	.201
Universal, 4*.....	2½ x 3½	14.	3,250	69	17.2	.199
Moon, 6.....	3¼ x 4½	44.	2,360	224	37.3	.196
Crane-Simplex, 6...	5⅜ x 6½	110.	....	563	93.9	.195
Overland, 4.....	3⅛ x 5	29.5	2,120	153	38.3	.193
Cadillac, 8*.....	3⅛ x 5⅛	60.	2,400*	314	39.3	.191
Simplex, 4*.....	5⅜ x 6½	108.	1,800	590	147.5	.183
National, 6.....	3½ x 5¼	55.	2,000	303	50.5	.182
Simplex, 4.....	4⅞ x 6½	85.	1,800	486	124.4	.174
Locomobile, 6*.....	4½ x 5½	82.	1,800	525	87.5	.156
Locomobile, 6.....	4¼ x 5	66.	1,740	475	70.9	.155
Pierce-Arrow, 6....	5 x 7	120.	1,600	824	137.4	.146
Continental, 6*.....	4⅛ x 5¼	40.	1,600	280	70.1	.143

*Shown in Fig. 1.

*The curves and figures illustrated and mentioned in this article have been taken from data published from time to time and do not necessarily refer to the latest models of the various makes.

number of r. p. m. no matter what the stroke-bore ratio, yet the piston speed given by the formula will give different speeds of revolution with engines of different stroke-bore ratios.

Effect of Cylinder Size

Because small cylinders have a greater proportion of cylinder surface to volume than large cylinders, resulting in greater heat losses through the water jacket, the British committee decided that the m. e. p. would vary with the size of the cylinder. It has since been shown, however, that in practice this is to a great extent made up for by the use of a higher compression in engines with small cylinders, so that the average m. e. p. is more nearly the same for cylinders of all sizes. One reason the committee went astray on the question was because in making tests they considered the variation in m. e. p. with relation to the bore instead of the piston displacement.

It is obvious therefore that, if the average number of r. p. m. had been considered instead of the piston speed and, if the average m. e. p. with relation to the piston displacement had been determined, the committee would have obtained a much more satisfactory formula than the one arrived at, which was,

Brake Horsepower $= 0.45(b - 1.18)\ (1 + b)$

It would appear, however, that a great deal of unnecessary labor is gone through in trying to develop a horsepower rating formula by making use of the formula for obtaining the brake horsepower of an engine under actual test, and then attempting to arrive at average figures for the unknown factors such as the m.e.p. and r.p.m.

TABLE II—RACING CAR ENGINES

Engine (all fours)	Bore and Stroke	Max. Hp.	R.p.m.	Pis-ton Disp.	Disp. Per Cyl.	Hp. Per Cu. In. of Disp.
1914 Peugeot*	3 1/16 x 6⅛	92	2,870	183	45.7	.503
1913 Talbot* .	4 x 5½	133	3,750	276	69.1	.482
1915 Stutz* ..	3 13/16 x 6½	131	2,950	297	74.2	.441
1914 Mercedes.	3 11/16 x 6 5/16	115	3,000	271	67.7	.424
1911 Austin* .	3½ x 4½	72	3,000	172	43.	.419
1913 Knight*..	2 15/16 x 4½	50	3,000	123	30.7	.407
1913 Deltal* .	4 x 5 15/16	120	3,200	300	75.	.402
1912 Peugeot..	4 5/16 x 7 13/16	175	2,200	456	114.	.384
1913 Delage...	4⅛ x 7 1/16	120	1,850	374	93.5	.321
Blitzen Benz*	7 9/32 x 7⅞	225	1,575	1,310	327.5	.172

*Shown in Fig. 4.

Average Power

Just as satisfactory results can be obtained by finding the horsepower that the average engine may be expected to develop per cubic inch of piston displacement.

The only thing that then enters into the question is whether engines with small cylinders will develop the same horsepower per cubic inch of displacement as engines with large cylinders. Experience in both the standard and racing car field indicates that the small cylinder engine is more efficient and will develop a higher amount of horsepower per cubic inch of displacement. This probably can be explained by the fact that while the thermal efficiency of a small cylinder may be lower, even with the use of a higher compression, this is more than offset by the fact that much greater valve area with relation to the displacement can be obtained, resulting in a higher volumetric efficiency. Increased volumetric efficiency means not only a higher speed of revolution, but also a higher m. e. p. at a given number of r. p. m.

To give some idea of the brake horsepower per cubic inch of displacement, which standard engines of up-to-date design will develop, Table I has been compiled, and in Fig. 1

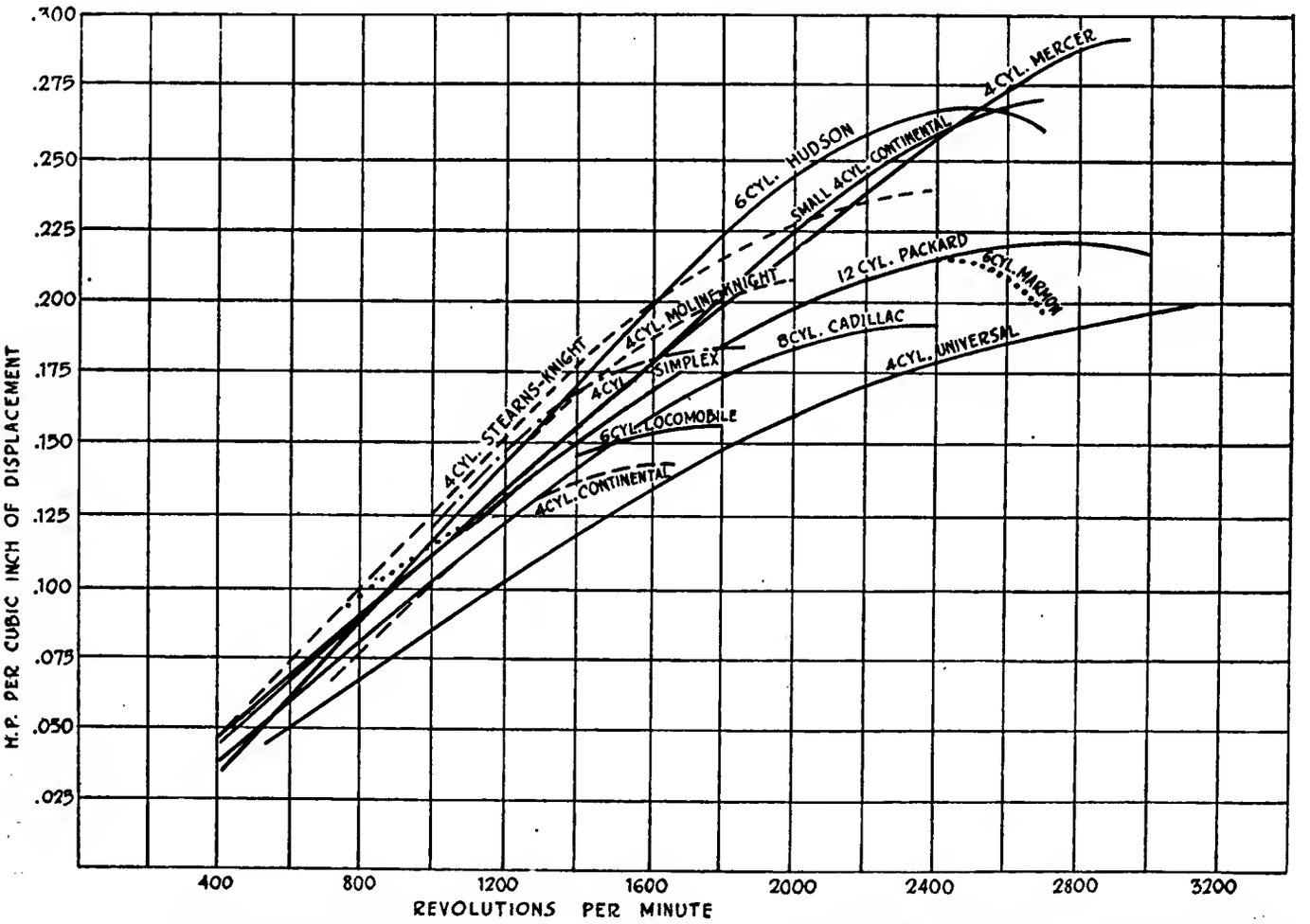

Fig. 1—Curves showing the horsepower per cubic inch of displacement at various speeds of several makes of stock car engines

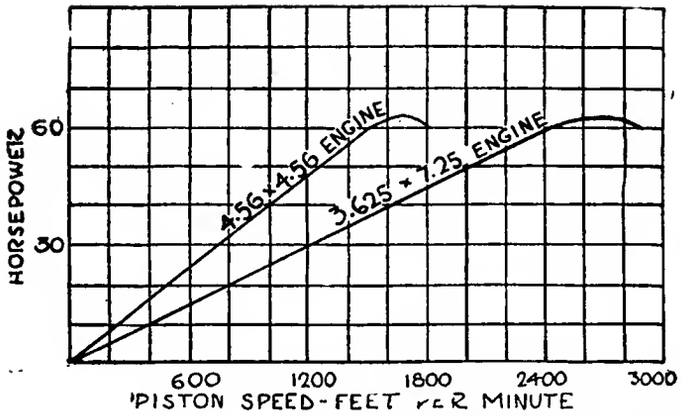

Fig. 2—Imaginary power curves plotted against piston speed

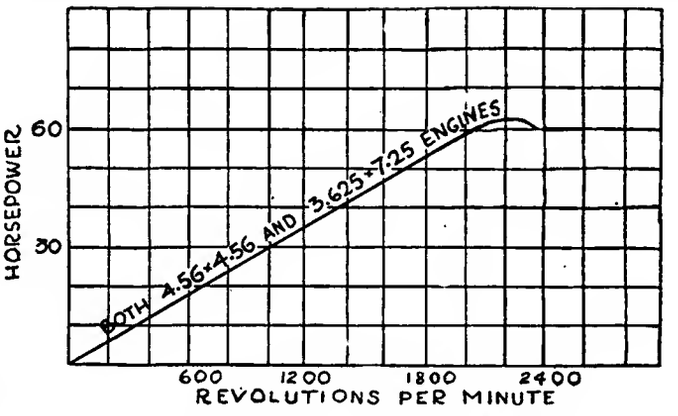

Fig. 3—Curve of engines in Fig. 2 plotted against r.p.m.

are shown power curves of some of these engines, plotted on the basis of horsepower per cubic inch of piston displacement. Outside of their value in determining a means of rating engines the figures are interesting, for this also is about the only satisfactory way of obtaining an idea of the relative power efficiency of engines of different displacements. The curves show not only the relative efficiency at maximum output but also at lower engine speeds.

It must be remembered, however, that because one make of engine is more efficient than another this does not mean necessarily that the performance of the car in which it is used will be better, since this depends upon the total displacement of the engine, weight of the car and many other considerations. Some designers prefer to use large slow-speed engines of relatively low efficiency instead of the high-speed type.

In speaking of power curves attention here may be called to the fact that it is much better to plot the horsepower against r. p. m. instead of against piston speed in feet per minute. For example in Fig. 2 is shown imaginary power curves of two engines of the same displacement but with different stroke-bore ratios plotted against piston speed. The engines are assumed to be of the same general construction so that the power developed will be essentially the same at any given number of r. p. m. up to the maximum. At any point where both engines are developing the same amount of power the piston speed will be different, so that the curves will never coincide. If, however, the curves are plotted against r. p. m. one curve will represent both engines, as shown in Fig. 3.

If the two engines were placed in identical cars, the same gear ratio should be used for both and the cars would make the same number of m. p. h. when the engines were developing the same power. The piston speed, however, would bear no direct relation to the engine output or to the car speed but would depend upon the stroke-bore ratio. Comparing engines on the basis of horsepower per cubic inch of displacement is really the same as considering each to be of the same total displacement no matter what is the real displacement.

Comparing Different Engines

In looking over Table I and the power curves in Fig. 1 the first thing to attract attention is the wide variation in the power per cubic inch of displacement developed by various makes of engines. The highest curve is that of a four-cylinder Mercer. This engine develops 0.292 hp. per cubic inch of displacement, which is over twice as much as that developed by the four-cylinder slow speed Continental engine, the curve of which is the lowest of all. The displacement per cylinder of these engines is 74.5 cu. in. and 70.1 cu. in. respectively.

Next to the Mercer in power efficiency comes a small high-

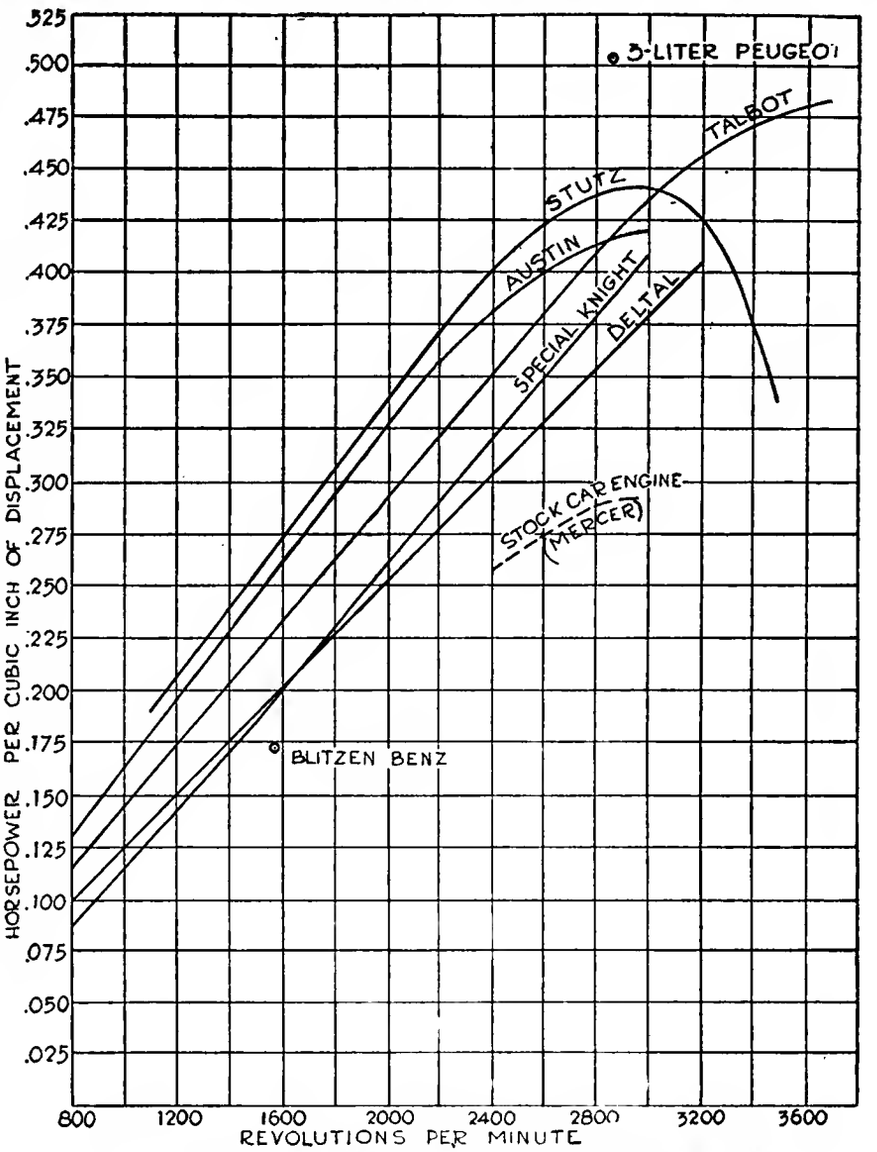

Fig. 4—Curves showing the horsepower per cubic inch of displacement at various speeds of several makes of racing car engines

speed Continental engine with a displacement per cylinder of only 23.7 cu. in., and closely following this comes the Hudson super-six engine with cylinders of 48.1 cu. in. displacement. Even though there is considerable variation in the power efficiency of engines of about the same displacement per cylinder, due to variations in design, still the tendency for engines with large cylinders to be less efficient is shown, though it is more marked in the case of cylinders of over 74 cu. in. displacement.

The large Simplex engine, for example, with a displacement per cylinder of 147.8 cu. in. is designed along very efficient lines yet its power per cu. in. of displacement is only 0.183. The average hp. per cu. in. of displacement developed by the eleven engines in Table I with cylinders of under 40 cu. in. displacement is 0.215, while the five engines with cylinders of over 80 cu. in. displacement show an average power efficiency of only 0.171.

While engines with large cylinders are less efficient at high speeds of revolution, there appears to be a tendency for them to be more efficient at low speeds. For example the Simplex curve is the highest of any of the poppet valve engine curves at 1000 r. p. m., while the curve of the little Universal engine with cylinders of only 17.2 cu. in. displacement is the lowest at this speed. Its maximum power efficiency, however, is higher than that of the Simplex engine. This tendency for large cylinders to be more efficient at low speeds of revolution may be due to the better thermal efficiency already spoken of, though just why this should be more apparent at low speeds is not altogether clear.

There is apparently a tendency for the small cylinder engine to develop maximum power at a very high speed of revolutions. The little Universal engine, for example, gives its maximum output at 3200 r. p. m., while the large Simplex engine develops maximum power at about 1800 r. p. m. Most of the other small cylinder engines develop maximum power at high rotative speeds. This seems consistent since the small cylinder is better off with regard to volumetric efficiency. The average number of r. p. m. for the engines in Table I with cylinders under 40 cu. in. displacement is 2545, and for engines over 80 cu. in. 1800.

Knight Engine Characteristics

A characteristic of the Knight stock car engines is high-power efficiency at low revolution speed even where the cylinders are small. The Moline-Knight curve is higher than most others at 1000 r. p. m. though the displacement per cylinder is only 48.1 cu. in. The curve of the Stearns-Knight is the highest of all at 1000 r. p. m. Maximum power also is reached at rather low speed compared to the poppet-valve engines. This may be due partly to higher thermal efficiency and partly to better volumetric efficiency within the engines' speed range. Of course, none of these tendencies always hold good, but this hardly is to be expected considering the many variations in individual engine design. For instance, both the Mercer and Hudson companies have been prominent in racing and have developed their stock car engines along exceptionally efficient lines. The power developed by these two engines therefore is abnormally high. Variations in valve timing undoubtedly make comparisons of the different makes of engines much more difficult. The Hudson curve, for example, is remarkably high at high speeds of revolution and quite low at low speeds. This probably indicates that the valve timing is such as to favor high maximum revolutions at the expense of a slight loss in efficiency at low speeds.

Much more convincing evidence of the fact that small cylinder engines show higher power per cubic inch of displacement is to be found in an investigation of racing car engines. This is because maximum power always is aimed at in racing practice while other considerations affect the design of standard car engines. In Table II is given the power efficiency of some typical racing engines of various cylinder sizes, and in Fig. 4 are shown power curves of some of these engines plotted on the basis of horsepower per cu. in. of displacement.

At the head of the table is the 3-liter Peugeot engine, which is probably the most efficient engine yet produced, its output being over 0.5 hp. per cu. in. of displacement. The cylinders of this engine have a displacement of 45.7 cu. in., and comparing this with the large Peugeot engine, which has cylinders with a displacement of 114 cu. in., it will be seen that the output of the larger engine is only 0.384 hp. per cu. in., that is the smaller engine is about 31 per cent more efficient. This comparison is particularly satisfactory because the two engines are of almost identical design throughout, both having four overhead valves per cylinder.

Perhaps even more convincing is a comparison of the 3-liter Peugeot engine with the huge engine of the Blitzen Benz. The Benz engine has cylinders with a displacement of 327.5 cu. in., and is built along very efficient lines, yet its output is only 0.183 hp. per cubic inch of displacement, which is lower than many touring car engines and only about one-third that of the 3-liter Peugeot. Maximum power is developed by the little Peugeot at 2870 r. p. m. and by the Benz at only 1575 r. p. m. A remarkable curve is that of the Talbot engine, which is of L-head construction with but two valves per cylinder. The cylinders have a displacement of 69.1 cu. in. and the hp. per cu. in. of displacement is 0.482, which is very high indeed.

To determine the variation in the power per cu. in. of displacement developed by engines with different sized cylinders would require extensive tests made on engines of otherwise similar design, and would tend toward a more complicated rating formula. Also while the variation is considerable in the case of racing car engines of widely different cylinder sizes, it is not so great in stock car engines, being less in fact than that due to differences in individual design. A very fair idea of the maximum power developed by the average touring car engine of to-day can be obtained by multiplying the total piston displacement by 0.17. True, many efficient small cylinder engines will give much greater power than this while very large cylinder engines or engines of inefficient construction may fall below this output; but the rule will give much more satisfactory results than those obtained from the rating formula now in general use.

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Valve Sizes Need Definition

FOR the past few years the magic words, "big valves," have been used as an attractive bait by the car salesman among his array of talking points. In fact, the words have not been infrequent at engineering discussions, and furthermore, since they deal with one of the developments of modern engines, it would be very advisable if they were made a little more clear. The way matters are at present when the engine manufacturer states that his valves have a diameter of a certain number of inches, no one can be quite certain as to what is meant.

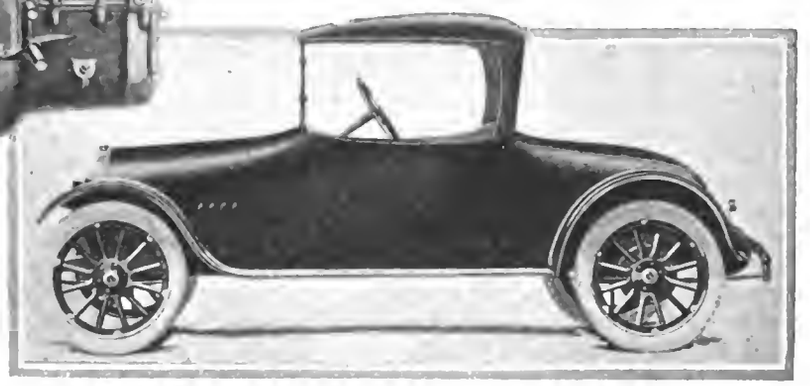
In the first place the so-called in-the-clear dimension means nothing unless the diameter of the valve stem is also given, as naturally it is only a matter of clear area. It would be far more to the point to give the area with the section area of the stem subtracted, as then a clear basis of comparison is given.

The class of purchasers of automobiles who are sufficiently educated to go into such technical points as valve sizes certainly is increasing. It therefore becomes increasingly necessary to make the information clear and definite instead of misleading. Information of this kind should be given correctly or not at all, and, as it is important and worth giving, a standard should be fixed so that a valve dimension will mean a definite thing applicable to all engines.

New Oakland Is More Powerful

Engine Output Increased 6 Hp. Without Changing Cylinder Dimensions—Body 6 In. Longer —Eight Continued Unchanged

Left side of new Oakland 34 engine, showing mounting of carbureter



The new Oakland coupé with the side panels removed

BY the substitution of a new body and a number of detailed mechanical changes the Oakland car for 1917 is made a roomier, easier riding and more powerful vehicle than its predecessors. Owing to the new body, the appearance is changed to a large extent and immediately gives the impression of being a much larger car throughout.

It is difficult to compare the present body with that of the 1916 model as the shape has been materially altered. It is 6 in. longer and of this, 5 in. has been taken up by increasing the depth of the tonneau and the other inch in enlarging the front compartment. In addition to the body change, the radiator is entirely new, being made with a deeper shell and a flat instead of a rounded front, so that although a number of indefinable features immediately proclaim the car to be an Oakland, the general appearance is in many respects different. The present model is known as the 34, and it is a refined and enlarged continuation of model 32. Model 50, the eight-cylinder car, is continued without change.

4 In. More Overhang in Rear

Although 6 in. has been added to the body, the wheelbase has been increased but 2 in., from 110 to 112, and the additional body space has been secured by giving 4 in. more overhang in the rear. To take care of the large proportions, 32 by 4 tires are new fitted all around in place of 32 by 3½, although, as far as the weight of the car is concerned, the 3½ size is sufficient, thus giving an over-tired car. This should make for tire economy.

Easier riding has been secured through an alteration of the spring suspension. The rear springs are now semi-elliptic in place of the three-quarter-elliptic and are 51 in. in length, whereas the three-quarter-elliptic had a length of 40 in. In changing the spring suspension, the use of Hotchkiss drive has been continued. Another factor in the easy riding qualities is the improved upholstery which is now finished in plaited instead of tufted leather, besides being better sprung.

Power Development Increased 6 Hp.

More power has been given the car by making a series of small changes in the engine, while not altering its dimensions. Actually, an increase of 6 hp. has been obtained and the principal difference is in a re-arrangement of the valve timing and the use of an offset fulcrum on the valve rocker. This now gives a reduction of 2 to 1, whereas with the former arrangement a 1 to 1 rocker was employed. The practical result of this is that the cams give a longer dwell or open period of the valve, and this, taken in conjunction with the new timing, gives a higher volumetric efficiency and hence the gain in power. The engine output is now 41 brake horsepower at 2500 r.p.m. on the block. The only other change in the engine has been the employment of a Fabroil gear in the timing set. This is a compressed cloth gear of pronounced non-resonant qualities.

Axle Ratio Now 4.5 to 1

Structurally, the chassis is the same as it was a year ago, the only change in the running gear being in the wheels. There is a change in the drive, however, which is of a minor nature, and that is the substitution of another make of universal of the four-block type for that previously employed, and a change in the rear axle ratio, making it 4.5 to 1 in place of 4.25 to 1.

A number of improvements have been made in the equipment. The driver's comfort has been considered in the windshield, which is now an over-lapping type, so that the rain cannot blow through the juncture point of the two glasses. The top now carries a side curtain and pockets, and a little feature which may prove of great value in conserving the car is a connection of the dash lamp with the oiling regulation. By this arrangement the dash lamp acts as a pilot light and burns continuously while the motor is running so long as there is oil in the crankcase. As soon as the supply of oil ceases the lamp goes out.

Perhaps the most striking change in the car, since it is contrary to the trend of the past few years, is the placing of the spare tire carrier in the left front fender. This has been done for the sake of rigidity as it puts a solid supporting platform beneath the tire. It has been moved forward to such an extent that it does not interfere with the left entrance.

Engine Is 2 13/16 by 4¾

The power plant is an Oakland-Northway product of the overhead-valve, detachable cylinder head design. It has a bore of 2 13/16 and a stroke of 4¾ in. The six cylinders are

cast in a single block and the entire cylinder head carrying the valve action is removable as a unit. In fact, the engine is accessible to a high degree, as the overhead casting permits of reaching the valves and combustion chambers while the removal of the bottom pan allows the main bearings and connecting-rods to be inspected.

Cast-iron pistons are employed and these carry three rings, all above the wristpin. The valve mechanism is actuated from a single camshaft with the lifter rods on the exterior at the right side of the engine. These operate the valve rockers directly on a 1 to 2 ratio so that the lift of the cam is doubled. The rockers are assembled on two shafts, each carrying six of them with a support between each two and the rocker. The supports screw into the cylinder head and are easily removable when necessary. For adjusting the valves there is a nut at the top of the push rod at the point of contact with the rocker arm. The valves are 1¼ in. diameter in the clear and the lift is 5/16 in. The valve timing at present has the intake open at 17.5 deg. after upper dead center and close 38 deg. after bottom center, and the exhaust opens 42.5 deg. before lower center and closes 7½ deg. past upper center. This gives a 10 deg. lead of the exhaust over the intake opening for the creation of a vacuum in the combustion chamber. Formerly, there was a 5-deg. lead and this new timing in conjunction with the longer dwell of the valve opening has been an important factor in securing the 6 additional horsepower from the same engine.

Water Pump and Fan Combined

One of the features of the engine which is unique is in the front construction which combines the water pump impeller, fan and fan bearing. This makes a unit of the fan and water pump, with the fan belt driving both. The water connection is direct from this point to the radiator with the pump case a part of the cylinder block and also forming the fan support. Particular care has been taken to give an efficient belt with the simple adjustment, so that the layout can be readily taken care of by the average owner, and in fact requires little or no attention.

Both manifolds are separate from the cylinders and held to them by dogs and studs. With this arrangement in removing the cylinder head, the entire manifold connection can be taken off with it, and it is not even necessary to remove the carbureter when the cylinder head is taken off. In fact, about the most important connections to be attached are the water and exhaust manifolds from the radiator and muffler pipe, respectively.

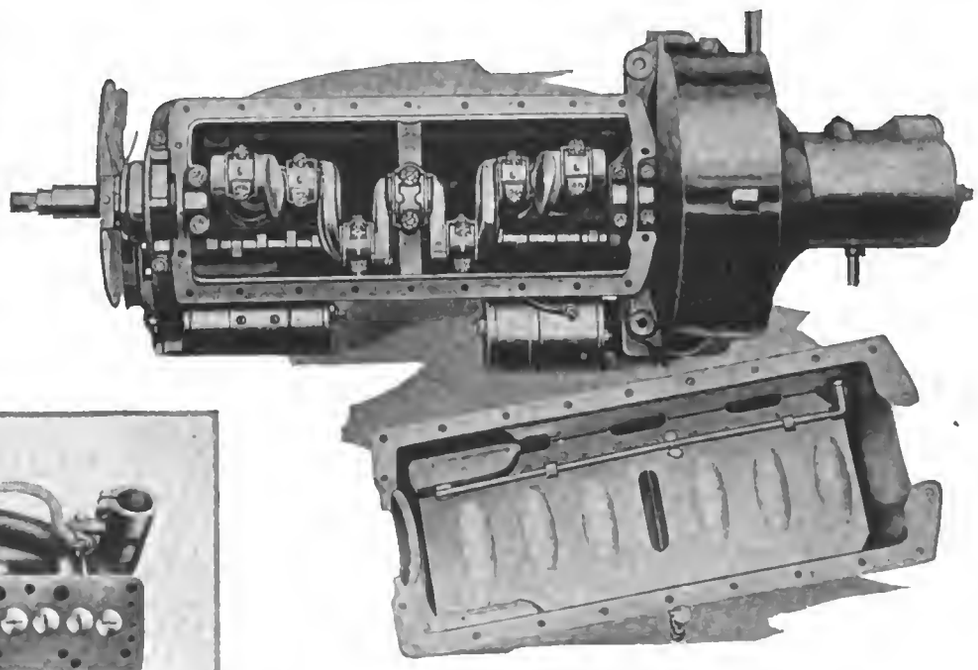
Gasoline feed is by the Stewart vacuum system in conjunction with a Marvel carbureter. The vacuum tank is on the front of the dash, that is, engine side, with the main tank having a capacity of 12½ gal. at the rear. The Marvel carbureter is provided with a heated-air intake and is mounted high on the engine, as shown in the illustrations.

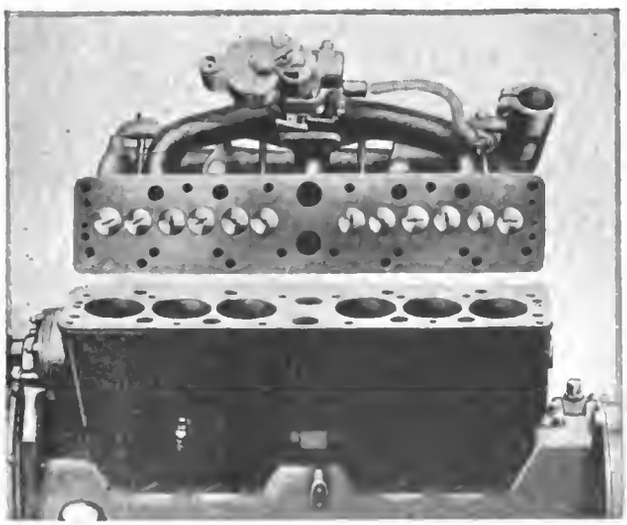
Delco equipment is used for ignition, lighting and starting. This was also true of the model 32 Oakland as far as the last 3 months of production are concerned. Before that time a different make was used.

Circulating Splash Oiling Continued

With the exception of the dash pilot lamp, no change has been made in the oiling system, a circulating splash system

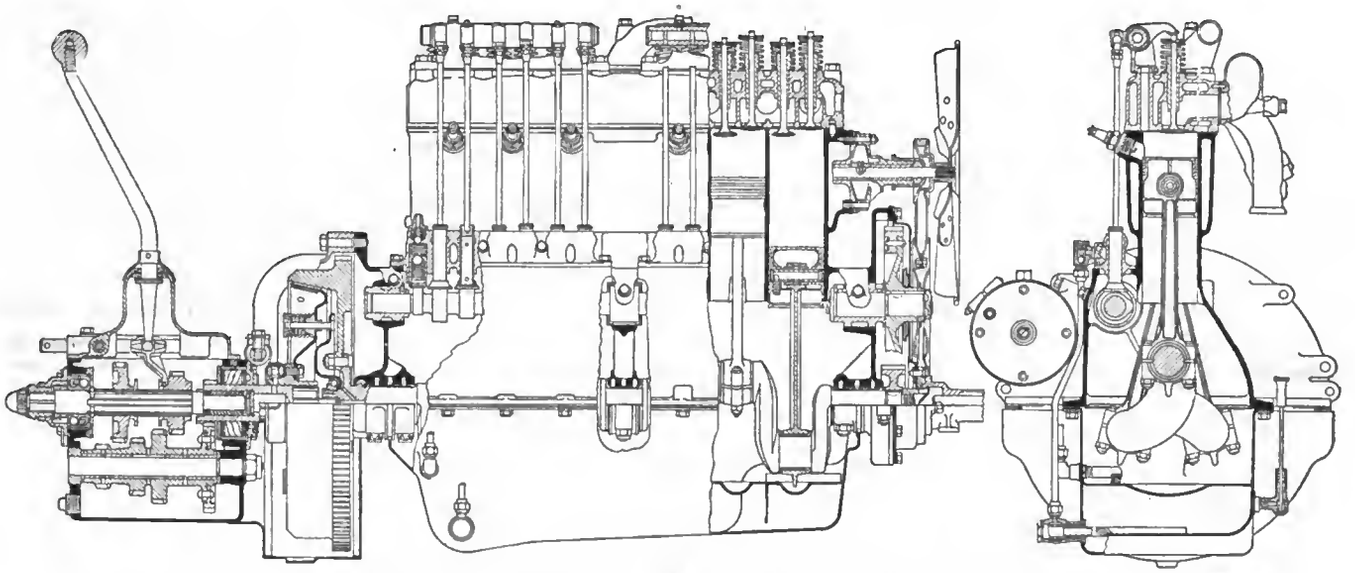
Combined fan and water pump which is a feature of the new Oakland. The fan belt drives both units



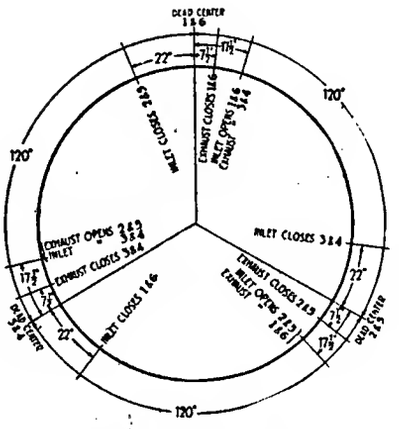


The new Oakland engine, the view above showing the crankcase removed to give an idea of the accessibility of the connecting-rod and crankshaft bearings, and other parts which the car owner or repairman is frequently called upon to inspect. The view at the left shows the cylinder head removed, illustrating the easy access to the piston heads, valves and waterjackets

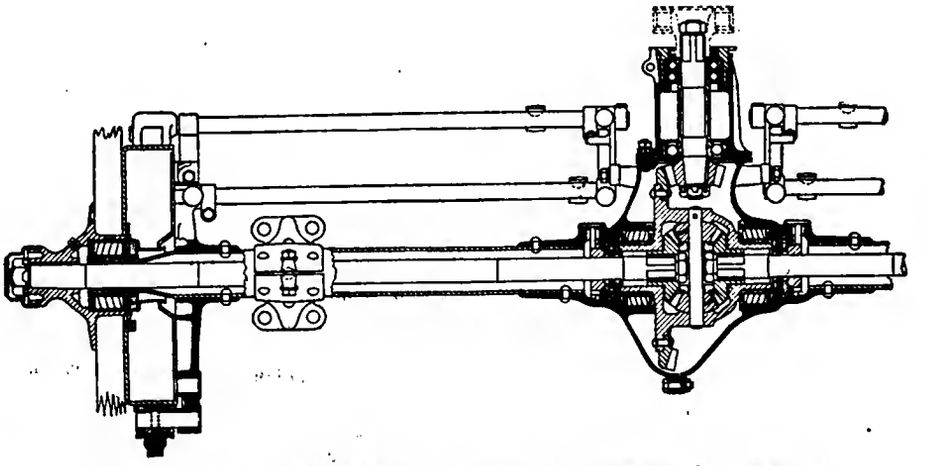
Engineering Details of Oakland 34



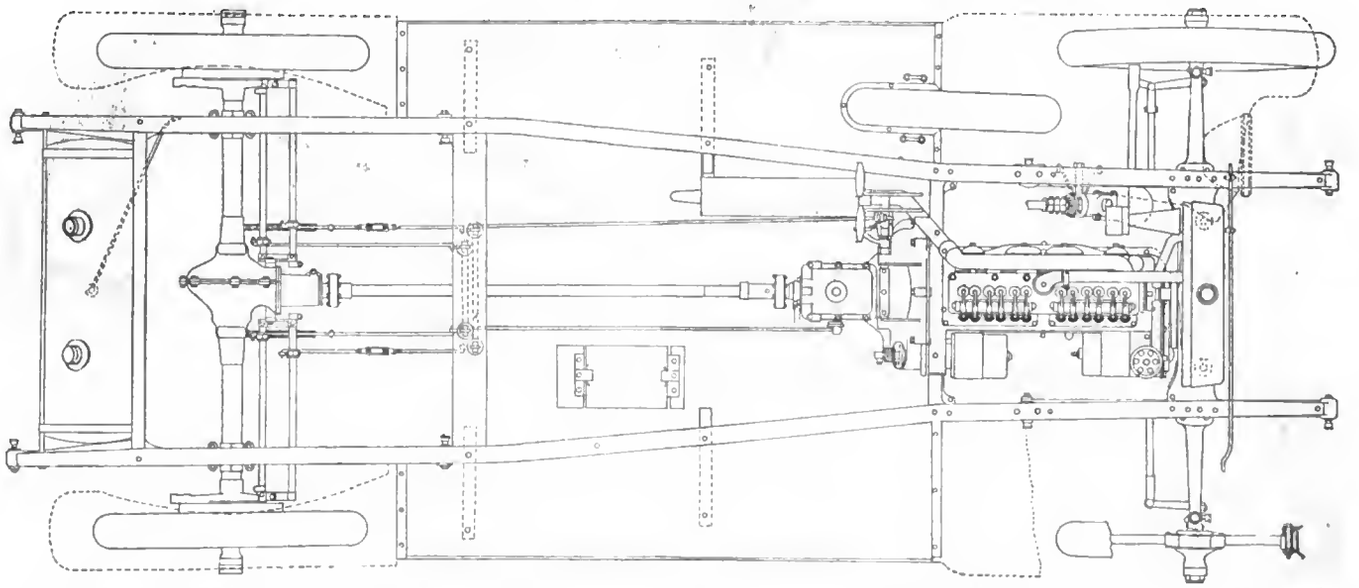
Sectional views through the gearbox and clutch assembly of the unit power plant, the front of the engine and a transverse section. At the front of the engine the combined fan and water pump drive is shown



Valve timing diagram



Section through the one-bearing floating rear axle, showing brake connections



Plan view of Oakland 34 chassis, showing tapered frame, mounting of spare tire on left running board, as well as position of storage battery. Note clean layout due to Hotchkiss drive

being used, operated by a plunger pump driven by an eccentric on the camshaft. This forces oil to a series of splash troughs and the three main bearings. A screen is provided through which all the oil must pass before it again reaches the pump, thus insuring a clean supply for circulation.

Unit Power Plant

Both the clutch and gearset are in a unit with the Northway engine. The clutch is a cone type with a ball bearing release and the gearset provides three speeds with reductions in the gearbox of 3.09 to 1 on low, 1.73 to 1 on second, and direct on high. The reverse ratio in the box is 3.98 to 1. These, of course, are multiplied by the 4.5 ratio in the rear axle for final reduction, giving ratios of 13.9, 7.8 and 4.5 on low, second and high speeds, respectively, and 17.9 on reverse gear.

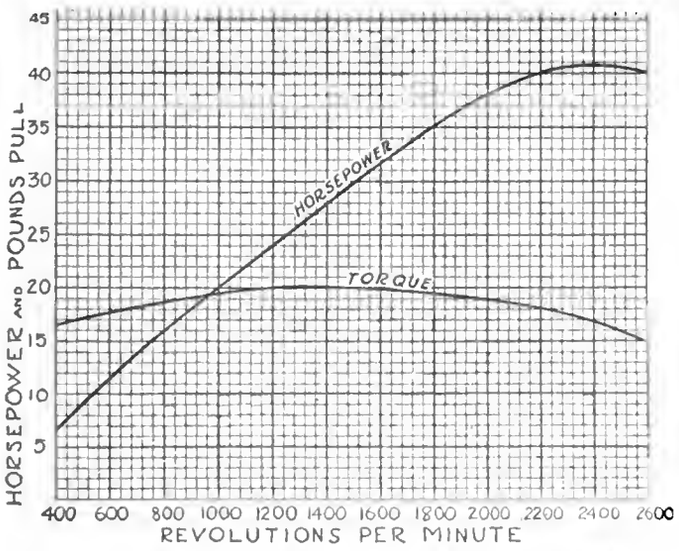
Frame Is Tapered

From the gearset the drive is taken through two universals and a hollow propeller shaft to the bevel gear rear axle. The master leaves and the front shackle bolts of the springs are the direct units in the Hotchkiss drive, transmitting drive and torque stresses, and hence have been made extra heavy in this construction. The elimination of torque tubes, arms, and radius rods, together with the simple brake layout, has given a very clean chassis, as is apparent from a study of the plan view. From this view it will also be seen that the rear springs are directed to meet the side members of the frame instead of outside and the entire frame has a pronounced taper to the transverse member at the rear of the engine. This gives a wide support which takes the body directly without the necessity for a sub-structure.

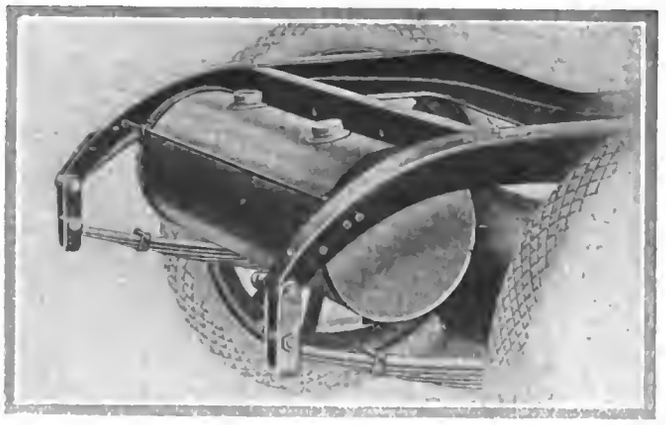
Floating Rear Axle

The rear axle is a Weston-Mott. It is a one-bearing floating type with longitudinally split housing. The brakes are external contracting for service and internal expanding on the hand lever. As will be seen in the plan view, the brake links are carried back to the rear transverse member, at which point they are broken with a short link to the rear. Adjustments are made by means of turnbuckles which are also illustrated in the sectional drawing of the axle which appears on the opposite page. The layout of the brake connections is also clearly illustrated.

The steering gear is a Jacox irreversible type with a 17-in. wheel. The control members are notably accessible with a ball type shifting gear within easy reach of the driver. The



Horsepower and torque curve of the new Oakland engine



Rear construction of the new Oakland, showing the mounting of the gasoline tank at the end of the frame members and the shackle for the semi-elliptic springs which replace the three-quarter elliptic type

floor is tilted beneath the cowl and the pedals project in such a way as to provide plenty of foot room for the driver, as well as the passenger in the front compartment.

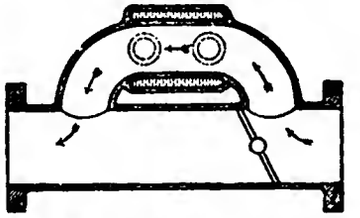
Equipment Is Very Complete

In the way of fittings, the car is complete. The tires are non-skid in the rear, and all the necessary instruments including speedometer, ammeter, gasoline gage, switches, etc., are included at the list price. The top is a one-person design or it may be a close convertible at an extra price. The storage battery is an Exide having a capacity of 80 amp.-hr. at 10 amp. discharge rate. The speedometer is a Stewart and the car is provided with a full set of lamps, license plate bracket, electric horn and tools. Trimming is in genuine leather, with coach green for the body and wheels, with black for the fenders as standard. The prices are $845 for the five-passenger touring and two-passenger roadster, $980 for the closed convertible sedan model, and $970 for the closed convertible coupé. A year ago the car sold for $795 and the $50 difference in price is made up in the more expensive tires, bigger bodies, and generally better equipment of the new model.

Pre-Heating Fuel

IN the paper with which he opened the Detroit section season last month, C. F. Kettering mentioned the advantages of insuring that gasoline should not be too cold when it reaches the nozzle of the carbureter. It is also important that it should not be too hot. C. F. L. King has lately obtained a British patent for an exhaust by-pass intended to provide controllable pre-heating for gasoline or kerosene. In the cut the large pipe shown is the main exhaust line, and the annular chamber surrounding the branch, or alternative passage, is interposed in the fuel line between the tank and the carbureter. When the throttle shown is closed, as in the cut, all the exhaust gas passes through the branch and so heats the fuel in the annular jacket. When the throttle is opened the bulk of the exhaust will pass straight out, thus reducing the temperature in the branch.

In the abstract of the patent published in the official journal, no mention is made as to how the inventor proposes to link up the throttle. Presumably it could be interconnected with the main carbureter throttle with fairly good results.



Device for pre-heating gasoline

Belgian light field pieces used in connection with motor trucks. Note the steel wheels required by their weight

Belgians Develop

SINCE the beginning of the European war some of the most interesting developments in armored automobile construction have been made by the Belgian army and the most recent constructions which they have produced are illustrated herewith. While no information as to the specifications and general details of these cars is yet available, it may be noted from the illustrations that the experiences of the war have borne fruit in their design.

For example, protection to the car, occupants and equipment has been made as complete as the ingenuity of the engineers who constructed it could make it. Even the rear wheels and rear axle are protected by armor plate as are the radiator and engine hood, in addition to the driver's compartment. Even the spare tires are carried so that they are protected from front and rear fire. Revolving gun turrets are fitted, equipped with either machine guns or rapid-fire light pieces, on the more heavily built types, while gun

Above—One of the new Belgian armored cars just before going into an engagement. Note how it is painted so as to blend with the landscape, a precaution against artillery fire under all conditions

Right—A train of the new Belgian armored cars with their crews and a squad of the motorcycle sharpshooters who act as skirmishers in connection with the armored vehicles, giving warning of the enemy's approach, etc.

Motor truck drawing a piece of heavy artillery into position at the double quick on the Somme front. Note special trailer

New Armored Cars

shields which protect both the rifle and its operators, and which usually are made to revolve, are fitted to the cars designed for less formidable but speedier work, such as skirmishing, scout work, etc.

While the mechanical side of the new armored cars shows direct results of the sometimes costly experiences gained during the early days of the war, the exteriors reflect in another way the development in strategy which has characterized the entire struggle. They are painted in varying shades of gray, green, brown, etc., so that they will merge imperceptibly into the landscapes, whether they may be in wooded or open country, upon the meadows lands or the sand dunes by the sea. This color scheme is not only valuable as a protection against the artillery fire of the enemy, but also helps to prevent the whereabouts or movements of

Above—One of the Belgian armored cars engaged in outpost work. Note how the crew keep sheltered as they make their observations. The gun turret is pointed toward the enemy

Left—A good rear view of the Belgian armored cars, showing how the rear tires are protected from puncture by bullets. The cars are shown here advancing toward the firing line at a rapid pace

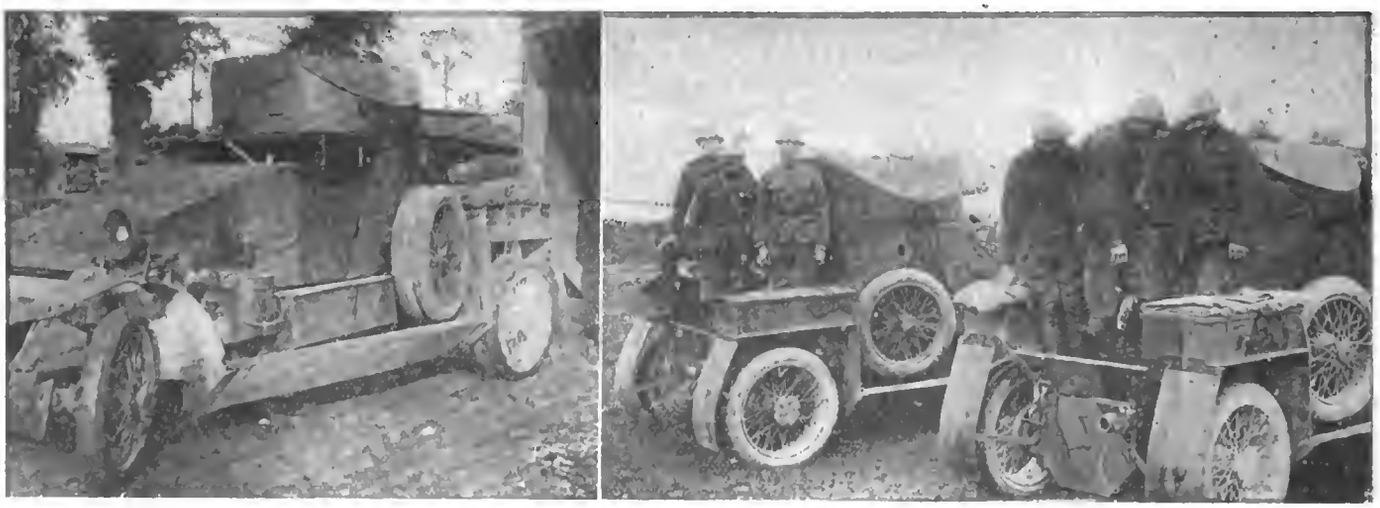
Two of the Belgian armored cars on skirmish work. Note the single large headlight and how the armor plate protects the engine hood and radiator. The motorcycle men are between the cars and the enemy so the crews are simply awaiting the word to advance

The Belgian armored cars in battle formation behind the lines. The cars differ in minor details such as the size and position of tool and ammunition box, etc. Note the steel-studded tires

the armored cars being discovered by hostile airmen, who are frequently hovering overhead searching with powerful field glasses for just such prey.

Touring Chassis Used First

The earliest Belgian armored cars, which won such renown in the first campaigns in northern France were built up from powerful touring car chassis fitted with machine guns and armor plating consisting of steel not less than 5 mm. thick, the gun being pivoted in the center of the single compartment. In some places a revolving pivot was fitted, while others merely had a shield in the front of the gun and revolving with it. The driver occupied the most central position in the machine and was practically immune from attack. He had a view straight ahead through a hinged shutter and in addition had a small port on the right, level with his head.



Left—A feature of the new Belgian armored cars is that there are practically no excrescences which may be shot away. Even the headlight is mounted close to the armor plated hood. Right—An excellent view of the rear construction used on the latest Belgian armored cars. Note the armor plate protecting the tires and the sheet across the rear

Extending Aluminum's Field

How to Make Best Use of Aluminum Alloy in Automobile Work While Avoiding Difficulties Outlined in Extracts from J. E. Diamond's S. A. E. Paper

THE fundamental advantage of aluminum is quite naturally that of lightness. The specific gravity of pure aluminum when cast is 2.59; when rolled, 2.68. The specific gravity of iron is about 7.21; that of steel somewhat higher. Thus, it will be seen, the weight of aluminum is for equal volumes but slightly more than one-third that of iron. The coefficient of expansion of aluminum is 0.000022 per degree Centigrade (Richards); that of iron is 0.0000119 per degree Centigrade (Roberts-Austin). The melting temperature of pure aluminum is 659 deg. C., or 1218 deg. F. The specific heat of aluminum is 0.22. Its thermal conductivity based on the conductivity of pure silver as unity is 0.313. Of the baser metals, copper, with 0.5, is the only one that exceeds it in thermal conductivity. The conductivity of iron is 0.11, or only one-third that of aluminum. It has recently been discovered that the thermal conductivity of aluminum increases with its temperature and at a temperature of 700 deg. F. is practically three times the conductivity at ordinary temperature. The electrical conductivity of aluminum is 60.5 per cent that of copper for equal volumes; and since copper is three times as heavy, its conductivity is higher, weight for weight. Aluminum is preceded by gold only in malleability, preceding in this respect silver, copper, tin and platinum. It ranks sixth in ductility. The tensile strength of approximately pure aluminum is about 15,000 lb. per square inch. Therefore, as far as strength is concerned, it is seen that even in the unalloyed state, weight for weight, it will compare favorably with fair grades of cast steel. It was early discovered that aluminum unalloyed was too soft and that structures cast in it lacked rigidity. A number of alloys have been developed and have corrected the inherent limitation of the pure metal, at the same time sacrificing only to a limited degree its fundamental advantage of lightness.

The most widely used alloying metals are copper and zinc. Copper and aluminum alloy particularly well with high or low content of either metal. The aluminum bronzes with high copper content have been found to be equal if not superior to any other bronze so far developed. The copper-aluminum alloy most commonly used has a tensile strength of about 20,000 lb. per square inch. Zinc alloys have been developed having greater strength, but at the present time probably 95 per cent of all automobile and aviation engine castings are made of copper-aluminum alloy.

Casting of Aluminum

The production of aluminum castings is a science in itself, and present-day success is built on many early failures.

Points on Casting Design

¶ Make the keynote the elimination as far as possible of complicated coring. When it is necessary, bend every effort so to design the job that as much of the coring as possible can be green sand work. Design as far as possible all sections with uniform thickness. In crankcase design do not try to decrease the thickness of the walls below 3/16 in. A thickness of 7/32 in. is better. The number of sound castings will increase appreciably if the foundry is granted this additional metal, and paradoxical as it may seem, the heavier casting can cost less because of the reduction in the defective casting loss. Design cases so that the ribs, brackets and bosses have plenty of taper. Further, have such parts join the main casting with liberal fillets. It is imperative that when a fairly light section runs into a heavy one that large fillets be employed. As far as possible, do not use loose pieces on the pattern for bosses. In most cases the green sand is not sufficiently strong and it is necessary to use dry sand cores, thus increasing the expense of the work.

It is a long cry from the first attempts of castings to the complicated work turned out to-day. The mere possession of the formulas of suitable alloys by the foundry is not all that is required. Haphazard methods in the foundry are not conducive to the production of sound castings. In the early days "hit or miss" methods in the metal room in the preparation of the "charge" resulted in a great variation in quality of castings.

It was found necessary in the furnace room to control the temperature, lest the metal be burned. Too high a temperature destroys the natural vitality of the metal, and castings made from this burned metal are brittle. In so far as strength is concerned, probably no one factor is of more vital importance than the pouring temperature. The lower this is the stronger the casting. The casting that has barely escaped being a "misrun" in the thinnest sections, because of a low pouring temperature, is the best casting from all standpoints. The reason for this is found in the rapidity of crystallization. Naturally, where the metal is poured cold, so to speak, the crystallization takes place quickly; and the crystals do not have time to arrange themselves in orderly manner, as they do if a longer time is granted. The production of successful castings requires careful attention to all the little details.

In the foundries of the Aluminum Castings Company technically trained men supervise every stage in the evolution of a casting, from the analysis of the virgin ingot to the delivery of the casting to the sand blast. Every foundry bay has a pyrometer, each casting being poured at the temperature an expert has determined to be the proper one; that is, just short of a mis-run. It is not too much to say that it is this technical oversight all along the line that makes it possible to produce so many crankcases in a day.

By far the larger number of aluminum engines are those in which the cylinders and crankcases are integral. This is an extremely rigid construction, and the aluminum makes a much lighter construction than the iron engines constructed after this design. Here again the overhead-valve engine is the favored type, although occasionally an L-head is found. Both the Marmon and the new Premier engines have overhead valves. Except in rare cases the heads of all these integrally-cast cylinder and crankcase engines are removable. From a structural and mechanical standpoint the ideal way to make this engine may be with the head integral, but it multiplies many times the difficulties in the foundry. In the present stage of the art it is doubtful if this type of construction can ever be placed on a production basis. The foundry occasionally finds itself taxed to turn out individual castings with integral heads. The cores in the heads are extremely intricate, and require the ingenuity of the best pattern makers and foundrymen to determine how to make and how to hold them properly.

Details of Sleeve Construction

The general practice has been to lay down a design similar to that dictated by past and current iron-cylinder practice, taking into account the modifications ne-

cessitated both by foundry and by mechanical requirements. The outside diameter of the cylinder barrels is made larger than would be the case with an iron engine, thus accommodating a cast-iron or steel sleeve. These sleeves are either a drive fit and forced into place with a light press, or steam or hot water is run through the jacket space and the sleeve dropped into place. It is essential to get the sleeve into place at once without loss of time, as otherwise it will heat and expand, sticking before it has been dropped home. This construction, in the main, differs from iron-cylinder construction only in that the piston and piston rings operate against an iron sleeve. In the overhead-valve construction this sleeve is flanged at the upper end, fitting in a corresponding recess. In the integral-head jobs, of course, it is necessary to put the sleeve in from the bottom.

When the cylinder blocks are not cast integrally with the crankcase, the bottom of the sleeve is machined flush with the bottom of the casting and is supported, although such support is not at all necessary, on the top of the crankcase, the cylinder opening being somewhat smaller than the outside diameter of the sleeve. When the cylinder head and crankcase are integral the sleeve can be flanged at the bottom and held by one or two machine screws. Another method is simply to upset the aluminum about the bottom of the sleeve.

A discussion of the use of aluminum in modern motor-car construction would not be complete unless mention were made of the Lynite piston. The aluminum piston has come and has come to stay. Any trouble existing has been in the nature of "growing pains." We have learned in the past year that it is not wise to attempt to carry weight-saving to the limit. In other words, we should all be fully satisfied in cutting the weight of an iron piston in half instead of following the exact design of the latter in order to avail ourselves of the two-thirds saving in weight. The metal thus added will have beneficial effects if employed in increasing the length and the wall thickness of the piston. I have always advocated a long piston with a reasonably thick skirt. In a paper given before the Detroit section of the society last winter I advocated a length equal to one and one-third the piston diameter. The long piston with a fairly heavy skirt will take care of piston slap and should help materially in preventing oil pumping. On account of limitations that cannot be removed, occasionally it may not be found advisable to substitute aluminum pistons for iron ones in an engine already built. The piston unquestionably is the heart of the engine, which should largely be built around the piston.

The use of the aluminum brake-shoe is another step in the direction of unsprung weight reduction. Aluminum brake-shoes lined with suitable brake material have rendered eminently satisfactory service when and wherever tried. Aluminum brake-shoes have not had much vogue in America, but in Europe both the Panhard-Levassor and the Peugeot companies use Cothias permanent-mold aluminum brake-shoes on all their models, both touring cars and trucks. Ordinarily brake-shoes of conventional design lend themselves extremely well to production by the Cothias process. We have produced Lynite permanent-mold brake-shoes, in some cases imbedding in the casting a steel slug to take the action of the expansion cam. Unquestionably future development in car construction will be in the direction of refinement of details, and I am certain that the aluminum brake-shoe will be heard from in the next 3 or 4 years.

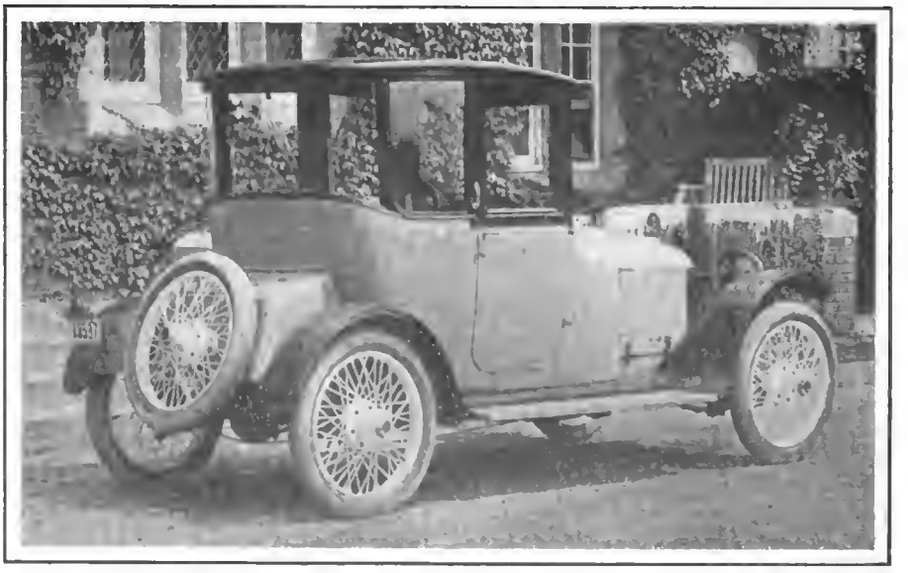
Machining Qualities

Casting for casting, aluminum can be machined nearly twice as fast as cast iron, resulting in a corresponding reduction in cost. Fewer men, consequently smaller floor space, are demanded when the shop is laid out to machine aluminum than would be the case with cast iron. Considering the ease with which an aluminum casting can be handled in the machine shop, from the unloading platform to the assembly floor, to say nothing of the rapidity with which the casting can be put through one machine after another, comparative costs will show aluminum, even with the abnormal conditions prevailing, with an increased initial cost for castings as a consequence, to be quite competitive with cast iron. When the market is normal, considering initial costs, casting for casting, it will be found that it is cheaper to use aluminum than iron.

Some time ago a certain manufacturer whose crankcases were machined outside his own plant considered the use of an iron crankcase in the belief that he might reduce his costs. It happened that the manufacturer was, and will be for some time to come, dependent on one shop for the machining of his cylinders and crankcase castings. The manager of this outside shop refused point-blank even to consider machining iron cases, stating that the trouble they were having with the one iron casting was quite sufficient.

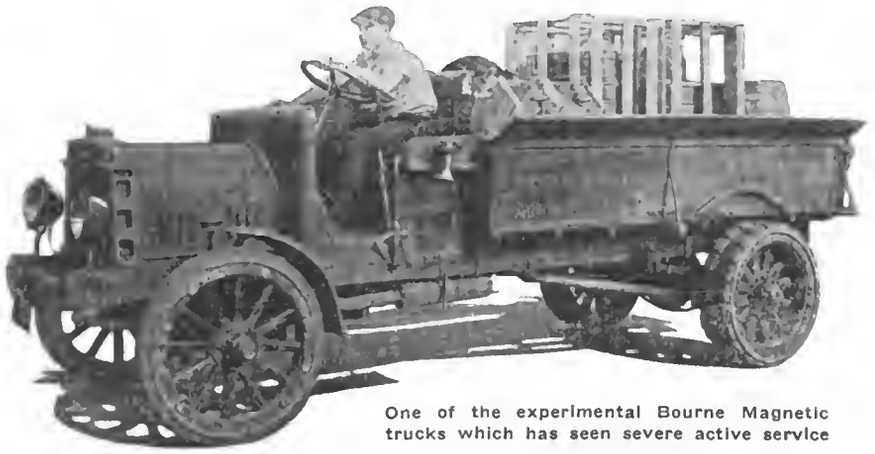
Coupé Body for Scripps-Booth Four Chassis

THE coupé body illustrated herewith has been brought out by the Scripps-Booth Corp., Detroit, Mich., for mounting on its standard four-cylinder chassis. The characteristic mounting of the spare wire wheel at the rear of the tool and luggage compartment has been continued, the only part of the body differing from the well-known roadster being the coupé section from the dash to the rear deck. The body is luxuriously finished and maximum light is assured by the almost continuous glass sides, curtains being provided for use if desired. This model is particularly designed for use by doctors and business men who desire an economical closed car for use in cold weather. The price of the coupé model mounted on the standard four-cylinder Scripps-Booth chassis, as illustrated herewith, is $1,450.



Bourne Truck Has Magnetic Transmission

New Vehicle Employs Same Unit as Owen-Magnetic Car



One of the experimental Bourne Magnetic trucks which has seen severe active service

THE Bourne Magnetic Truck Co., Philadelphia, Pa., will soon be ready to deliver 2-ton and 3½-ton trucks with a magnetic transmission precisely similar in its method of operation to the Owen transmission used on Owen-Magnetic passenger cars. Experimental vehicles have been driven thousands of miles in actual service, the one illustrated on this page having been used by the Atlantic Refining Co., of Philadelphia, and another has been doing express work in New York City. A great reduction in wear and tear on the chassis and substantial economy in operating costs are claimed to have been proved for the transmission by these tests.

The chassis built is not an entirely new creation erected around the electric transmission unit. S. N. Bourne has built a number of special trucks with gear transmission of which a majority are in the service of the Atlantic Refining Co. They have a number of points of interest quite apart from the transmission, the most noticeable being a special method for mounting the springs. These, as shown in the illustration, have no shackles in the ordinary sense of the word. Instead the end of the spring is flat and makes a square contact with a rocking block, this having a rounded head which rests in a groove provided for it in a bracket attached to the frame.

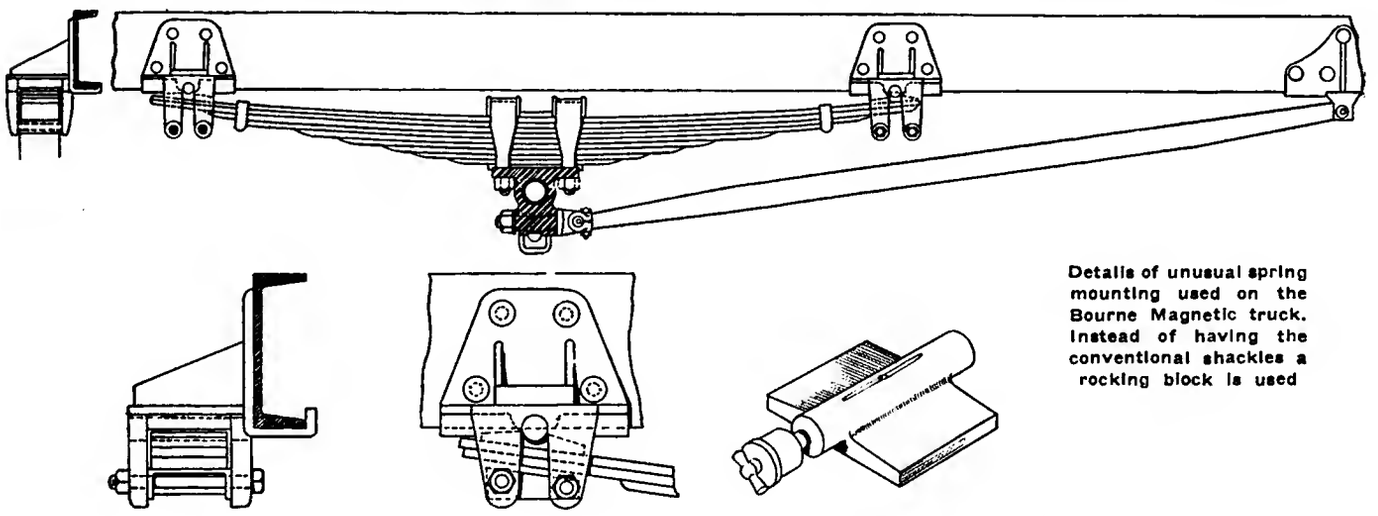
The best of material is used throughout the truck and it is to be observed that the driver's seat, dashboard, fenders and similar parts have an exceptional rigidity and strength. In developing trucks to suit the very strenuous service required by the Atlantic Refining Co. in the distribution of petroleum products the ability of different parts to shake loose was soon demonstrated and that the detail fittings as now supplied are solid enough to withstand any amount of jarring.

Naturally, these trucks are not in the cheap class, the 2-ton chassis costing $3,150 and the 3½-ton $3,850. The engines used are similar, both having 5½ in. stroke and a five-bearing crankshaft. The bore of the smaller engine is 4 in. and that of the larger 4¼ in. The cylinders have individual removable heads giving maximum facility for cleaning out the combustion chambers. A non-adjustable type of carbureter is fitted and ignition is provided by high-tension magneto with fixed spark. An electric lighting and unusually powerful starting system is, of course, provided by the transmission.

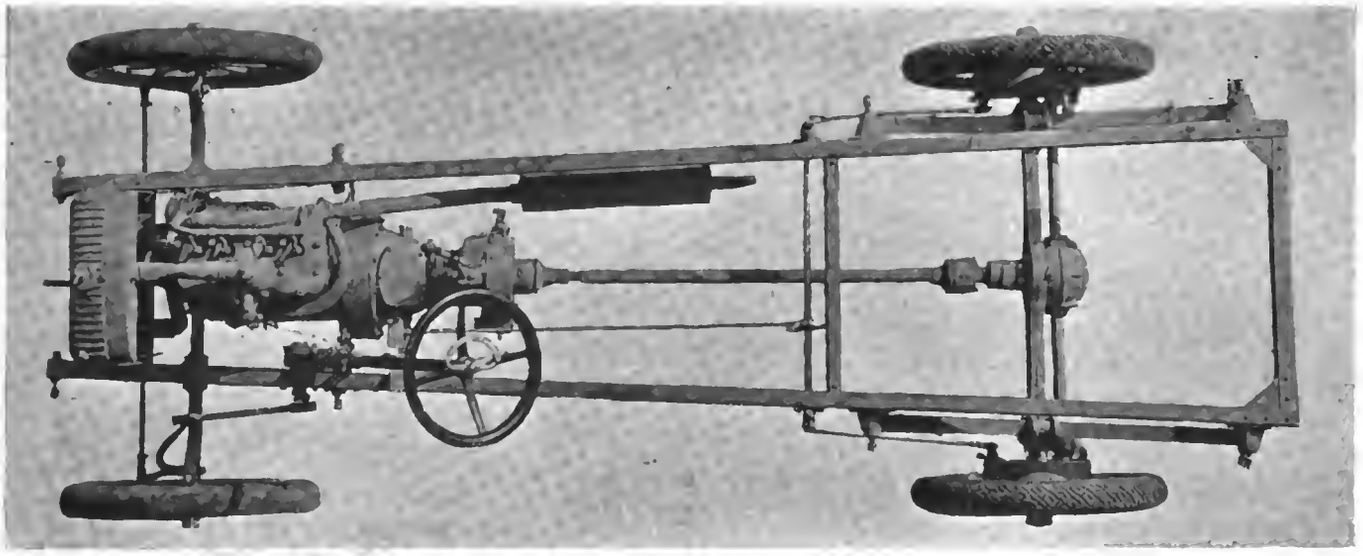
The transmission is mounted integrally with the engine, being bolted up to the crankcase precisely as on the Owen-Magnetic car. The control operates exactly like a throttle lever, the engine control being confined to a foot accelerator. Both trucks are governed, the smaller to 15 and the larger to 12 m.p.h.

The frames are constructed to give a maximum flexibility, the side rails being 6-in. chrome vanadium channels and the cross members little more than distance pieces to keep the side rails apart. This means that a very large amount of weave is permissible and cannot result in loosened rivets. The power plant is mounted on three points so arranged that any distortion of the frame cannot possibly transfer stress to the crankcase.

The rear axles are of the worm type and carry two sets of inclosed brakes. In addition to these, which are operated by the usual pedal and hand lever, there is a powerful electric brake which can be brought into action any time when the truck is moving. This brake consists of an arrangement of switches which causes the part of the transmission driven by the rear axle to operate against a strong electrical resistance and the electric brake is applied by the movement of the same lever which controls the different electrical speeds.



Details of unusual spring mounting used on the Bourne Magnetic truck. Instead of having the conventional shackles a rocking block is used



Chassis of new 1500-lb. Republic truck, showing clean design, power plant mounting and tapered frame

Originality in 1500-Lb. Republic

FEW firms in the motor truck industry have grown as rapidly as the Republic Motor Truck Co. of Alma, Mich. This concern is planning to make 23,000 machines next year and more than half of these will be the new 1500-lb. delivery truck which will be known as the Dispatch model. The first of these is now on its way from the factory to Los Angeles, on a demonstration run.

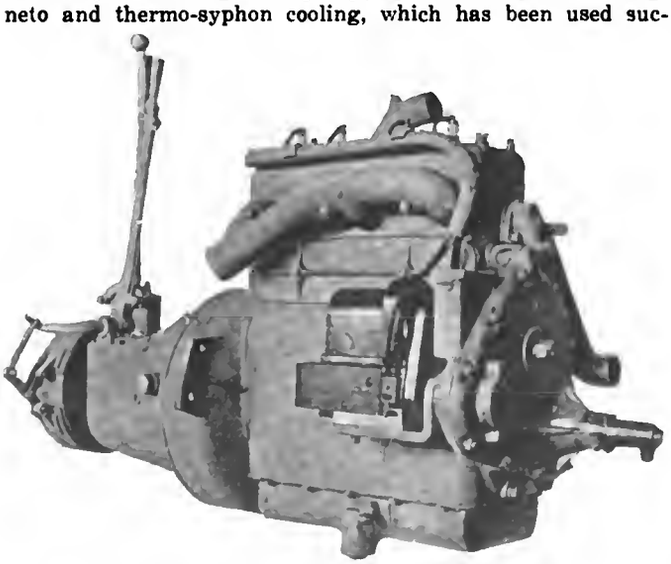
The chassis is in every respect a truck engineer's job and is therefore capable of being run on solid tires. Pneumatic tires can be used and either of the following tire equipments will be provided, 32 by 4 in. (non-skid rear) pneumatics, or 32 by 3 front and 32 by 3½ rear solids.

The engine is new, having been designed especially for this particular chassis. It has a bore and stroke of 3½ by 5 in. with cylinder barrels cast integral with the crankcase. The crankshaft is quite unusual, as it has ball bearings; the diameter is 2⅛ in. and there is no center bearing, the rigidity being obtained by making the cheeks of a massive section. There is a detachable head which greatly facilitates removal of carbon, and the valves are arranged in a normal L-head manner being 1⅝ in. diameter. The lubrication is maintained by a submerged oil pump; ignition is by Bosch magneto and thermo-syphon cooling, which has been used successfully by the Republic company on other models, is also adopted for this, the smallest of the range.

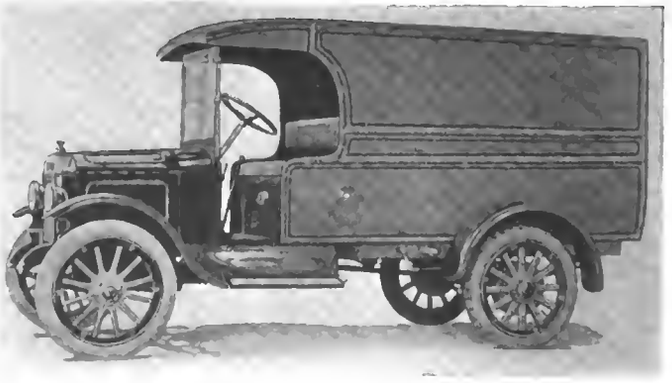
The transmission, which gives three speeds, is bolted up in unit with the engine, the flywheel being inclosed in a bell housing. It contains a multiple dry disk clutch. The internal gear axle is a Torbenson.

As typical of the robust nature of the chassis, the frame layout shown in the illustration should be noticed, and another typical truck feature is the radiator which has cast tanks and a special form of core. There is one standard wheelbase of 110 in., but two bodies are provided. One of these is the regular express type with canopy top and side curtains and it is this model which sells for $750. A large solid panel type is provided for an extra $25. The length of either body is 81 in. and the width 42½ in., the height from floor to top being 54½ in. As to the color scheme, the Republic yellow wheels are adhered to, the body being finished in Brewster green. A glass windshield and electric lights are included in the equipment, the necessary current being provided by a Bosch generator. Starter is extra.

Somewhat similar in general design are the Republic models 10 and 11 rated at 1 ton and 1½ ton. These have wheelbases of 124 and 144 in., the model 10 costing $1,095 with either express or stake body and the model 11, $1,275 for the chassis only. The engines of models 10 and 11, like model 9, have a 5 in. stroke, but the bore differs being 3½ in. for the model 10 and 3¾ for the model 11. The 2- and 3-ton chassis will not be materially changed.



New 3½ by 5-in. power plant used in Republic Dispatch truck



Republic Dispatch truck of 1500 lb. capacity, with panel body

Ramps a Feature of Hudson Garage

Will Cut Overhead $18,250 Per Year Besides Saving Each Customer 20 Min. Per Day—Four-Story Structure Will House 600 Cars in Individual Spaces

A FOUR-STORY garage to store 600 cars without the use of an elevator is in course of construction by the Hudson Motor Car Co. of New York. It is estimated that it will cost $600,000. By the use of two 20-ft. ramps in place of elevators the company has not only saved each customer nearly 20 min. time each day, but it has saved itself a heavy overhead expense of about $18,250 per year. This is based on engineering facts giving the cost of each trip of an elevator as 10 cents. Approximately 250 cars would be going up and down these elevators each day, thus giving the above figure. In regard to the time saved by the use of ramps, it is stated that there is no possible chance of congestion and it is possible for a car to come down the ramp from the fourth floor to the street in between 10 and 15 sec. The space taken by the ramps is equal to that taken by the elevators.

The new garage being built by the Hudson Motor Car Co. of New York

The garage will be public and is being built on a plot of 41,000 sq. ft., giving at least 4 acres of storage space. It will run 100 ft. west of West End Avenue to the New York Central tracks and clear through from Sixty-eighth to Sixty-ninth Streets.

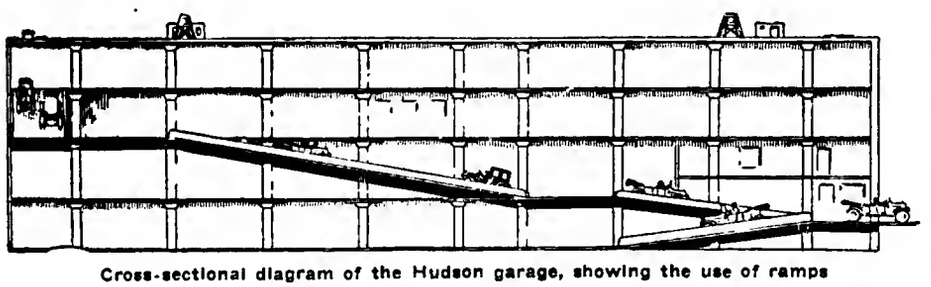
Every point in construction and equipment has been well looked after. The ramps, instead of running in spiral form as in the garage of the Automobile Club of America, reach their respective floors in practically a straight line, there being only one turn from the third to fourth floors. The ramps will run at an angle of from 10 to 15 deg. One will go to the first floor and the other will go to the other floors. The use of these ramps eliminates the inevitable delays of elevator service. Each set of ramps is divided by a concrete curbing, thus eliminating all danger of sideswiping when cars are going in opposite directions. Two cars can pass comfortably on the ramps, thus avoiding any possible congestion on the up or down trip. Extra precaution has been taken against skidding on the ramps by the use of an abrasive metal. During the busy parts of the day, there will be an attendant on each floor entrance to guide the cars from their floors, thus eliminating all danger of possible collision.

A scientific layout has been adopted in the car spacing. Each customer is assigned a specific space and number. Each space is provided with a concrete guide 10 ft. long, 49 in. wide and 4½ in. high, located under the car between the wheels. The car can thus only enter the space when it is lined up correctly. A small bumper, 6 in. high, is provided for blocking the rear wheels. There is a 14-in. space between the running boards of the cars. Each car is pushed out into the 18-ft. aisle to be washed right in front of its space. The company has introduced, due to its architect, H. B. Mulliken, portable washing racks for each of the twenty aisles. These racks or cranes are run on an overhead track and are equipped with a cape large enough to cover a car so as to protect the other cars from splashing. A row of electric lights inside the cape is also equipped. Hot and cold water and compressed air are conveniently placed in each aisle. As the rack is moved to one end of the aisle, it is quickly and conveniently connected with either the hot or cold water by means of an air-brake coupling, another feature introduced to save time.

Each car space is provided with a spacious locker, large enough for two tires and other equipment.

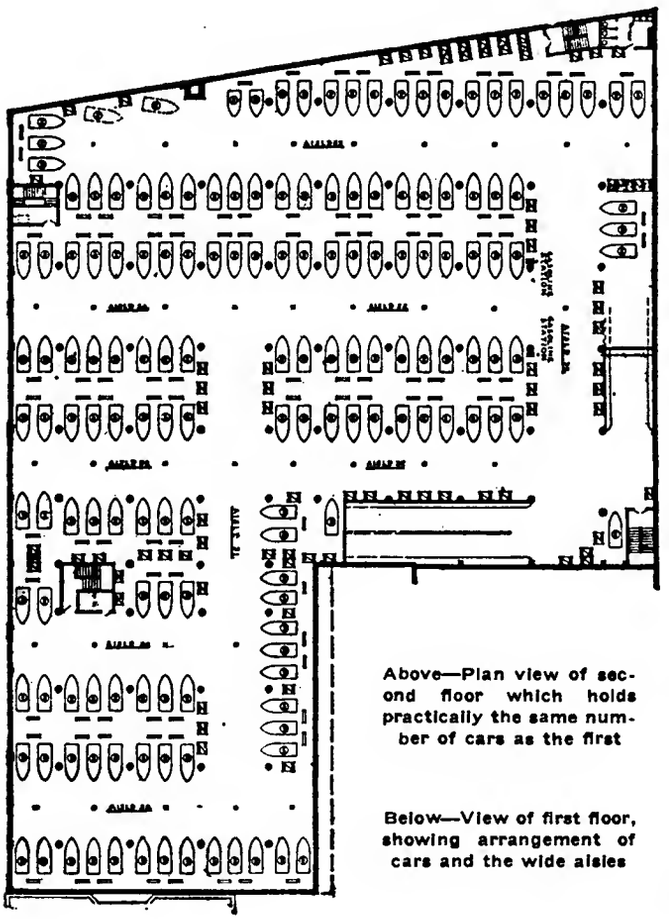
Part of the fourth floor will be used as a club room for the drivers. There will be a barber shop, library, restaurant, billiard and pool room and a smoking room. Each will be completely furnished by the company which will control each department. Meals will be furnished at cost.

Much has been planned for the convenience of customers. For instance, each floor will be equipped with a signal, which will flash the number of a car wanted. This device will be controlled at the office on the ground floor. Time is also saved by the installation of telephones on each floor. There will be a large supply



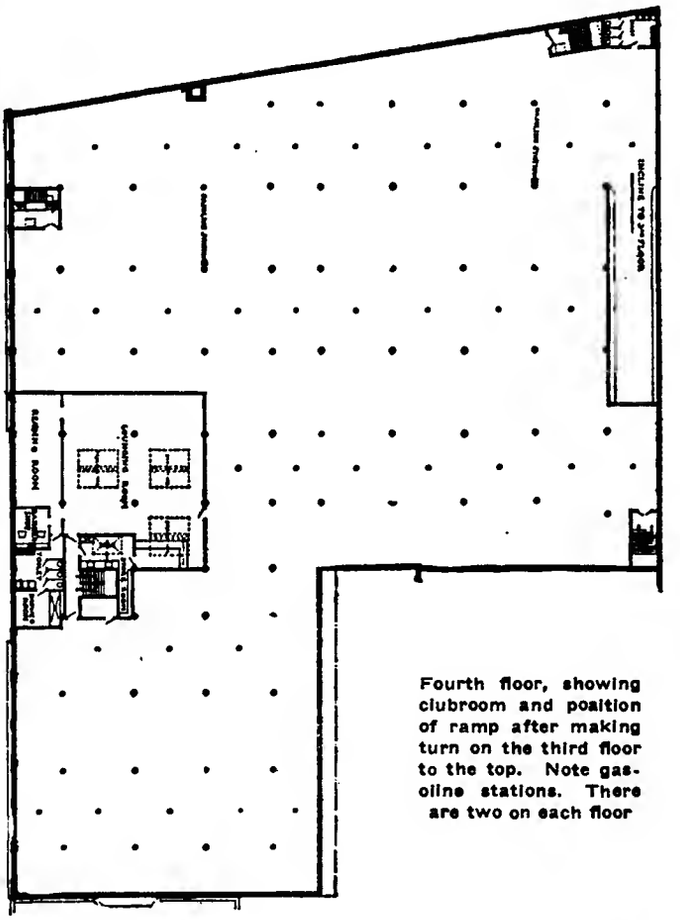
Cross-sectional diagram of the Hudson garage, showing the use of ramps

Layout of the Four Floors in New Hudson Garage

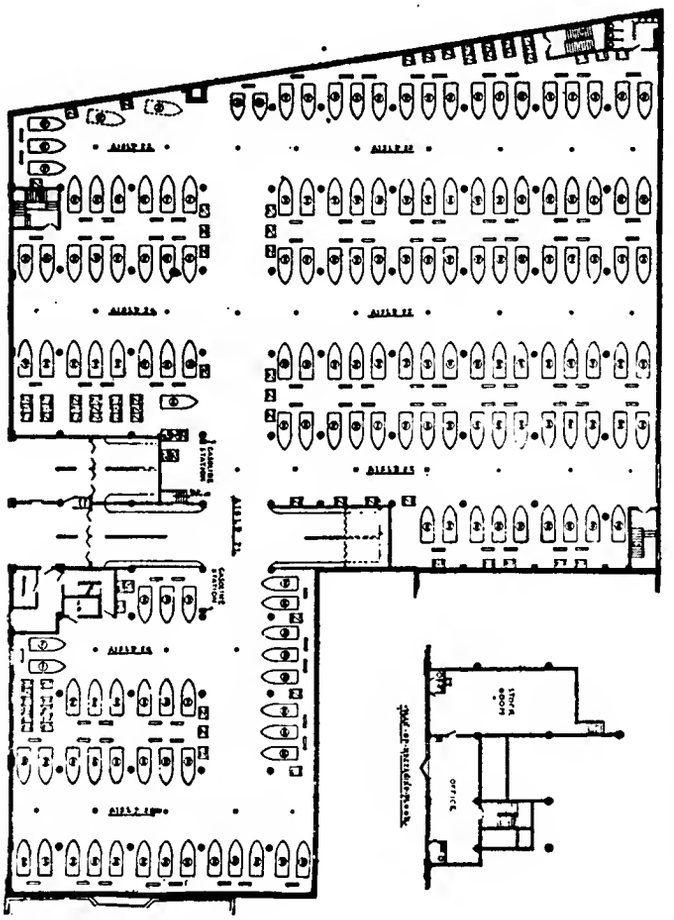


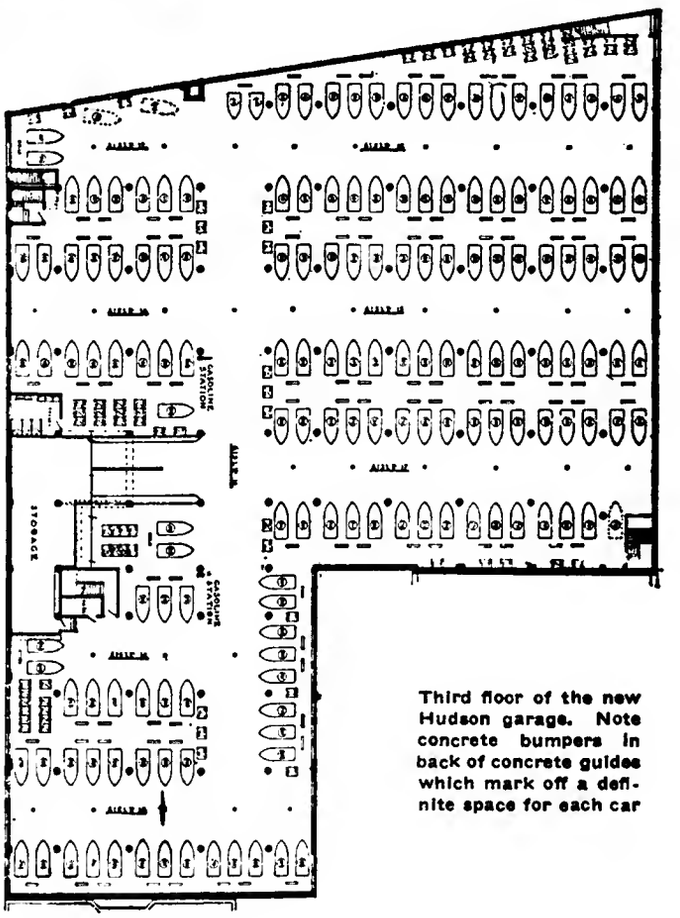
Above—Plan view of second floor which holds practically the same number of cars as the first

Below—View of first floor, showing arrangement of cars and the wide aisles



Fourth floor, showing clubroom and position of ramp after making turn on the third floor to the top. Note gasoline stations. There are two on each floor





Third floor of the new Hudson garage. Note concrete bumpers in back of concrete guides which mark off a definite space for each car

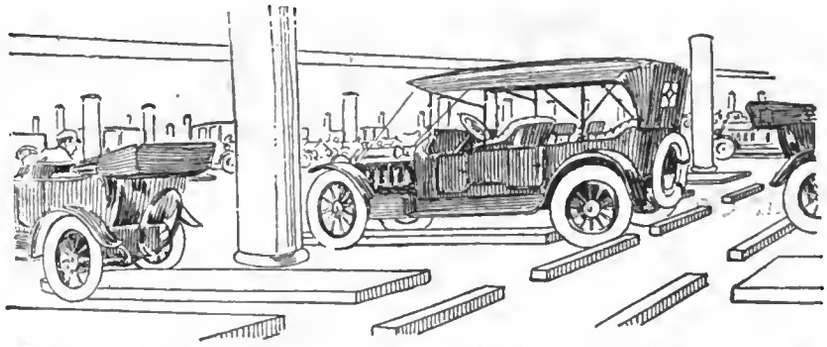
department on the ground floor. The Allen pressure system will be used for pumping gasoline and oil to each floor. A gasoline storage capacity of 23,000 gal. will be available. There will be a machine shop on the fourth floor, 40 by 100 ft., where chauffeurs will be allowed to work on their cars free of charge.

Only Two Entrances

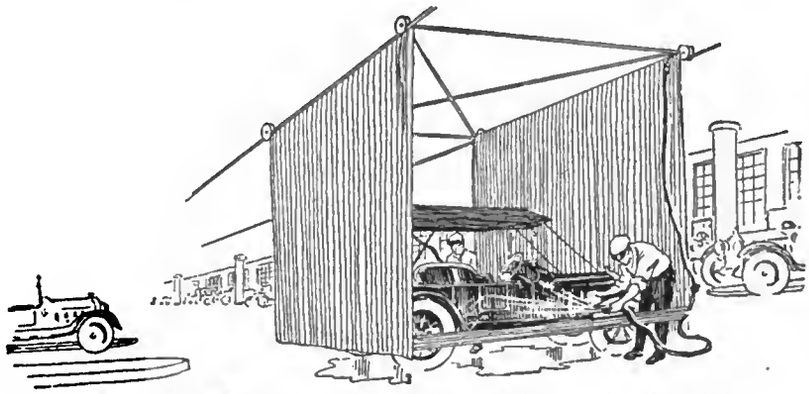
There will be two entrances only, these being on Sixty-eighth Street. Exits in case of fire will be established, two on Sixty-ninth Street and two on the West End Avenue side of the building. For fire protection an automatic sprinkler system will be installed. There will also be sand pails and Pyrene fire extinguishers placed at short distances apart on the floor. In addition to these precautions, automatic steel shutters will be installed to cut off each floor in case of fire. These shutters are held open by fusible connections which will melt when a fire occurs allowing them to close. A large siren horn will be installed on the floors and will be used in case of fire.

Details Well Planned

Such details as checking all outgoing and incoming cars, keeping track of each person that enters the building, provision for adequate lighting, etc., have been given careful attention, always with the practical side of the application of each in view.

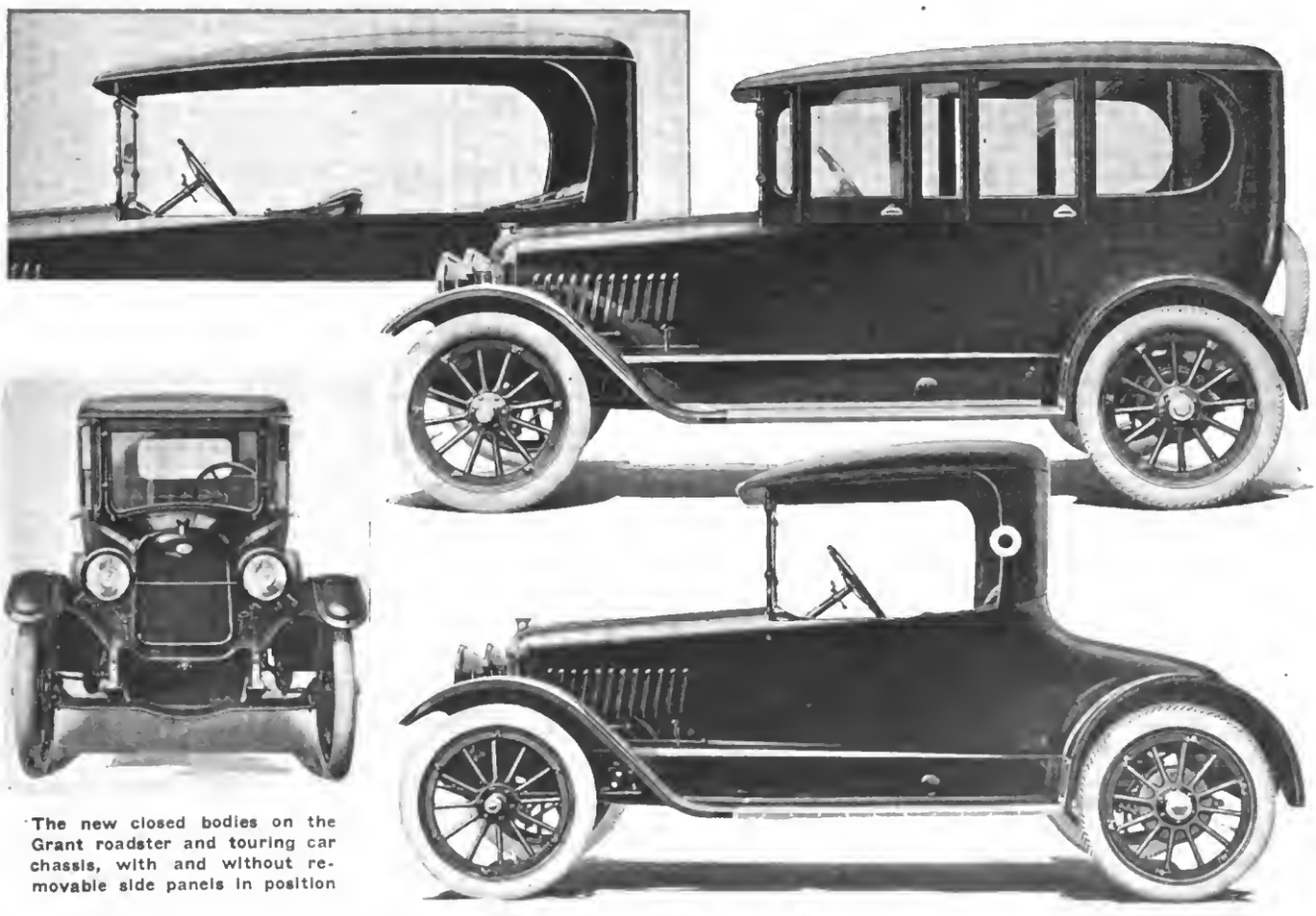


Each car has its own space in the Hudson garage and is blocked by concrete bumpers so that an aisle is kept open between the cars



A feature of the garage is the use of portable washing racks, there being one rack to each aisle

New Winter Bodies for Grant Chassis



The new closed bodies on the Grant roadster and touring car chassis, with and without removable side panels in position

The FORUM

Air Cooling and Two Cycles to Solve Troubles

By Charles E. Duryea
Consulting Engineer

THE AUTOMOBILE for Oct. 12 contains two articles that should be read together understandingly, and that this may be done I venture to call attention to them. Mr. Manning shows us that present day gasolines contain liquids having boiling temperatures of 175 to 210 deg., and Mr. Kline tells very properly of lubrication troubles traced to kerosene from the fuel diluting the oil in the crankcase and thinning it so it failed to lubricate.

Having recently been the victim of ruined bearings undoubtedly due to some such cause I feel strongly on this subject. One engine was run for many months with a rather small radiator, and aside from getting rather hot, gave no lubrication troubles. Duplicates of this engine were fitted with larger radiators and kept cool. "Impossible to make them boil" and similar remarks were heard concerning them. But bearing troubles followed. Not once, but more than once on the same job, and after great care had been taken to know that the oiling pump was working properly and that the oil line to the bearings was clean and open.

Cooling Too Efficient

It may seem like a far cry to blame the large and efficient radiator for the burned out bearings, but experience forced me to believe that there was a connection and that our fuel was being cooled too much after entering the cylinders. The temperatures mentioned by Mr. Manning show conclusively that my belief was correct.

Very few water-cooled engines run with their walls above 175 deg. unless controlled by thermostat. While on short, hard pulls they commonly exceed this temperature, they may run for miles at a time with much of their wall surface considerably below this temperature. Every particle of liquid that has a higher boiling point and strikes such a cool wall will remain liquid and work down to the lubricating oil unless the heat of the combustion for an instant may raise the temperature beyond the boiling point and partly vaporize it. Anyone who has noticed that a paper tag pasted on the bottom of a kettle or frying pan will remain there during many a dinner cooking can readily understand how unlikely it is that any instantaneous application of heat will vaporize such fuel so long as the wall is below the boiling temperature.

Many suppose that compression heats the new charge and vaporizes it. This is true if the liquid continues to float in the mixture, but any drops that are on the walls, or any vapor in contact with the cool walls, remains cool in spite of the compression and, since the temperature does not raise the compression, opposes vaporization, and tends to increase the liquid deposit on the walls.

Suggested Remedies

These are the conditions. What is the remedy? The first easy, proper one is to use hotter engines. Keep the walls so hot that no liquid fuel can remain on them. A thermostat that holds the water temperature well to the boiling point will catch the lower boiling point fuels, but it will not serve for the ones that have boiling points as high as 210. Who knows but that there may be even higher boiling points in use? A second remedy is to pass all the fuel through the crankcase as in two-cycle practice. This may sound foolish, but let the man who thinks so tell us the objections.

The maker who knows that kerosene will enter his crankcase in definite quantities can provide for lubrication accordingly. It is the engine which is not designed for such a mixture that suffers. It is the uncertain and indefinite mixture of kerosene with the oil that upsets the oiling system.

By mixing a high fire test oil with the fuel and feeding the mixture through the carbureter into the crankcase, we do away with mechanical means for lubricating the engine and its crankcase parts. We substitute fresh oil for the ever more diluted mixture that causes the trouble. We get a known and satisfactory oiling mixture instead of beginning with oil and ending with mostly kerosene and an unknown proportion of the original, but now old and dirty oil. Surely this is an advantage. This remedy assumes that the engine is so constructed as to pass along any oil more than the proper level, as most engines do. Anyone who has over filled his crankcase and seen excess smoke in consequence understands this. Any kerosene splashed on the piston head inside will be vaporized and pass along with the mixture as it is drawn from the case to the cylinders. The oil is less likely to vaporize and so tends to remain.

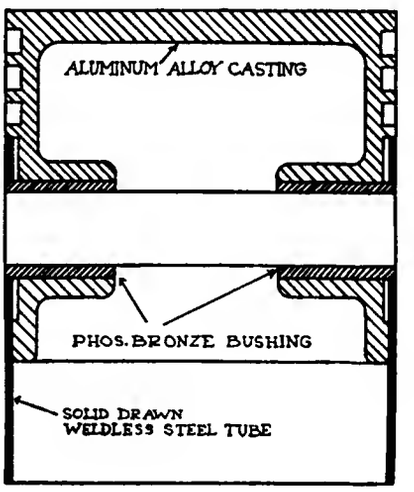
Air-Cooled Two-Cycle Engines

To step further in the answer to this problem I suggest air cooling, so that the cylinder walls may without question be hotter than the fuel boiling point, and two-cycles, which, if air cooled, have crankcases quite warm and tend to properly vaporize the mixture while in the crankcase. Both these things are in the line of simplicity and economy and will come as soon as the public learns enough about the automobile to decide for itself instead of buying what Jones buys or Smith sells.

Aluminum-Steel Piston

By W. H. Bishop

WITH reference to the recent article in THE AUTOMOBILE by A. Ludlow Clayden, on Aluminum Pistons, I beg to inclose print and outline specification of my composite aluminum and steel piston and trust same will be of interest to you, as it appears to entirely provide the type of piston which your article calls for to overcome the drawbacks and disadvantages of the present type aluminum piston.



With my design you will note the following points:

1—Simplicity.

2—Small cost of manufacture over and above the ordinary type piston.

3—Saving in weight of aluminum.

4—The amount of aluminum exposed to cylinder wall is only approximately one-

tenth of the total length of the piston; the outer wall of piston consisting practically of the steel liner and piston rings.

The piston consists primarily of two parts—a cast aluminum alloy head with extension which extends to just below the wrist-pin bosses. Fitting around the aluminum casting is a steel tube, the lower extremity of which extends well below the skirt of the casting and the upper portion is carried up to the first piston ring. The steel tube has two holes to take the extreme ends of the wrist pin, and the steel tube is located and held in position by the pin.

It will be noticed that the amount of aluminum alloy exposed to the cylinder wall is only approximately one-tenth of the total length of the piston, the outer wall of the piston consisting practically of the steel liner and piston rings, thus insuring, with the combination of the steel liner and the rings, a perfect gas-tight piston.

With regard to weight of this piston compared with ordinary cast-iron pistons, a good saving in weight is effected. For example, a typical cast-iron piston of 4-in. bore weighs approximately 4 lb. as against an approximate weight of 2 lb. with an aluminum alloy piston with steel liner. As regards cost of production, these pistons can be produced on an economical basis as a minimum amount of aluminum alloy is required owing to the short length of piston skirt, by making the liner from solid drawn weldless steel tube cut to length and machined to required limits.

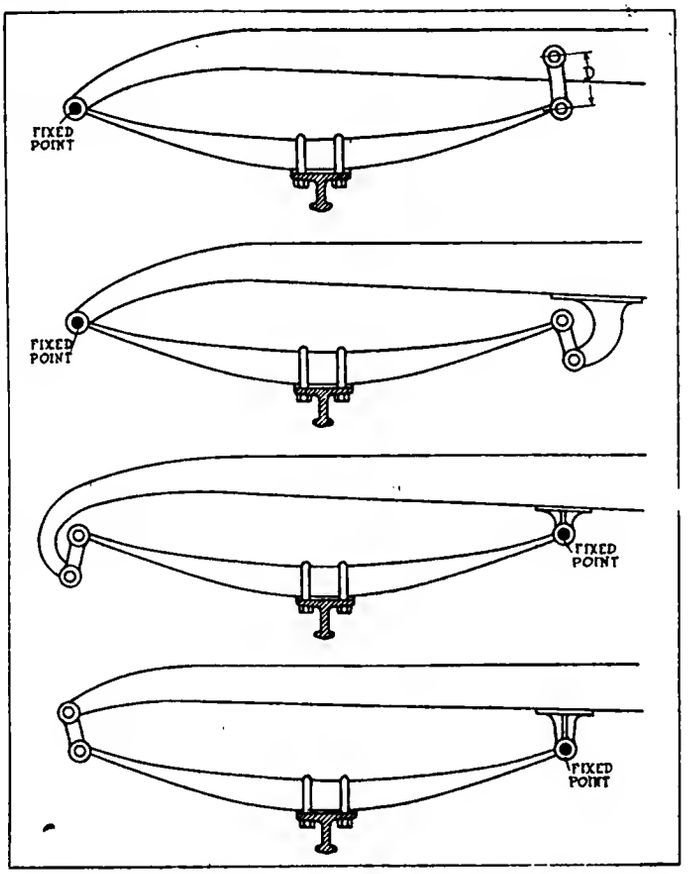
Spring Attachment as Shackle-Bolt Rattle Eliminators

By G. E. Wendle
Williamsport Electric Co.

I HAVE been much interested in your recent articles on spring designs as applied to pleasure cars, and in order to extend the field, I am taking the liberty of requesting you to open wide the columns of your magazine to persons with spring attachment experience.

As an automobile enthusiast, I find one of the greatest annoyances in and about cars to be the rattles and noises, due, in many cases, to shackle bolts. Various manufacturers have made modifications in application of the shackle links, push or pull, various changes in the center-to-center distance of shackle bolts and in using oil lubrication instead of grease. All these changes have been tried over and over again by the makers, and still the rattles and noises continue.

Would this not be a subject of wide interest to automobilists? The trouble is common to all and if your columns were opened to reports of improved methods, etc., would it not likely result in placing the matter of spring attachment on a better engineering basis.



Forms of spring attachments to frame and front axle, showing usual designs of shackling. The length of shackle links D varies widely in different designs, once the angularity of shackle links varies similarly

Wants Other Views

The sketches on this page show the front axle layout. Of course, the rear axle comes with the question.

The method of lubrication and shackle bolt design both vary widely. What are the advantages and disadvantages of the various methods of attachment, lengths of shackle links, grease or oil lubrication, etc.—as shown by operating experience with pleasure cars? What kind of bushing—bronze, graphite-filled bronze, impregnated wood, or other material has proved most satisfactory?

If this article attracts the attention of some of our engineers I shall greatly appreciate reading their views.

Owen-Magnetic in Coupé Form

THE Owen-Magnetic coupé, claimed to be especially suited to women drivers, is now on exhibition in the company's salesroom at Broadway and Fifty-seventh Street, New York City.

The new car was especially designed for women drivers, and more particularly for those who are afraid to drive in the congested thoroughfares. The new coupé is designed for three passengers but an extra seat for a fourth person is provided which folds out of sight when not in use.

The car has a wheelbase of 125 in. and there is ample room under the rear deck.

New Owen-Magnetic coupé especially suitable for the use of women drivers

The Rostrum

Reader's Idea for Sporting Phaeton

INDIVIDUAL and exclusive design has at last come into its own. The automobile enthusiast of to-day is not compelled to pay a very high price for a car modeled after his own design. The chassis can be purchased from any manufacturer and in the case of the lower-priced cars selling around $1,000 or more, an additional expenditure of $1,000 for a body and its accessories will give the owner a car suited to his own ideas and uses, and above all a car which he knows is his own individual creation. In large cities hundreds of these special jobs may be seen, every one having an air of luxury and style about them that compels immediate attention. The higher priced the chassis, the more luxurious the body and since a few thousand dollars is a good price to pay for a car nowadays the purchaser of a car of this price is entitled to an expression of his own ideas, if he has any.

Predicts Long Wheelbases

The writer has endeavored to show by the accompanying illustration the possibilities of uncommon design in the open types. The reader will at first glance call it a freak. With a little more study he will find that it is original, luxurious and a sport car, without any sport disadvantages. The design here shown embodies one idea that has never been expressed on a stock model nor on very few special jobs. There are other points of design that are uncommon, and will be explained in order. The writer predicts cars of very long wheelbases as the road conditions of the country improve. The wheelbase of the car shown in the illustration is approximately 155 in. The reason for this being the position of the radiator, the roomy body both in the driver's compartment and the tonneau, and the position of the rear seat which is slightly forward of the rear axle. However, it will be noticed that by placing the radiator over the front axle and shortening the space in the cowl and reducing the space between the rear wheels and the doors that the wheelbase will be considerably reduced. The chassis is hung very low yet with the usual road clearance. Long flat springs are used, the rear ones being almost horizontal with the frame and are of the heavy underslung cantilever type. The writer is convinced that springs of this type will offset any disadvantages as to the riding qualities of the car by placing the rear seat in front of the axle. The frame and rear springs are so built as to keep the chassis at all times horizontal with the road. There is nothing more unsightly than the back part of a motor car several inches higher than the front part, a feature which gives the car the appearance of running down hill all the time.

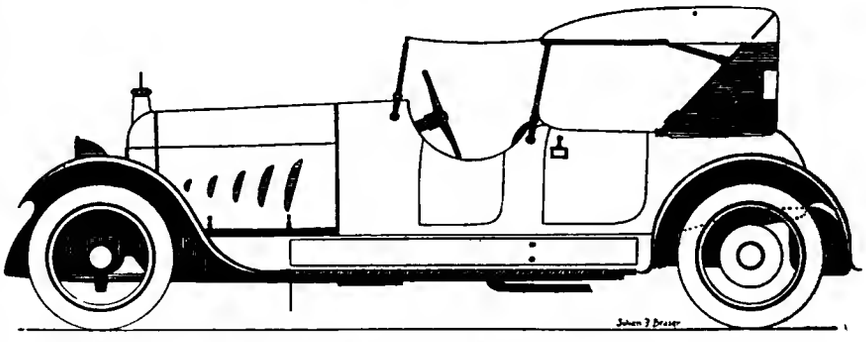
Radiator the Starting Point

The radiator is of the large, rounded type with a large water cap, and mounted several inches back of the front axle. This is the starting point, in designing the rest of the car. In order to get fast, racy lines, the body must have the appearance of flowing away from the radiator, bonnet and cowl. The bonnet and cowl rise gradually in a straight line to the slanted windshield. Note that the steering column, which is pitched quite low, is mounted close to the cowl within easy reach of its instruments. Note the curve of the cowl. This gives a sporty appearance to the body as well as facilitating the driver in the handling of the car. Note the double cowl and its windshield, a feature found on very few cars. It is collapsible, folding backward out of sight into the back of the front seat, a light wooden roll curtain raised from the floor and locked on to the top of the cowl hides it completely from sight as well as offering protection from breakage. Note the large door in the tonneau, its size in proportion to the fore door, and that the sides of the tonneau are quite high yet not topheavy. The upholstering is of the heavy armchair kind, barely showing above the top of the body, the thick cushions resting flat on the floor of the body. Note the bulbous back and the manner in which it is pitched forward, giving the body the fast, sporty lines of a phaeton. Note the shape of the top, which covers only the after part of the car. Its design is superior to the Victoria type since it permits a better view when raised. In order to protect the occupants of the front seat in rainy weather a curtain pulls out from the top and is fastened to the front windshield. It is also rigid enough to support side curtains if they are desired. Note that the fore doors are much smaller than the rear ones and that the handles are left exposed to break the smooth sides. There are no moldings around the doors, they fit flush with the sides of the body. Note the shape of the louvres in the hood.

Six-Cylinder Engine

The engine is of the six-cylinder type with worm drive having its own starting and lighting system as well as tire pump. Wire wheels with 35 by 4-in. tires are used. The gas and oil are carried in a tank in the rear, the tools and batteries between the frame, and running boards. The spare tires can be carried in the rear against the bulbous back or on the running boards and fenders. Note the shape of the one-piece oval fenders; they as well as the hood and body are made of aluminum, the best material for automobile body work. The radiator and other metal trimmings are of brass, highly polished. The color is preferably a light one.

The body and hood embody the streamline idea from bumper to tail light and the writer is convinced from what he



Suggested design for a sporting phaeton evolved by Julian F. Brasor, Chicago, Ill.

has actually seen in body construction that this design could be executed by any good body builder. It must be remembered that the secret of handsome design is entirely in the chassis. If the chassis has not been designed with the appearance of the body in mind, the whole will be a hopeless failure and a waste of time, money and energy.

Chicago, Ill. JULIAN F. BRASOR.

Best Temperature 170 to 180 Deg.

Editor THE AUTOMOBILE:—I have a 30-hp. Chalmers car. Kindly advise me as to what temperature the water in the radiator must be kept in order to get the best results from the engine, and how the temperature of the water may be found.

2—Which is the best water to use, soft or hard water, or is there no difference?

Rockford, Ill. L. C. W.

—The best temperature of the water is probably about 170 to 180 deg. If you fit a Boyce Moto-Meter on the radiator cap this will show you when the temperature is right without the necessity for reading it in degrees.

2—Soft water is much to be preferred to hard because it does not make any deposit in the radiator or cylinder jackets.

Information on Horsepower Taxes

Editor THE AUTOMOBILE:—Kindly give facts concerning the horsepower tax on automobiles.

Has anything been done to bring about the adoption of some horsepower rating based upon piston displacement? Such a method of rating, it seems to me, would be somewhat reasonable, but the idea of rating a 3¾ by 4 in. engine the same as a 3¾ by 6¾ engine is absolutely absurd.

If all engines ran at the same piston speed, which is not the case and never will be, then the old formula $\frac{B^2}{2.5} \times N = \text{Hp.}$ would mean something. According to this formula the two sizes of engines mentioned would each rate at 22½ hp. for four cylinders. One has a piston displacement of 177 cu. in. and the other 298 cu. in. With equally good design these two engines could not possibly develop the same power, so why give them the same horsepower rating and why tax them the same?

I think this subject should be of considerable interest to the readers of THE AUTOMOBILE and I hope that someone on your staff will give us some information on it.

Detroit, Mich. R. E. C.

—You will find the subject of rating and horsepower formulas discussed in an article on pages 700 to 704 in this issue. Rating by the standard formula is, of course, absurd but there are some objections to rating by piston displacement and the $\frac{D^2N}{2.5}$ formula was really quite good when it was first taken into use.

The horsepower tax on automobiles varies in different States. Practically all the States using this basis of taxation make their ratings by the formula $\frac{D^2N}{2.5}$ but the amount of the license fee or tax is determined in different ways. In some States the scheme used is to have a fixed fee for cars up to certain horsepowers. For example: In New York it is $5 for cars up to 25 hp., $10 for cars from 25 to 35 hp., etc. In other States there is a fixed fee for horsepower. It is 50 cents in California. The other States, as a rule, have a set tax without regard to horsepower.

Raw Linseed Oil as Tar Remover

Editor THE AUTOMOBILE:—Your answer to the inquiry of A. E. J., Westmount, Que., Canada, in THE AUTOMOBILE for Oct. 5, regarding removing tar from a car body prompts me to state that I believe you will find that raw linseed oil will serve the purpose best wherever tar or road oils have been splattered upon the body of the automobile or other finished surface. It is a fact that linseed oil will readily dissolve tar and this residue can be easily washed from the surface of the body without harming the latter, by the use of soap and water.

Philadelphia, Pa. H. A. M.

All-Weather Bodies for Allen

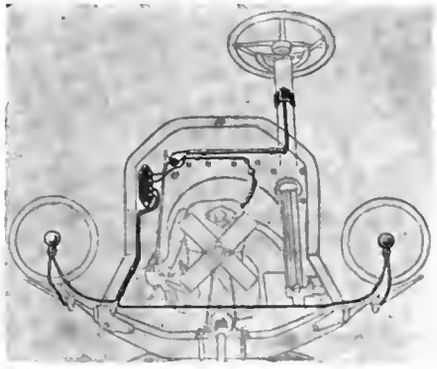
Inside view of Allen coupé. Note roomineas for passengers in front seat. The driver's seat is located slightly in advance of the other, so that there will be ample space for manipulation of the control levers. The price is $1,075

Allen roadster and touring car with all-weather bodies. These bodies are convertible, the sedan being of the type in which the roof is permanent and the windows and door fillers can be removed to a compartment, back of the rear seat. Price, $1,095

ACCESSORIES

Constolite for Fords

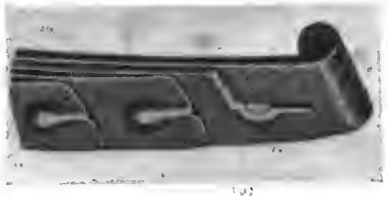
THIS device is a combination of coils which automatically regulates the light from the headlamps, increases the brilliancy of the light at low speeds and provides for dimming. It also will keep one headlight burning if the other bulb is broken. The device is wired from the magneto and is controlled by a switch on the steering column. The coils are stated by the manufacturer to be so perfectly balanced that the operation of the magneto is not affected in any way. The unit is attached to the right side of the dash under the hood beside the terminal end of the lighting switch. When the headlights are in multiple a light of two to five times as much power as with the standard arrangement is claimed, and at 20 m.p.h. or more the light is constant. No additional wiring is necessary and connections can be made from the instructions furnished with each equipment. The device is waterproof and no adjustment is needed. It sells for $4.85.—Detroit Starter Co., Detroit, Mich.



Laycut of Constolite headlight regulator

Stanley Self-Lubricating Spring

The main features of these springs are oil pockets provided in the ends of every leaf so that the springs may be lubricated with an ordinary oilcan. The pockets are fitted with felt pads which retain the oil, so that it is only necessary to supply lubricant two or three times a year. The action of the spring sufficiently distributes the oil throughout the surfaces. Price, Ford, $4.50 up; Hudson, $5 up; Cadillac, $9.50 up; Packard, $9.50 up; other makes in proportion. —Fulton Sales Co., 910 Michigan Avenue, Chicago.



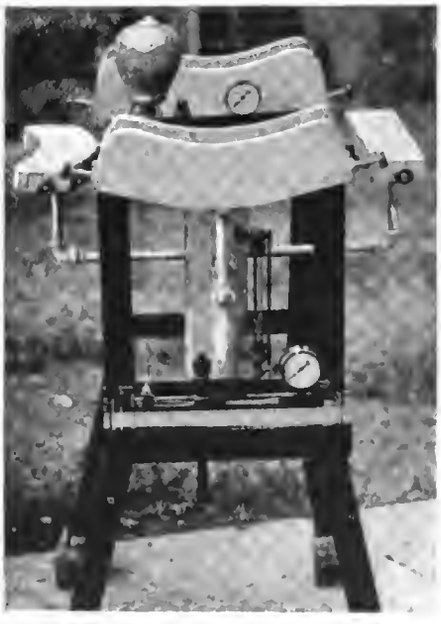
Stanley self-lubricating spring

Tracford Tractor Attachment

With this device any Ford may be converted into a tractor in 2 hr. It consists of a rectangular sub-frame which bolts onto the rear of the Ford frame, and which carries two heavy steel wheels driven by roller tooth gears on the axle ends, meshing with internal gears on the wheels.

The ratio is 9 to 1, which gives a total reduction of 32.6 to 1. The machine is designed to operate on high gear exclusively, and since the reduction is 9 to 1, the speed of the motor at 2 m.p.h. is equivalent to that of a Ford car running 18 m.p.h. The drawbar pull is, normally, about 1200 lb., and if low gear is used, but only in an emergency, the pull may be anywhere up to 2000 lb. The cooling efficiency is increased by adding a pump.

In attaching the Tracford it is necessary to drill only two holes, one in each side member of the frame. The machine is designed for all sorts of farm work, including drawing spring-tooth harrows, rollers, mowing machines, binders, corn harvesters, potato diggers, and plows. Price, $125.—Standard Detroit Tractor Co., 1506 Fort Street, West, Detroit, Mich.



Anderson steam vulcanizer

Anderson Steam Vulcanizer

This gasoline-operated steam vulcanizer for repairing tubes and casings is equipped with a large sectional mold which will take care of a 16-in. section in 4-in., 4½-in. and 5-in. tires, and a small sectional mold for sections to 15 in. in 3-in., 3½-in. and 4-in. tires. The tube plate has a capacity of four tubes, and seven tubes can be treated at one time when the section molds are not in use. The normal capacity is three casings and four tubes. Price, $125, including set of tools.—Anderson Steam Vulcanizer Co., Worthington, Ind.

Premo Transmission Flanges

A flange for the Ford transmission designed to facilitate the removal and replacement of the cover. It is fitted to the crankcase under the transmission and is tapped to receive the retaining bolts, which are screwed into it instead of into nuts. The retaining bolts are put in from the top and may be tightened up making an even pressure the whole length of the gasket. The advantage of the flange is that it is not required to hold the nuts from below. Price, 75 cents per set.—New York Motor Car Devices Co., Eleventh Avenue, New York City.

Kennedy Signal

In this accessory, two signals, one on each of the rear fenders, electrically controlled from the driver's seat, indicate either by night or day the intentions of the driver. Each signal is controlled independently and turns in the direction you intend to go, showing two red lights, an arrow and the word "Turn," and remains a signal until the turn is completed. A pilot light, attached to the switch, shows that the signal is in working order. Price, $12, complete with wiring and

Tracford for converting Ford car into a tractor

Premo transmission cover flange for Fords

Kennedy automobile signal

Goodrich switch lock. By its use the switch is locked when the motor is shut off

switches.—Nu-Way Tire and Rubber Co., 1004 South Michigan Avenue, Chicago, Ill.

Goodrich Lock Switch

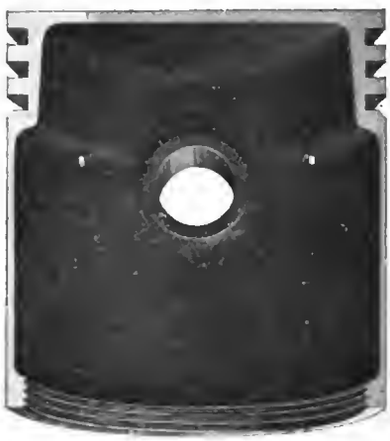
A switch for Ford cars operated by a Yale lock. The device takes the place of the regular ignition switch, and may be attached in little time, as its screws fit the screw holes already in the coil box. The switch cannot be removed when locked, as metal shutters cover the screw heads. Throwing off the current to stop the motor locks the switch, thus removing the possibility of forgetting to lock it. Two keys come with each switch. Price, $3.25.—Goodrich Accessory Assn., 809 Widener Bldg., Philadelphia, Pa.

Mecco Creeper

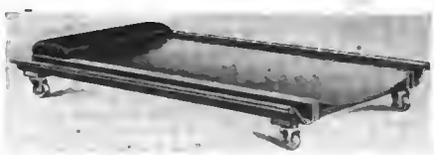
The Mecco creeper is 20 in. wide, 36 in. long, with a smooth steel curved body and padded head rest. There are pockets at the sides for holding tools and small parts. Weight, 15 lb. Price, $2.—Moeschl-Edwards Corr. Co., Inc., Covington, Ky.

Thiefoil Ignition Lock

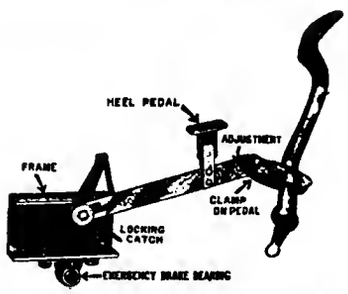
A combination ignition lock that is applied to the face of the standard Ford switch without making any changes in the wiring arrangement. Three buttons project from the top of the lock and each must be pressed the correct number of times to complete the circuit. Pressure on one of the buttons throws the switch off. Each of the buttons operates a notched disk that must be rotated until the notches come in line. A trip-pin



Semi-steel piston. Note the thin walls and drilled holes for the return of excess oil to the crankcase



Mecco creeper for use under car



N. Y. clutch control for Fords

then falls into the groove and the lock mechanism is released. More than 1000 working combinations are possible and the entire installation may be made by the purchaser. Price, $3.50, complete with hose and connection.—Caskey-Durpee Mfg. Co., Marietta, Ohio.

N. Y. Clutch Control

This device permits the clutch of the Ford to be locked in the neutral position. A pedal operated member connects the clutch pedal to a hanger bolted to the frame just above the emergency brake bearing. A spring holds the locking catch from acting until pressure is placed on the locking pedal, the device having no effect on the operation of the clutch pedal in changing from low to high. The installation requires no machine work and may be done by the owner. Price, $3.—New York Coil Co., 338 Pearl Street, New York City.

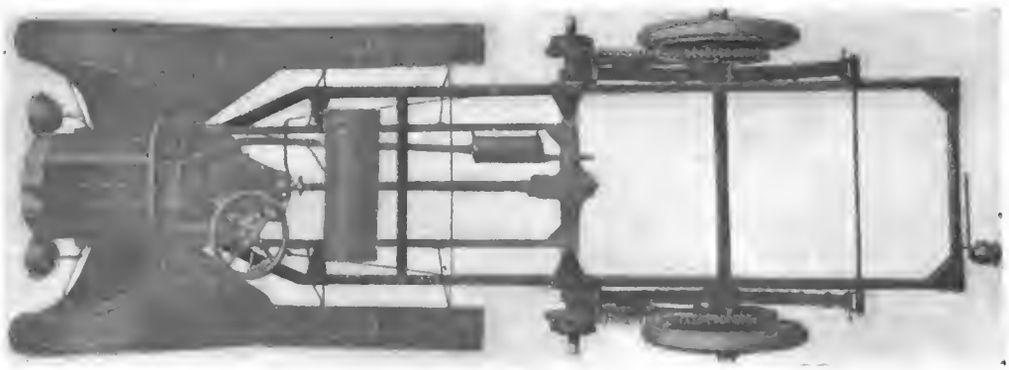
Semi-Steel Pistons

These light semi-steel pistons are made for any car. They are cast from metal patterns and because of the thin wall are extremely light, though strong. The weight of the piston for Buick cars is 1 lb., 11 oz. Cylinders are rebored by this company, fitted with new pistons, rings, wristpins and bushings; shipment made in 24 hr. after receipt of cylinders. Price, $2.80 each, for Buicks, all other cars in proportion.—Allen & Curtiss Co., 415 S. Main Street, Mishawaka, Ind.

Truckford Attachment

Converts a Ford into a 1-ton truck, leaving the chassis intact. The Ford rear axle becomes the jackshaft and carries the sprockets for the chain drive, the attachment bolting on over the frame. The lengthened frame gives a loading space of 8½ to 11½ ft. back of the driver's seat, making the wheelbase 128 in. Solid rubber tires are used on the rear and carry almost the entire load. The Truckford may be attached by two men in a short time, and may as readily be removed and the original body replaced. Price, $350.—Robinson Machine Co., Detroit, Mich.

Thiefoil ignition lock



Truckford attachment for converting Ford car into a 1-ton truck

Kerosene Is Choice of Independent Oil Men

(*Continued from page* 683)

Dr. Lucke discussed this subject very fully in a lengthy paper on kerosene devices which he read at the June meeting of the Society of Automobile Engineers this year. On that occasion he stated very positively that the problem of successfully burning kerosene in an ordinary automobile engine had been solved.

Starts on Kerosene

The Good vaporizer uses a heating device which consists of a very long venturi contained within the exhaust header. This venturi is made as long as the design of the header permits, and mixture is fed to this venturi by an ordinary carbureter. This naturally delivers a very wet and unsatisfactory sort of gas, but this is changed to a warm dry mixture at the far end of the vaporizing tube, whence it is taken directly to the intake header. In the section shown in Fig. 1, it will be noticed that the intake manifold is arranged directly beneath the exhaust, so that the gas does not have to pass around the cylinders in order to get to the intake valves. Dr. Lucke states that this assembly permits precisely the same delicacy of throttle control and as good idling as can be had with gasoline. An essential feature is the placing of the throttle between the spray nozzle of the carbureter and the vaporizing venturi. The effect of the throttle is to disturb the nature of the gas and of the heated venturi to remove the effects of such disturbance. One of the main virtues of the Good instrument is the great length of the venturi, because this permits a very high velocity in the front, while it does not cause the great drop of pressure and therefore limit the possibility of cylinder filling.

The most interesting feature of the Good system is that it permits an engine to be started up exactly as though it were operating on gasoline. Passing through the intake manifold from end to end is a small tube of thin steel. At the end of this is a burner fed with kerosene sprayed by a small electric blower and ignited by a series of sparks which can be provided either by a magneto or by a battery fitting. Dr. Lucke says that this vaporizing tube will attain a red heat in 15 sec. and when in this condition it will vaporize any mixture reaching the intake manifold to a sufficient extent to enable the engine to be started and to permit it to fire regularly until the main venturi heats up.

The burner operates so quickly that the whole engine and the burner can be started simultaneously. If the engine is cranked with the ordinary self-starter and the blower is in operation simultaneously, the time taken to start is, according to Dr. Lucke, the same as that required for starting with heavy gasoline in cold weather. It is best, however, to arrange to control the blower independently so that it can be started by pressing a button a few seconds before the main engine is cranked. By this means the deposition of kerosene in the intake manifold or in the cylinders is prevented. Dr. Lucke says that with this device there is no smoke and little carbon accumulation and that the operator would never know that he was using kerosene except that in cold weather he would have *less* starting trouble than he now experiences with gasoline.

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September Gasoline Exports Increase 83 per Cent

WASHINGTON, D. C., Oct. 23—Exports of gasoline during September totalled 37,857,477 gal., an increase of 17,230,058, or 83 per cent, as compared with 20,627,419 gal. shipped abroad in September, 1915. Exports of gasoline for the 9 months ending September were 274,816,625 gal., an increase of 67,757,366 gal. over the corresponding period of 1915.

Lubricating oil totalling 23,690,556 gal. was exported in September, an increase of 5,197,105 gal. over September, 1915. Shipments for the 9-months' period were 204,513,350 gal., a gain over the same period in 1915 of 21,737,145 gal.

Illuminating oil exports were 89,189,368 gal. in September as against 68,381,361 gal. in September, 1915, and for the 9 months ending September 637,830,762 gal., compared with 643,964,310 in the same period of 1915.

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Packard-Missouri Managed by Loomis

DETROIT, MICH., Oct. 23—G. S. Loomis, formerly in charge of the Packard interests at Louisville, Ky., is now the general manager of the Packard-Missouri Motor Co., St. Louis. H. W. Spaulding who formerly held this position has been made vice-president in charge of sales.

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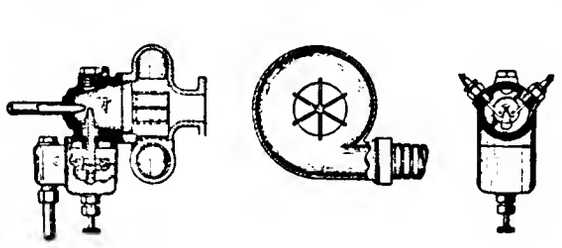
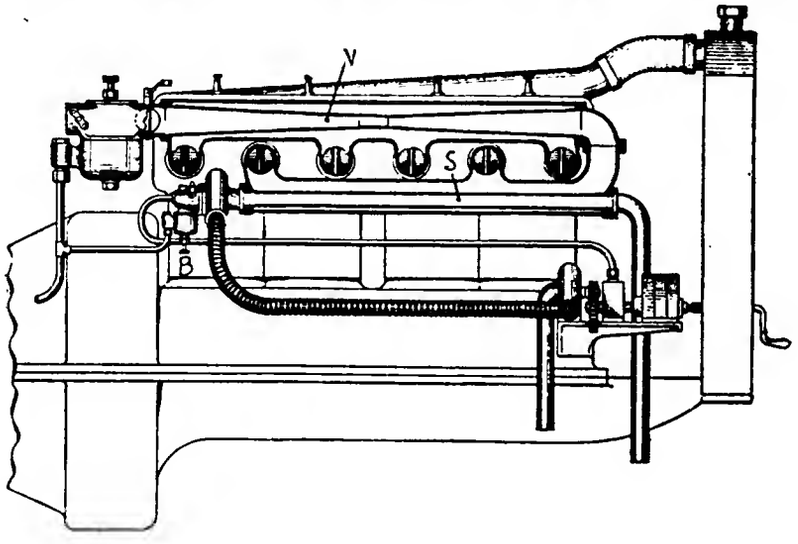
Ward Leonard Patent Licensees

BRONXVILLE, N. Y., Oct. 25—One of the largest patent licensing transactions was concluded to-day when the estate of the late H. Ward Leonard, originator of the Ward Leonard Electric Co. of this place, granted a non-exclusive license under all of Ward Leonard's electrical patents to the General Electric, Westinghouse, and Cutler-Hammer companies. The consideration is perhaps the largest that has ever been paid in a patent license arrangement. In all, upward of seventy-five Ward Leonard patents are concerned in the deal. A feature of the deal is that all three companies agree to recognize the work of Ward Leonard by having the system in their product known as the Ward Leonard system. The field covers such electrical controls as used for mine hoists, turret training, rheostats, circuit breakers, rolling mills. and everything excepting controls for automobile lighting and gearboxes.





Arrangement of the Good kerosene vaporizing system, showing the long venturi V in the exhaust header. Starting is accomplished on kerosene by means of the electrical lights burner B, which heats the tube S in the inlet manifold. The detail sketches show the construction of the burner

Industrial Miscellany

Factory

Goodyear Tire & Rubber Co., Akron, Ohio, has posted notices in its plant informing all workmen that beginning Nov. 1 the regular 8-hr. workday schedule will be effective. For nearly 2 years the firm has been gradually working toward that goal. Some of the departments have been on an 8-hr. schedule for some time.

Good-Wear Rubber Co., maker of tires and other rubber goods, will operate a plant in Elyria, Ohio, at the Topliff & Ely plant. Within 4 months, the company expects to be turning out from 160 to 200 tires per day. About 100 men will be employed at the start. Jacob Murbach of the Elyria Milling Co. will be vice-president and W. E. Brooks, president of the Elyria Telephone Co., will be treasurer of the company.

Western Malleables Co., Beaver Dam, Wis., maker of automobile castings, is improving its works. The Elm Street plant is being enlarged by a brick and steel addition, 26 by 90 ft., and a new and larger core room and sand shed. An air compressor room is being erected at the South Street plant.

Aluminum Castings Co., Cleveland, Ohio, has started work on a large plant development to be devoted to the Lynite pistons. The company has purchased 18½ acres at East Forty-ninth Street and the Newburg & South Shore Railroad. The price was about $75,000. The first factory building to be build is to cost $125,000. It is to be 900 ft. long. The company expects to occupy it by December. Other buildings will be erected as needed.

Canadian National Carbon Co. will build a factory at Toronto, Ont.

Ontario Steel Products, Ltd., Brockville, Ont., is making extensive additions to its plants at Brockville, Ont., and Chatham, Ont. The company recently signed up contracts with three automobile companies for springs which will cover production for nearly 3 years.

Perfection Motor & Tire Co., Madison, Wis., will erect a plant in Niagara Falls, Ont., to cost $35,000.

Maple Leaf Tires, Ltd., Belleville, Ont., has secured a factory site there of 22 acres and building operations will be commenced at once. The main building will be nearly 300 ft. long and will be of concrete and steel construction, and will cost approximately $100,000.

Maxwell Motor Car Co. will commence work at Windsor, Ont., shortly on the erection of a plant to cost $60,000. A site was purchased some time ago.

Personals

E. M. Taber, truck sales manager for Russell P. Taber, Hartford, Conn., has been promoted to be manager of the wholesale department which covers Reo passenger and commercial vehicles. Under his new assignment he will have entire charge of the wholesaling of Reos in the territory covered by Taber, nearly all of the State. W. E. Walker succeeds E. M. Taber as manager of the truck department.

W. H. Wetherell, head of the Saxon department of Frank G. Robins, Inc., Hartford, Conn., and formerly a member of the firm of Kingsbury & Wetherell, has joined the Saxon factory forces as a district representative.

F. A. Wright, St. Louis, has been appointed sales manager for the Weber Motor Car Co., Studebaker distributor, that city.

C. Snyder has become general works manager of the Parker Rust Proof Co. of America, Detroit, manufacturer of rustproof liquid for motor vehicles. He was formerly superintendent of manufacture for the Chalmers Motor Co.

W. Leahy, of Albany, N. Y., has disposed of his holdings in the Kingsbury-Leahy Co., designer and builder of automobile bodies, to devote his attention to other business interests.

J. L. Wierengo has been appointed general manager of the Detroit Truck Co., Detroit, maker of the Tonford truck. Mr. Wierengo was formerly the advertising manager and sales manager for the Continental Motors Co.

W. E. Kenyon has resigned as general sales manager of the Sandow Motor Truck Co., Chicago, his resignation to take effect Nov. 15. His future connections will be announced later.

S. E. Straight will be in charge as branch manager of the Savage Tire Corp. factory branch in Detroit.

H. K. Reinoehl has resigned from the Sayers & Scovill Co., Cincinnati, maker of motor-driven funeral cars. He has joined the A. Howard Co., Galion, Ohio, as chief engineer.

J. E. Dockendorff & Co., 20 Broad Street, New York City, has been appointed general export agent by the Central Steel Co., Massillon, Ohio.

Mason Motor Car Co., New York City, has taken on the Monroe car in connection with the Ross Eight.

Adams-Bagnall Electric Co.'s New York office is now located in the Engineering Building, 114 Liberty Street, under the management of F. C. Perkins, Eastern representative.

H. W. Johns-Manville Co. has opened a branch office at Great Falls, Mont., on the fourth floor of the Ford Building, in charge of J. H. Roe. With the opening of the Great Falls office the Johns-Manville Co. increases its number of branches to fifty-five.

The Automobile Calendar

ASSOCIATIONS

Oct. 25-26—Columbus, Ohio, Automobile Trade Assn., second annual meeting, Virginia Hotel.
Oct. 26—Philadelphia, Pa., Section meeting of Society of Automobile Engineers. Paper by Herbert Chase.
Dec. 2-9—Electricians' Country-wide Celebration.
Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.
Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.

CONTESTS

Oct. 28 — New York Speedway Race, championship.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.
Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race. Arizona State Fair.
Nov. 30—Uniontown, Pa., Speedway Race.
Nov. 30—Los Angeles, Cal., Ascot Speedway 200-mile Championship Race.

1917

April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 14 — Des Moines, Iowa, Speedway Race, Championship.
July 28—Tacoma, Wash., Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15 — Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race, Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13—Chicago Speedway Race.
Oct. 27 — New York Speedway Race.

SHOWS

Nov. 10-18—Providence, R. I., Show, Rhode Island Automobile Dealers' Assn.
Nov. 20-25—Worcester, Mass., Show, Worcester Casino; Worcester Automobile Dealers' Assn.
Dec. 2-9 — Springfield, Mass., Show, Auditorium. H. W. Stacey, Mgr.
Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 6-13 — New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 9-10 — Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.
Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.
Jan. 27-Feb. 3, 1917 — Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.
Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.
Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.
March 6-10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 14-17 — Davenport, Ia., Show, Coliseum Bldg., Tri-City Automobile Trade Assn.

L. B. Miller, St. Louis, has resigned as manager of the St. Louis branch of the U. S. Tire Co., to become general sales manager for the Inland Machine works, makers of the Inland piston rings. Mr. Miller had been with the U. S. Tire Co., since March 1, 1913 and manager in St. Louis since Dec. 1, 1915.

A. E. Schaefer has been appointed business manager of the Scripps-Booth Corp., Detroit. Mr. Schaefer was the business manager for the Sterling Motor Co., prior to its merger with Scripps-Booth.

Fred W. Chaffee has been made the manager for the George W. Franklin Co., Detroit. Mr. Chaffee was connected with the Dort.

H. S. Farish has been appointed assistant to the president and general manager and also purchasing agent of the Abbott Corp., Cleveland.

E. Guenther has been appointed manager of the accessory store of the Puritan Machine Co., Detroit. Mr. Guenther was formerly accessory salesman.

W. P. Kennard has been employed by the King Motor Car Co., Detroit, as a travelling sales representative—his territory at the present time is in the middle west.

M. C. Bias has been appointed purchasing agent of the Mitchell Motors Co., Racine, Wis., to fill the vacancy caused by the resignation of Guy W. Morgan, who has become president and general manager of the Abbott Corp., Cleveland, Ohio. Mr. Bias served as assistant purchasing agent under Mr. Morgan.

Henry Fink, Milwaukee, has been appointed sales manager of the Columbus branch office of the Sterling Motor Truck Co., Milwaukee, Wis.

A. G. Waddell has been appointed special representative of the Chevrolet Motor Co., on the Pacific Coast, with headquarters at the new Chevrolet factory at Oakland, Cal. He will have charge of the advertising of the states of California, Oregon, Washington, Idaho, Utah, Nevada, Arizona, New Mexico and the Islands of the Pacific.

Alvan T. Fuller of Boston, Mass., has extended his Packard agencies to New Bedford, where he has placed F. C. Graves in charge of a new branch just opened there.

J. T. Clinton has been sent from New York to Boston to take charge of the New England branch of the Firestone Tire & Rubber Co., succeeding T. J. Glenn, who has secured a long leave of absence due to illness.

J. B. Dub has been transferred from Atlanta, Ga., where he managed the Studebaker branch. to the branch at Worcester, Mass. The latter company has just leased new salesrooms and service station on Main Street.

J. R. Corby, St. Louis, has been appointed manager of factory branch in that city of Chicago Pneumatic Tool Co., makers of Little Giant truck.

Earl Freese, Indianapolis, Ind., has been appointed manager of the Logansport, Ind., branch of the Gibson Co., Overland distributors and accessory dealers. He will succeed E. C. Kurman who has been made manager of the Gibson company's Indianapolis branch.

F. E. A. Brock, St. Louis, Secretary of the Vesper-Buick Auto Co., has resigned that position to enter the candy trade in this city. He will be succeeded by E. R. Stewart, salesmanager, who will become assistant manager. Oscar Norris of the Maxwell Branch, Kansas City, succeeds Mr. Stewart. Mr. Brock had been with the Vesper-Buick Co., since Mr. Vesper came here as Buick distributor.

C. F. Barth has been made works manager of the C. R. Wilson Body Co., Detroit. During the past three years he has been factory and production manager of the Murphy Chair Co., Detroit.

G. D. Wilson has been made manager of production and sales of the C. R. Wilson Body Co. and will also have charge of the inspection department. For the past four years he has been production manager.

T. J. Turk, chief engineer of the Interstate Motor Co., Muncie, Ind., has been appointed assistant general manager of the company. He will also retain charge of the engineering department.

W. I. Ballentine, Indianapolis, Ind., formerly general superintendent of the Link Belt Co.'s Indianapolis works, has resigned to accept the position of works manager of the Chain Belt Co., Milwaukee.

Dealer

J. Edward Jones and V. R. Washburn, who have been connected with the sales department of the Ohio Auto Sales Co., Columbus, have formed a sales firm known as the Jones-Washburn Motor Co., to be located in Piqua, Ohio, to handle Dodge.

Lichtlie Automobile Co., Toledo Ohio, will open a branch in Lima at once. G. H. Hack will be manager. It will handle the Chandler and National.

Hudson-Phillips Motor Car Co., St. Louis, has opened a special truck department at their salesrooms, 3301 Locust Street, for Diamond T and Vim trucks.

Henry Hotze & Son, St. Louis, has taken the agency for The Pilot cars. George A. Frey is manager of the salesrooms opened at 2809 Locust St.

Federal Truck Co., St. Louis, has been selected as distributor for Troy trailers.

Henderson-Overland Co., Youngstown, Ohio, with a capital stock of $100,000, has been formed to take over the sale of Overland cars in North Eastern Ohio and Western Pennsylvania which was formerly conducted by James A. Henderson.

Chamberlain Automobile Co., agent for the Apperson and Velie cars at New Bedford and Fall River, Mass., has bought the S. Leyden garage at Fall River and placed W. T. Sandeman of Boston in charge of the agencies there.

Louis Jandorf is going out of the automobile body selling field. A sale was held Oct. 17 at the New York building.

Times Square Auto Supply Co., New York City, has opened a branch at 880 Nassau Street.

Bearing Service Co., Detroit, is establishing a branch in Kansas City, at 2205 Grand Avenue, and will open about Nov. 1.

Chevrolet Motor Co., Kansas City, Mo., will establish a wholesale and parts department in the Firestone building, retaining the present quarters at 1610 Grand Avenue for retail and service department.

Chalmers Motor Sales Co., Kansas City, Mo., will soon move from 1506-08 McGee Street to 2615-17 Walnut Street, where it will occupy the basement and first floor of the recently completed Shukert building.

O. E. Morehouse and S. C. White, Kansas City, Mo., formerly successful grocers, have formed the Pullman Motor Sales Co., to retail and distribute Pullmans in this territory. G. W. Compton, division sales manager of the Pullman company, will handle the distribution department.

Columbia Tire & Rubber Co., Seattle, Wash., has opened quarters at 905 East Pike Street, from which station Columbia tires will be distributed to Western Washington points.

Reinhard Bros. Co., Minneapolis, dealers in accessories, will have a new four-story building on Ninth Street near Hennepin Avenue. The building will be ready Feb. 1 and will cost $75,000.

Welling Motor Equipment Co., St. Louis, has been organized by Conrad A. Welling of the Monarch Auto Repair Co., to handle the Ford starter made by the Detroit Starter Co., and the Compensating Vapor Plug. The salesroom will be at 613 Chestnut Street.

Moreland Motor Truck Co., Los Angeles, will shortly begin the construction of an assembly plant in Seattle, which will be the Northwest distribution point for their product.

E. A. Allen is the manager of a new tire store in Seattle at Broadway and Pine Street, and will handle the Lancaster Wiregrip tires.

W. D. Sharp Co. has been organized in Seattle to handle the Cole line, and salesrooms and service station have been opened at Tenth Avenue and Seneca Street.

O. E. Logan of the Chalmers Auto Co., Spokane, Inland Empire distributor for the Chalmers, closed with C. F. Kolle of Kalispell, Mont., to handle the Chalmers. T. C. Martin has contracted to handle the Chalmers line at Pullman, Wash.

W. W. Trumbull, manager of the Spokane Auto Co., has contracted to distribute Oakland cars to all points in Washington east of the Cascades and in Idaho north of Salmon River.

Fowler Motor Car Co. has taken on the KisselKar line for Springfield, Mass., and vicinity.

New England Velie Co. is now located in its new building, 1123 Commonwealth Avenue, Boston, where it has executive, sales and service departments all in one structure.

Chalmers Motor Co. of New England moved into a new building at Portland, Me.

New York Lubricating Oil Co., Denver, is the new name for the Monogram distributing agency for Colorado, Wyoming and New Mexico, at 1441 Wazee Street, formerly called the Dickey Oil Co. G. B. Hayward, a salesman for the former concern, is manager of the new Western branch, and W. G. Dickey, head of the former Denver agency, has gone to Kansas City to manage the branch there under the name of the New York Lubricating Oil Co.

Tom Botterill, Denver, Pierce and Hudson distributer for Colorado, Wyoming and New Mexico, and Dodge dealer for Denver and vicinity, with headquarters at East Thirteenth Avenue, Broadway to Lincoln Street, has secured the Colorado, Wyoming and New Mexico distributing agency for the Pierce truck.

Truck Specifications in this Issue

NOV 1916

The AUTOMOBILE

Vol. XXXV
No. 18

NEW YORK, NOVEMBER 2, 1916

Ten cents a copy
Three dollars a year

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Advertisers' Index—Next to last page

Stewart

Motor Driven Tire Pump

Every Car Needs One

The best cars are now equipped with the Stewart Tire Pump before they leave the factory.

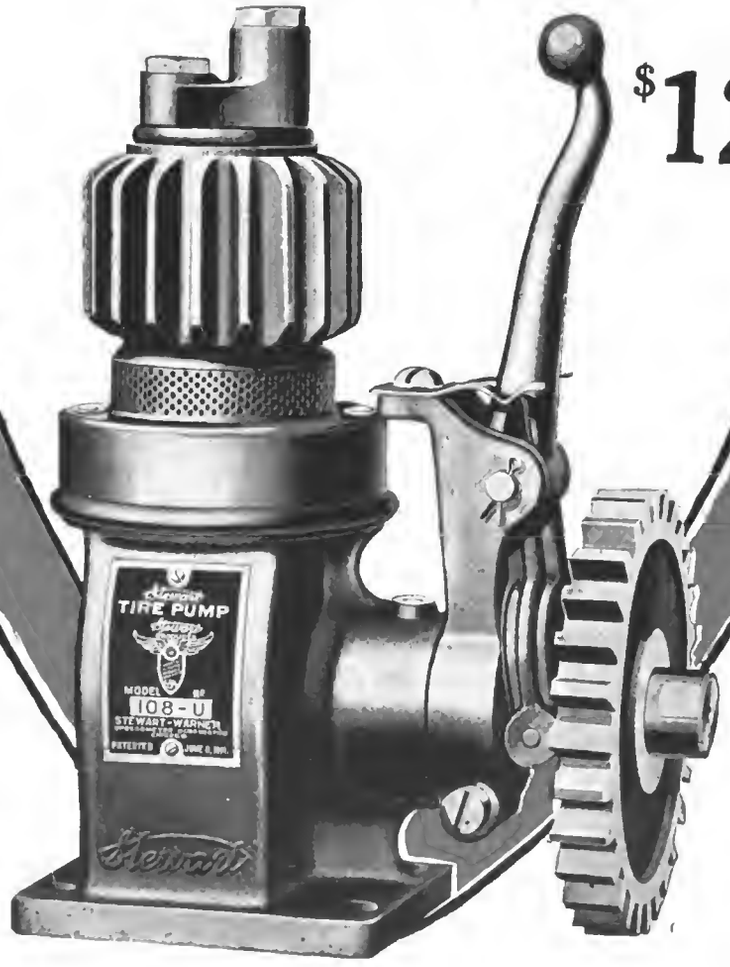
But there are thousands of cars in every territory still unequipped.

Get this business. The Stewart Tire Pump is the best—and the least expensive.

It goes on any car. Installations will keep things moving in your shop.

It's a real money maker for dealers.

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.



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The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, NOVEMBER 2, 1916—CHICAGO No. 18

A. O. Smith Corp. Formed

Stock on Curb—Offers $3,000,000 Preferred and 100,000 Shares Common

NEW YORK CITY, Nov. 1—One more company has entered Wall Street activities by listing its stock on the Curb. Increased business, as in the majority of cases, has been the cause of the formation of a new company to accommodate further factory expansion. The A. O. Smith Corp. has just been formed to take over the entire plant, assets, business and good will of the A. O. Smith Co., Milwaukee, manufacturing pressed steel frames, pressed steel rear axle housings, heavy stampings and drop forgings. An offering of $3,000,000 7 per cent cumulative preferred and 100,000 shares of common is being made in Wall Street. W. P. Bonbright & Co., and White, Weld & Co., this city, and Elston & Co., Chicago, have purchased the entire issue of preferred and are offering it at 98 with the privilege of subscribing to 40 per cent in common at $35 a share.

Management Unchanged

The management of the company will remain unchanged under Raymond Smith, who is president and general manager and chief stockholder.

The old company has been in active operation since 1904, having succeeded to the business of the Federal Mfg. Co. Average net earnings of the company after full depreciation for the 5 years ended July 31, 1916, were $474,540; for the year ended July 31, 1916, $1,505,162, or more than seven times the new preferred dividend requirement of $210,000. Net earnings for the year to end July 31, 1917, are estimated at $1,800,000. Net assets of the new corporation will be in excess of 113 per cent and net quick assets in excess of 45 per cent of the preferred stock. The stock has a sinking fund of at least 20 per cent of net earnings after preferred dividends, commencing Oct. 1, 1917, which is to be applied to purchase and cancellation of the stock. No dividend in excess of $6 per share per annum can be paid on the common stock until the amount of the preferred has been reduced to $1,500,000.

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Chalmers Refinancing Under Way

NEW YORK CITY, Oct. 28—Plans for the refinancing of the Chalmers Motor Co., Detroit, are now being worked out by J. S. Bache & Co. and C. D. Barney & Co., both of this city. Though the details of the transaction have not been consummated, it is stated that the company will acquire an addition of more than $5,000,000 in working capital. It is expected that the plan will be announced in the near future.

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Smalley Is Bound Brook Bearing V.-P.

BOUND BROOK, N. J., Oct. 30—George O. Smalley has been promoted to first vice-president and general manager of the Bound Brook Oil-less Bearing Co., succeeding the late Leigh S. Bache. Mr. Smalley has been connected with this company for 10 years and for the last 4 years as assistant general manager and assistant treasurer.

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Railroad Car Shortage Grows

DETROIT, MICH., Oct. 30—The freight car shortage is now greater than was ever before experienced at this season of the year. On Sept. 30 there was a net shortage of 61,030 cars as compared with a surplus of 131,027 cars on Oct. 1, 1914 and of 78,299 on Oct. 1, 1915.

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Disco Reduces Ford System $10

DETROIT, MICH., Oct. 28—The Disco Electric Starter Corp., this city, has reduced the price of its electric starting and lighting systems for Ford cars $10 to $65.

United Motors Adds Radiator Co.

Addition of Harrison Mfg. Co. Makes a Total of Eight Units

NEW YORK CITY, Oct. 31—The Harrison Mfg. Co., Lockport, N. Y., has been purchased by the United Motors Corp. The Harrison company manufactures radiators. The same policy will be followed with regard to the Harrison company as with the other concerns which the United Motors Corp. has taken over. The purchase of the Harrison company brings the total United Motors Corp. purchases up to eight companies, these being: Hyatt, New Departure, Delco, Remy, Perlman, Klaxon, Brown-Lipe-Chapin and Harrison.

The Harrison Mfg. Co. now becomes the Harrison Radiator Corp., and plans have been perfected to increase its present capacity of 350 radiators daily to 3000 per day. The corporation will make radiators for Chevrolet and other General Motors Co. subsidiaries.

The directors of the Harrison company have voted to keep the industry in Lockport and have secured options on all property adjacent to the plant on which a three-story factory will be built at once to cost $300,000. Further additions will follow. The company will employ about 700 men when the new facilities are available. It now has nearly 300 on its payroll. The enlarged factory capacity will be ready by March, 1917.

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Michigan Wheel Co. to Make Joints

GRAND RAPIDS, MICH., Oct. 25—The Michigan Wheel Co. is floating an issue of $50,000 preferred stock in the company for the manufacture of an automobile joint about to be marketed. With the completion of the subscription joint manufacture will start immediately.

Emerson Buys Plant at Kingston

Materials, Engines and Parts Purchased for First Lot of 500 Cars

NEW YORK CITY, Oct. 30—The Emerson Motors Co. of this city, manufacturer of the Emerson four-cylinder car, deliveries of which are soon to start, has purchased a factory in Kingston, N. Y., where the car will be produced in quantities. The factory purchased last week is known as the Peckham plant. The deal for it was made with Almirall & Co. of this city. This factory when equipped will have capacity for 100 cars per day. There is a machine shop 424 by 70 ft., which is having an addition of 96 by 70 ft. built which is incorporated in the 424 by 70 dimensions. There is a main factory 487 by 224 ft., with a 2-in. plank floor, which will be used for assembly purposes; and in addition are four warehouses with floor area of 70,000 sq. ft. The power house is 60 by 40 and the office building 50 ft. square. At present there is no machinery in the plant. As soon as the floors are finished machinery will be installed, and T. A. Campbell, president of the company, says that much machinery has been purchased and will be installed as soon as the floors are ready.

In addition to this new plant the company has a factory in Long Island City of 18,000 sq. ft., where the first 110 cars will be built.

The Emerson company early in October placed its contract for the manufacture of 500 motors with an outside concern. These motors are to be all delivered by contract before Jan. 8. Deliveries on these motors will be starting in the near future. The company has already built ten cars, which have been running for test purposes.

That the Emerson company is prepared to go forward with its first lot of 500 is proven by the orders placed for other car components and the quantity of these at present on hand. Over 100 frames are already on hand and the other 400 on the way to the factory. The 500 bodies are at present well under way and will all be delivered by Dec. 20. Ninety axles are on hand and two carloads are in transit. All of the 500 will be delivered by Dec. 21. There are 100 gearsets and 300 sets of lamps on hand. Starters are to be coming through at fifty a week. There are 200 sets of springs on hand. The same stock of parts applies to many other minor components of the car.

To date the Emerson company has not signed with a single agent or allotted agents territory. No money has been accepted from agents as deposits for cars for agency rights. There are applications on hand from several thousand agents for territory, and allotment of territory will be started on Dec. 15.

There have been sold to date over 200 cars by direct sales to consumers. These have been sold at retail price with a cash deposit of 10 per cent. No specific delivery date has been given, but delivery will be by rotation in order of deposits. The cash deposited on these cars is held as a separate account and is deposited in one of the trust companies in Long Island City.

The finances of the company as of Oct. 1 are shown by the audit report of the American Audit Co. of this city, which shows liquid assets at that date of approximately $551,000. Cash on hand totaled $307,447 and securities $182,000.

Studebaker to Raise Prices Dec. 1

DETROIT, MICH., Oct. 28—The Studebaker Corp. will shortly announce an increase in the prices of its various models, to take effect on or about Dec. 1. The increase will be between $75 and $100 on each of its products.

Cole Prices to Advance Jan. 1.

INDIANAPOLIS, IND., Oct. 30—The Cole Motor Car Co., this city, will increase the price of its cars on Jan. 1, 1917, by $100 to $200. The present price of the Cole eight is $1,595.

Canadian Ford to Make Trucks

DETROIT, MICH., Oct. 28—The Ford Motor Co. of Canada, Ltd., will begin the manufacture of trucks in March, 1917.

Berger and Thompson with Abbott

DETROIT, MICH., Oct. 25—Fred Berger has been appointed chief of the engineering department, and Alfred Thompson, factory and production manager of the Abbott Corp.

Schulz Is Mercer Chief Engineer

TRENTON, N. J., Oct. 29—A. C. Schulz has been appointed chief engineer of the Mercer Automobile Co., this city. Mr. Schulz was formerly connected with the Locomobile Co. of America in the capacity of assistant chief engineer. He was with Locomobile for 14 years.

Alford Vice-President of Nash

KENOSHA, WIS., Oct. 28—W. H. Alford, formerly Comptroller of the General Motors Co., has rejoined his old chief, C. W. Nash, as vice-president and comptroller of the Nash Motors Co.

White Empire Purchasing Agent

INDIANAPOLIS, IND., Oct. 30—E. E. White has been appointed purchasing agent of the Empire Automobile Co., this city. Mr. White has been associated with the Premier and American companies in this city.

Monroe Co. Increases Capital

Raises Stock from $250,000 to $1,000,000—R. F. Monroe Elected President

DETROIT, Oct. 27—The Monroe Motor Car Co., Pontiac, Mich., has increased its capital from $250,000 to $1,000,000. New officers were elected at a directors' meeting held Oct. 24, and include R. F. Monroe, president and general manager; S. W. McFarland, secretary and treasurer, and S. S. Jenks, vice-president and manufacturing manager. The board of directors is composed of R. F. Monroe, S. W. McFarland, S. S. Jenks and W. C. Rowles, Pontiac; L. E. Haase, general sales manager, and R. T. Armstrong of the Armstrong Mfg. Co., Flint, Mich. S. W. McFarland was formerly the secretary and treasurer and S. S. Jenks was the manager of the Port Huron Construction Co., Port Huron, Mich., which has now been purchased and absorbed by the Monroe Motor Car Co. Mr. McFarland is also cashier of the Port Huron Commercial Bank.

The company plans to utilize the Port Huron plant for the construction of motors until some time in the future, when the plant will be moved to Pontiac.

The Monroe company, which opened its plant in August, 1914, making its first delivery Jan. 1, 1915, has heretofore been selling its product through the Chevrolet company of Flint. It will sell its cars directly in the future. The company made 3500 small roadsters in the past year and plans to turn out approximately 7000 cars during the coming 12 months, which will include 2000 small roadsters with roadster, clover-leaf or sedan bodies and 5000 four-cylinder touring cars with either touring or clover-leaf bodies. Its prices will be $565 for its present roadsters, $635 for the clover-leaf roadsters, $965 for the sedan and $985 for the new touring cars with either touring or clover-leaf bodies.

Murphy Joins Hoyt Service

CLEVELAND, OHIO, Oct. 30—Gail Murphy has become manager of the local office of the Hoyt's Service, New York, advertising and sales management. For the past year Mr. Murphy has been advertising manager of the Chalmers Motor Co., Detroit. His headquarters are in the Leader-News Building.

Lane Is U. S. L. Vice-President

NIAGARA FALLS, N. Y., Oct. 28—At the recent meeting of the board of directors of the U. S. Light & Heat Corp., C. L. Lane, who has been secretary of the company, was elected vice-president.

Oct. Shipments 19,510 Carloads

Freight Car Shortage Hampers Manufacturers—License Case Argued in Washington

CARLOAD SHIPMENTS OF AUTOMOBILES

Month	1916	1915
January	18,064	8,369
February	21,502	11,273
March	28,600	16,442
April	28,000	17,112
May	24,000	13,642
June	23,879	15,325
July	18,079	12,517
August	18,254	16,959
September	21,660	18,940
October	19,510	17,848

NEW YORK CITY, Nov. 1—According to statistics submitted by the traffic department of the National Automobile Chamber of Commerce at the directors' meeting to-day there were 19,510 carloads of automobiles shipped during the month of October, with 1 day missing, as against 17,848 carloads for the same month last year. Shortage of freight cars continues in all lines of trade.

The commercial vehicle department reported that it was endeavoring to supply complete data to the lawmakers in various States in connection with proposed legislation governing the use of trucks on the highways, which will permit the special commissions and others to make recommendations for reasonable legislation which will not hamper the growth of the commercial vehicle industry.

Charles Clifton, president of the N. A. C. C., will act as national councillor representing the automobile manufacturers' organization in the Chamber of Commerce of the United States.

At Washington on Wednesday counsel for the N. A. C. C. argued the automobile license case before the Supreme court having to do with the constitutionality of the State registration law. The case is to decide whether the States have a right to raise funds for good roads work under the guise of registration fees and whether they can interfere with interstate traffic and require registration of a motor vehicle which has already complied with the registration laws of its home State.

In attendance at the meeting were: Charles Clifton, president, Pierce-Arrow; C. C. Hanch, Studebaker; Hugh Chalmers, Chalmers; R. D. Chapin, Hudson; William E. Metzger, Columbia; H. H. Rice, Waverley; Carl H. Pelton, Maxwell; Windsor T. White, White; A. L. Riker. Locomobile; R. E. Olds, Reo; John N. Willys, Willys-Overland; Alfred Reeves, general manager, and S. A. Miles.

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48,750 Studebakers Built by Canadian Company

WALKERVILLE, ONT., Oct. 28—For the first 8 months in 1916, sales of Studebaker cars exceeded the record for the entire year of 1915, according to figures just announced by J. E. Grady, sales manager of the Studebaker Corp. of Canada, Ltd., Walkerville.

In number, the cars, 48,750 Studebakers were sold from Jan. 1 to Aug. 31 of this year, as compared with 47,040 for the whole of last year, a gain of 1710.

At the present rate 1916 sales will be 55.4 per cent greater than in 1915, or 73,125 cars this year compared with 47,040 last year, a gain of 26,085. As a matter of fact, however, the balance in favor of 1916 over 1915 will be greater than the estimate just given, for the Studebaker output is being steadily increased and the sales for the last 4 months of this year promise to be larger in proportion than for the first 8 months of the year.

Sept. Exports Lower Than in 1915

Though Number of Cars and Trucks Falls Off, Value Is Slightly Higher

WASHINGTON, D. C., Oct. 30—There was a pronounced falling off in the exports of automobiles in September last as compared with the same month of last year, according to the returns of the Department of Commerce, announced to-day. The exports in September last were as follows: Commercial cars, 1835, valued at $5,203,215; passenger cars, 3585, valued at $2,819,405. For the same month of last year the exports were: commercial cars, 2227, valued at $5,882,255; passenger cars, 4299, valued at $3,215,459. The gain during the month was in the exports of parts, not including engines and tires, which rose in value from $1,613,419, in September a year ago to $2,095,188, in September last.

Detailed statistics for the various countries appear in the table.

Fewer Trucks Shipped

Taking the figures for the 9 months' period, ended September, there is a distinct loss in the exports of commercial cars, for this year's period, due to the curtailment of war orders, while passenger car exports show a tremendous gain. The figures show that during the 9 months ended September, 1915, there were 17,269 commercial cars, valued at $47,769,216, shipped abroad, as against 14,773 cars, valued at $40,371,055, exported during the same period of this year. Passenger car exports during the 1915 period amounted to 31,036 cars, valued at $26,793,972, while during the

(*Continued on page* 737)

Exports of Automobiles, Trucks and Parts for September and 9 Previous Months

	September				9 Months Ending September			
	1915		1916		1915		1916	
	Number	Value	Number	Value	Number	Value	Number	Value
Passenger cars	4,299	$3,215,459	3,585	$2,819,405	31,036	$26,793,972	47,246	$32,291,633
Commercial cars	2,227	5,882,255	1,835	5,203,215	17,269	47,769,216	14,773	40,371,055
Parts, not including engines and tires	.....	1,613,419	.....	2,095,188	.....	10,994,859	.....	17,322,349
	6,526	$10,711,133	5,420	$10,117,808	48,305	$85,558,047	62,019	$89,985,037
By Countries								
Denmark	.....	.....	177	$139,301	.....	.....	936	$714,412
France	421	$916,830	653	1,523,761	4,885	$12,126,628	6,497	16,529,055
Germany	.....	.....	.....	.....	4	2,801	.....	.....
Italy	49	34,516	5	3,500	170	109,014	237	143,967
Russia	.....	.....	670	1,957,287	.....	.....	2,852	7,912,407
United Kingdom	2,650	3,119,806	700	1,684,579	19,434	28,648,749	7,275	12,076,838
Other Europe	1,144	3,341,676	248	232,579	6,688	18,082,964	3,102	3,867,419
Canada	367	278,382	621	528,461	5,049	3,951,585	10,097	7,306,117
Mexico	5	4,160	44	33,239	75	71,891	410	373,887
West Indies and Bermuda	286	194,832	242	207,710	2,358	1,305,005	4,039	2,647,191
South America	595	273,449	.....	.....	2,081	1,066,486	.....	.....
Argentina	.....	.....	158	147,572	.....	.....	3,956	2,011,197
Brazil	.....	.....	24	15,367	.....	.....	304	199,814
Chile	.....	.....	178	107,241	.....	.....	880	554,029
Venezuela	.....	.....	25	19,553	.....	.....	411	260,535
Other South America	.....	.....	94	77,132	.....	.....	703	444,891
British East Indies	.....	.....	323	210,093	.....	.....	3,101	2,284,246
Australia	.....	.....	428	338,286	.....	.....	6,678	5,086,981
British Oceania	387	312,856	.....	.....	3,147	2,681,592	.....	.....
Asia and other Oceania	442	486,757	731	565,448	2,950	5,189,938	6,807	7,995,846
Other countries	180	134,450	308	231,511	1,464	1,326,536	3,707	2,253,856
	6,526	$9,097,714	5,629	$8,022,620	48,305	$74,563,189	61,992	$72,662,688

Marmon Co. Rushes Additions

Assembly Plant To Be Further Enlarged — Improved Power Facilities

INDIANAPOLIS, IND., Oct. 30—The Nordyke & Marmon Co. is steadily adding buildings and making improvements to its plant in order to take care of the increasing demand for the Marmon 34. Last winter the company felt the pinch of room and erected a large final assembly building 100 by 400 ft. on a plot of ground across the street from the main plant. Building operations are being rapidly pushed at the present time to add some 500 ft. to this building so that when it is completed it will be a structure almost 900 ft. long by 100 ft. wide. In addition a large capacity heating and power plant will also be erected.

Considerable improvements are also being made on the original factory plot by an additional two new buildings center of the plant including a new blacksmith's shop with several thousand feet of floorspace and a new experimental building which will contain about 4000 ft. of floor space.

New loading and unloading docks with additional railroad siding facilities are also being completed and additional shipping docks for wagon freight have been erected.

An interesting feature of these changes is the passing of the old brick stable for horses which has been a part of Nordyke & Marmon Co.'s plant for almost 2 decades. Automobile and motor trucks have almost wholly taken the place for hauling and the stable of olden days has been converted into a new employment office and factory doctor's headquarters.

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Dodge to Build Additional Factory

DETROIT, MICH., Oct. 28—Permit has been given to Dodge Bros. for erection of an additional factory to cost $300,000. The building will be used as a warehouse and will be 310 by 118 ft.

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Alvin Heads Schoeneck Co.

CHICAGO, ILL., Oct. 30—F. J. Alvin has become president and general manager of the Schoeneck Co., this city and Harvey, Ill., maker of the Geneva six. This company was recently formed with a capital of $1,500,000 to build the car designed by George Schoeneck, well known in the automobile field and connected with such concerns as Renault and Palmer & Singer.

Mr. Alvin was at one time connected with the American Ever-Ready Co. He then formed the National Sales Corp. in this city, which controlled the entire factory output and sales of the Schebler carbureter, Dow magnet, Kingston coils, etc. Later he took entire charge of the business of the Byrne-Kingston Co., Kokomo, Ind., in Detroit, and later became sales manager of the Sears-Cross Co. In 1915 he formed the New Era Engineering Co. to manufacture the New Era car at Joliet.

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Pontiac Plant for Olympian Motors

PONTIAC, MICH., Oct. 30—The Olympian Motors Co. will permanently locate its plant in this city. The company is incorporated under the laws of Delaware for $1,000,000, all of the stock being common with a par value of $100 per share. The company takes over the business of the Pontiac Chassis Co., which has been manufacturing chassis for the market in large quantities for some time. From 12,000 to 15,000 cars will be built annually.

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Empire Axle Plans Large 1917 Production

DUNKIRK, N. Y., Oct. 30—That the automobile and truck axle manufacturing companies are sharing in the general prosperity of the country is manifested in a statement made by the Empire Axle Co. that it will put out as many axles in the first 4 months of the coming year as it did in the whole year of 1916. It has increased its daily capacity in worm drive axles more than 400 per cent over that of a year ago.

Increased demand and production necessitated an increase during the year of 54,600 sq. ft. in its factory space, centered mainly on three new buildings, 85 by 110; 30 by 50; and 85 by 100. The first building is being used as an assembly plant, tool making and some machine work; the second is an addition to the assembly plant, used as a forge shop; the third is not yet built, but will be used for the machining of castings, etc. Preparations are also being made for an office building separate from the factories.

Keeping in line with the general improvement in working conditions in the modern factory, the company has made several important installations to its plant. Scientific sanitary facilities for its employees in the way of steel lockers, shower baths, and special lavatories have been added; also bulletin boards displaying new safety-first ideas, safety appliances and guards on all machinery and many other improvements.

The gradual increase in its business has made necessary two shifts throughout the plant. The heat treating department has been operating night and day for the last 6 months. The power plant has not been idle for more than 1 hr. at a time with the exception of holidays, since May, 1915.

Franklin To Increase Production

Company Has Added Six New Buildings This Year at a Cost of $1,000,000

SYRACUSE, N. Y., Oct. 25—Factory expansion this year by the H. H. Franklin Mfg. Co., this city, has been centered in six new buildings, giving an additional factory space of approximately 550,000 sq. ft. at a total cost of over $1,000,000. These increased manufacturing facilities are at present enabling the company to produce twenty-seven cars per day, as compared with eleven per day a year ago. Within the next 6 months the company will produce forty cars per day. Between Oct. 30, 1915, and Oct. 2, 1916, the production force has changed from 1215 to 2133.

The development that has taken place in the enlargement of factory space this year has been in a one-story building, 154 by 160, costing $40,000, used for the experimental department, chassis testing and the sawmill; a three-story building, 60 by 100, costing $30,000, for die casting; a six-story building, 108 by 265, costing $250,000, for manufacturing; an employment office and hospital, costing $4,000; a building for lumber drying, costing $6,000, and a six-story, 240 by 300 structure now being built at a cost of $500,000 for shipping and manufacturing.

Better Factory Methods

Improvements have taken place in the methods of manufacture and in the handling of the employees. Among its major improvements in manufacturing methods are the complete development of humidified oven drying apparatus for the paint department, completely eliminating the use of the old style of brush in the paint shop except in the last coat of varnish; pneumatic methods of drilling cap screw and nut driving, as well as wood screw driving. To thoroughly provide safety for its employees a safety man, who was formerly in charge of the first-aid room, is taking care of the safety devices. During the year the company has designed and put into use an entirely new set of manufacturing tools, costing approximately $300,000.

Workmen Rated

Probably not the least important in the changes during the year is the new method of rating workmen and supervisors, up to and including the foremen, which has resulted so far in the increase in wages of 5½ cents average per man since April, 1916, applying to approximately 25 per cent of the entire working force of the factory.

Surplus of 2-In. Maple

Uncertainty of Steel Deliveries May Affect Sales to Body Builders

ST. LOUIS, MO., Oct. 30—For the first time in 5 months there is a surplus of 2-in. maple offered in the hardwood market here. Maple of 2 in. and thicker is used almost exclusively by automobile builders for frames on which to build the metal sides of the bodies. The maple is to-day quoted at $27 per 1000 ft. at the mill, or at about $35 at most of the automobile factories. There is considerable speculation here among hardwood men as to why this accumulation while the automobile industry is forging ahead so rapidly. There are two explanations: First, the automobile builders are not buying far ahead because they are uncertain as to the steel deliveries; second, the rapid advance of maple last spring and a scarcity for a time persuaded the mills to cut more than is needed. The figures in the hands of the local sawmill men do not bear out the latter theory.

St. Louis a Center

A very large proportion of the maple used by the automobile industry is sold in this city, which is one of the great hardwood markets of the country. It is the largest hardwood reshipping point, there being half a dozen large reshipping yards here and a dozen small ones. These yards buy hardwoods from small yards throughout this section and the South, and regrade the lumber here and then reship it. Most of the maple produced in this country comes from Missouri and Arkansas, and the Missouri cut is estimated at 4,000,000 ft. The Arkansas cut is smaller. Maple is only an incidental part of the output of mills, probably the largest output being that of the Gideon-Anderson mill at Gideon, Mo., with sales offices here. The output of this mill is about 750,000 ft. a year, while the mill cuts more than 100,000 ft. daily of all hardwoods. From 250 to 500 ft. of lumber is required for an automobile.

Before the automobile industry came into being, maple was used chiefly by furniture makers and was then not cut more than 1½ in. thick and sold on a mill basis of about $15 per 1000 ft. At first ash was used for automobile body frames, but when it mounted to $50 per 1000 ft. a substitute was sought and was found in maple. In the 4 years since this use of maple began the price has advanced about $9 per 1000 ft.

Gum Widely Used

Last spring there was a pronounced scarcity of maple and for a short time there was considerable bidding for it; but the builders of lower-priced machines turned to gum and relieved the pressure. Some of the gum used for automobiles is sold through this city, but a greater portion is sold through Memphis. One-inch gum has for a long time been used by automobile builders for floors, etc. Yellow pine, which is sold chiefly through this city and Kansas City, is used for crating.

Wagon Makers to Merge and Build Motor Vehicles

CINCINNATI, OHIO, Oct. 30—Steps have been taken by almost a score of wagon manufacturers of this city for the merging of their interests into a large concern for the manufacture of both horse-drawn and motor-driven wagons, to be used for all purposes. A preliminary meeting was held Oct. 28, when the project was discussed and Attorney Emil Hauch was instructed to draw up the articles of incorporation for a $500,000 concern.

It is planned to erect a large central plant and use a number of the existing plants as branches. Some of the present plants will be abandoned entirely. Among those interested in the movement are Fred Dhonau, Jr., president of the F. Dhonau Son's Co.; L. J. Froelicher of A. Froelicher Sons Co., Michael Klopp of Philip Klopp & Sons, George Finn of the J. Finn Sons Co., J. H. Lewis, H. Burdorf and Harry W. Monning, individual manufacturers.

Goodyear Secures Cotton Plantation

PHOENIX, ARIZ., Nov. 1—In order to obtain a fixed supply of long staple Egyptian cotton, the Goodyear Tire & Rubber Co., Akron, Ohio, has purchased 10,000 acres of land in the Salt River valley, and will at once embark in the business of cotton raising on a large scale.

It is reported that the Goodyear company is also planning to increase this acreage by leasing from 20,000 to 25,000 acres additional, leases to run for 5 years. Contracts to supply the Goodyear company with long staple cotton have been awarded the operating corporation, on long-term contracts.

American Chain Co. Buys Standard

BRIDGEPORT, CONN., Oct. 28—The American Chain Co., manufacturer of Weed tire chains in this city, has purchased the Standard Chain Co., Pittsburgh, Pa. Announcement of the acquisition of the Standard company was made at a dinner given to the distributors of Weed chains by the American Chain Co.

Plans for combining the sales organizations and part of the office force of the two companies are in preparation and will probably be put into effect by Jan. 1.

Welfare Work at Remy Plant

Special Bldg. for Women Employees—Co-operates in Teaching Electricity

ANDERSON, IND., Oct. 30—The extensive construction work that is under way at the plant of the Remy Electric Co., Anderson, is not concerned entirely with increasing the production of the various units. A part of the building activity is directed at co-operative welfare work with the employees.

Ground has just been broken by the company for a two-story building designed solely for the many women employees. The new building will be devoted to the manufacture of small parts of its products at the making of which women are particularly adept. The structure will contain every convenience for the transfer of work so no lifting need be done, the interiors will be painted white and there will be rest rooms.

The Remy company is working in cooperation with a local high school in the teaching of the elements of electricity. The school has a membership of 400, meets 3 nights a week and gives Remy employees, young men and women in the local high school and anyone else interested the opportunity of securing a practical training in electricity. The Remy company furnishes text-books at cost and pays the salary of the instructor.

Pa. Rubber Establishes Sales Districts

JEANNETTE, PA., Oct. 31—The Pennsylvania Rubber Co., this city, will establish districts under sales directors in order to give closer attention to the various sections of the country. This does not mean that the whole branch system has been abolished, but merely that the branches will now come under certain districts and sales directors as follows: Eastern territory, C. C. McCullough; southern district, D. D. F. Yard; central States, J. Q. Goudie; the west, C. F. Kent; and the Pacific Coast, J. F. Madden. Vice-President C. M. DuPuy will continue in charge of the Pennsylvania district.

Holt-Welles Co. Elects Officers

NEW YORK CITY, Oct. 28—At the recent annual meeting of the stockholders of the Holt-Welles Co., Inc., New York, manufacturer of the Branford and Browne carbureters, the following officers were elected for the ensuing year: E. H. Stickels, president; F. E. Hamilton, vice-president and counsel; Calvert Holt, treasurer; Paul Welles, secretary; Wm. M. Williams, assistant treasurer and secretary.

U. S. A. Cars Gain in Chile

Value of Shipments Jumps from $44,169 to $202,498 in Year

SANTIAGO, CHILE, Oct. 18—That the American automobile industry is fast getting a foothold in Chile is manifested in the fact that U. S. A. shipments to that country increased from $44,169 to $202,498 from 1913 to 1915. Though there was a slight decline in automobile imports as a whole during 1915, and Chile's purchases of foreign automobiles declined considerably, the American car's popularity held strong with much larger sales.

That the automobile is popular in Chile is proved in a comparison of its imports from 1908, 1909 and 1910, which were $14,054, $11,760 and $26,971, respectively. At present there are about 1300 cars in this city, between 300 and 400 of them being used as taxicabs at a charge of $1.10 in U. S. gold, or about 22 cents a trip.

Poor road conditions will not allow of many trips outside of this city, and as a result the most popular cars for private use are broughams, limousines, and landaulets. Black and dark blue cars should be sent only on special order. The prospect of better roads is not particularly encouraging, although there is some talk of building one between Santiago and Valparaiso. In such a case there should be an increased demand for touring cars.

Two-seated runabouts are not common, and when seen generally have a small seat behind for the chauffeur. This is demanded by custom, for even though the owner of the car is driving he must always have the chaufleur with him in case of need. American runabouts with a third seat behind, which could be folded into the body when not in use, thus giving the car a smarter appearance, should find a market.

Trucks are not used to any extent in the central and southern part of the country and the low cost of hauling by oxcart and wagon would limit their introduction. In the nitrate fields, however, they have begun to be used with good results.

The maximum price for gasoline during the past few months was $5.45 per case of two 5-gal. tins, which is the method of handling used here.

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New Zealand a Fertile Field for Automobile Sales

AUCKLAND, NEW ZEALAND, Oct. 20—If we judge a country from its export trade then New Zealand must be put in the prosperity column, for its exports have increased 30 per cent in the last year. These islands are the most fertile areas in the world and naturally good automobile markets. The European war, and increased demand for foreign products, account for the present prosperity.

U. S. Leads in Imports

As a consumer of automobiles, motorcycles, etc., New Zealand imported in 1915, $6,889,893. The United States lead all of the countries in supplying this demand. The value of cars imported from the U. S. A. was $1,842,948, whereas the value supplied by the United Kingdom was $1,612,671.

An indication of how New Zealand profited by the war is that wool, which is the greatest product, increased 22½ per cent in value; frozen meats, which constitute the second greatest article of export, increased 30 per cent; butter in fourth position as an export, rose 20 per cent; cheese rose 30 per cent in value: and other export articles increased similarly.

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Perlman Stock on Exchange Basis

NEW YORK CITY, Oct. 30—L. G. Kaufman and W. C. Durant have caused to be sent to the Perlman Rim Corp. stockholders notice that on presentation of their Guaranty Trust Co. receipts, United Motors Corp. stock will be issued forthwith. It was agreed that this release would be made on Nov. 25, but it is decided to grant the release at once.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.65	.65	.65	.65	.65	.65	...
Antimony, lb.	.13	.13	.13	.13	.13	.13	...
Beams and Channels, 100 lb.	2.88	2.97	2.97	2.97	2.97	2.97	+ .09
Bessemer Steel, ton.	45.00	45.00	45.00	50.00	50.00	50.00	+5.00
Copper, Elec., lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl.	12.50	12.15	12.50	12.61	12.70	12.47	— .03
Fish Oil, Menhaden, Brown, gal.	.60	.60	.60	.60	.60	.60	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.10	1.10	1.10	1.10	1.10	1.25	+ .15
Lead, 100 lb.	7.05	7.05	7.05	7.05	7.05	7.05	...
Linseed Oil, gal.	.88	.88	.88	.88	.88	.90	+ .02
Open-Hearth Steel, ton.	45.00	45.00	45.00	50.00	50.00	50.00	+5.00
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.95	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb.	.75	.77	.77	.80	.80	.81½	+ .06½
Rubber, Ceylon, First Latex, lb.	.61	.62	.62	.63	.63½	.63½	+ .02½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	41.25	41.63	41.63	42.00	42.00	42.00	+ .75
Tire Scrap, lb.	.06	.06	.06	.06	.06	.06	...

Metal Prices Are Higher

Rise in All Steel Quotations Also Extends to Rubber and Other Materials

NEW YORK CITY, Oct. 31—Metal prices featured last week's market activities with a general rise in all departments. Bessemer and open-hearth steel reached $50.00 per ton at a gain of $5.00; beams and channels rose 9 cents per 100 lb. to $2.97; and tin rose 75 cents per 100 lb. to $42.00. Rubber prices have also followed suit with the metals with a large rise. Fine up-river Para is now quoting at 81½ cents a pound, just 6½ cents higher than a week ago; Ceylon is 2½ cents higher a pound at 63½. Rubber from the Dutch East Indies is now in the midst of a boom and its production there is increasing by leaps and bounds. According to authoritative statements, the crop harvested last year in the island of Java alone was 6,059,098 kilograms, as against 3,260,274 in 1914, and it is estimated at as much as 9,205,825 kilograms in the current year.

Drought in Brazil

In regard to the rise in Para rubber, it may be explained as due to a drought in the Amazon region of Brazil. The water is so low in the tributaries of the Amazon that many steamers are lying at Para and Manaos, loaded with provisions for the rubber country, but unable to get there. By the same token, the rubber-laden up-river ships cannot get down.

Fuel prices remained constant last week. Gasoline prices in some sections of the country have gone down with no prospects of a sustained decline. Crude oil prices are still quoting at their record quotations. The high prices of crude oil have indirectly brought the price of gasoline down, at any rate, have eased the tension on quotations. Before crude prices rose, it was stated that refiners found it impossible to get the required quantity of different grades.

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Parts Companies Add Capital

CONNERSVILLE, IND., Oct. 30—The Metal Auto Parts Co. has increased its capital from $50,000 to $150,000.

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PERU, IND., Oct. 30—The Peru Auto Parts Mfg. Co. has increased capitalization from $200,000 to $500,000.

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Punctureless Tire to Increase Capital

AKRON, OHIO, Oct. 25—In order to take care of factory expansion the Punctureless Auto Tire Co., this city, has called a meeting of the stockholders

for Dec. 25 to vote on an increase in capitalization from $100,000 to $1,000,000. An additional five-story building will be erected. A plant is now being operated at Kenmore. Twenty-five men are employed and the working force will be increased to 100 within a month. The company is also operating a plant at Millersburg. Within 6 months the company will be turning out 500 tires daily, according to present plans and in consideration of the increased factory facilities which will be available.

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Auto Wheel Increases Capital $200,000

DETROIT, MICH., Oct. 28—The Auto Wheel Co., Lansing, Mich., has increased its common stock capitalization from $300,000 to $500,000. The issue was authorized by the directors at the annual meeting of the board on Oct. 24. The funds derived from the increase will be devoted to new buildings to care for increased business. Officers of the company remain the same and include E. S. Porter, president; H. E. Bradner, vice-president; D. L. Porter, secretary and treasurer, and John Winters, superintendent.

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Billings & Spencer to Expand

HARTFORD, CONN., Oct. 28—Shareholders of the Billings & Spencer Co. have authorized the issue of 10,000 shares of stock and holders of record last Saturday have the privilege of subscribing for 10,000 shares of unissued stock at par, $25 per share, on or before Nov. 18 at the rate of one new share for every two shares now held.

Slump in Security Prices

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Bearish Market Results in Drops of from a Fraction to 30 Points

NEW YORK CITY, Oct. 31—Automobile and accessory issues last week were in the hands of the bears who are at last realizing much profit on a down market. Chevrolet, General Motors and United Motors were especially low as a result of much selling pressure. Chevrolet dropped 11 points during the week, reaching 186; General Motors dropped to 800, a loss of 30 points; and United Motors to 62½, a loss of 4⅛ points. The latter stock has been very active on both sales and buys. The automobile securities have been a big puzzle to investors and speculators during the last month on account of their failure to make any material gains. When news of the submarine activities was flashed on the ticker recently the stocks held strong with few losses. Now with no apparent cause they are quoting low.

Some Liquidation

Of course liquidation of stock has lowered prices to some extent, as in Lee Rubber. This stock reached 39, the lowest price at which the stock has ever sold, notwithstanding the earning of its present $3 dividend in the first 6 months of the year. Maxwell has fluctuated during the past 2 weeks, recording fractional gains last week and dropping badly this week. Willys-Overland common, after recording a fractional gain the previous week, dropped 3⅜ points.

Several of the issues, however, showed considerable strength as a result of important announcements. Chalmers common and preferred rose 15 and 8 points, respectively. This company, it is stated, is considering a plan for fresh financing in which an addition of more than $5,000,000 working capital will be used for expansion.

Spicer Strong

Spicer preferred, a new stock on the Curb, picked up 2¼ points. All the $1,500,000 first preferred 8 per cent cumulative and convertible stock of this company has been sold.

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Dividends Declared

B. F. Goodrich Co., quarterly of $1.75 per share on preferred, payable Jan. 2, 1917, to stock of record Dec. 21, 1916; and regular quarterly of $1 per share on common stock, payable Feb. 15, 1917, to stock of record Feb. 2, 1917.

Yale & Towne Mfg. Co., extra of 5 per cent, payable Nov. 10 to stock of record Nov. 3.

Lee Rubber & Tire Co., quarterly of 50 cents a share and usual extra dividend of 25 cents a share, payable Dec. 1 to stock of record Nov. 15.

Westinghouse Electric & Mfg. Co., quarterly of 1½ per cent, 75 per cent per share on common for quarter ending Sept. 30, will be paid Oct. 31, to stock of record as of Oct. 6.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Wks. Ch'ge
Ajax Rubber Co.	66⅛	66½	+3⅛
J. I. Case T. M. Co. pfd.	86	88	+1⅛
Chalmers Motor Co. com.	115	130	+15
Chalmers Motor Co. pfd.	98	100	+8
*Chandler Motor Car Co.	104	105	—2
Chevrolet Motor Co.	186	192	—11
Fisher Body Corp.	38	41	—1
Fisk Rubber Co. com.	..	93	..
Fisk Rubber Co. 1st pfd.	108	114	—2
Fisk Rubber Co. 2d pfd.	100	105	..
Firestone Tire & Rubber Co. com.	1145	1152	+15
Firestone Tire & Rubber Co. pfd.	110	112	..
*General Motors Co. com.	800	850	—30
*General Motors Co. pfd.	126	126⅛	— ⅛
*B. F. Goodrich Co. com.	72½	72⅝	—1⅛
*B. F. Goodrich Co. pfd.	112	114	—2⅛
Goodyear Tire & Rubber Co. com.	296	298	..
Goodyear Tire & Rubber Co. pfd.	108½	109½	+ ⅛
Grant Motor Car Corp.	8	9	..
Hupp Motor Car Corp. com.	5¼	5¾	+ ¼
Hupp Motor Car Corp. pfd.	92	100	+2
International Motor Co. com.	5	7	+ ½
International Motor Co. pfd.	20	30	+3
*Kelly-Springfield Tire Co. com.	75	76	+3¾
*Kelly-Springfield Tire Co. 1st pfd.	97	100	+1
*Lee Rubber & Tire Corp.	40½	40¾	—2¼
*Maxwell Motor Co. com.	85½	85¾	—4¼
*Maxwell Motor Co. 1st pfd.	85½	87	—1½
*Maxwell Motor Co. 2d pfd.	55	55⅛	— ½
Miller Rubber Co. com.	..	251	..
Miller Rubber Co. pfd.	105	107	..
Packard Motor Car Co. com.	170	180	..
Packard Motor Car Co. pfd.	94	99	—1
Paige-Detroit Motor Car Co.	42	45	+5¼
Peerless Truck & Motor Corp.	22	24	—2
Portage Rubber Co. com.	170	172	—4
Portage Rubber Co. pfd.	170	172	—3
Regal Motor Car Co. pfd.	23	30	+6
Reo Motor Car Co.	46	46¾	+2¾
Saxon Motor Car Corp.	77½	80	—2½
Spicer Mfg. Co.	103¾	104	+2¼
Springfield Body Corp. com.	95	100	+3
Springfield Body Corp. pfd.	120	130	..
Standard Motor Construction Co.	7½	8½	..
Stewart Warner Speed. Corp. com.	111½	†112	—1½
Stewart Warner Speed. Corp. pfd.	..	..	..
*Studebaker Corp. com.	129¾	130	—5⅛
*Studebaker Corp. pfd.	110½	112	— ½
Stutz Motor	66	67	—2
Swinehart Tire & Rubber Co.	90	92	+4
United Motors Corp.	62½	62¾	—4⅛
*U. S. Rubber Co. com.	59	60	—2
*U. S. Rubber Co. pfd.	110	110¾	—1½
White Motor Co.	54½	55½	—2½
*Willys-Overland Co. com.	42¾	43	—3⅛
*Willys-Overland Co. pfd.	102½	103½	— ½

*At close Oct. 30, 1916, Listed New York Stock Exchange. †Ex-dividend.
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Wks. Ch'ge
Auto Body Co.	42¾	..	+1¾
Cbalmers Motor Co. com.	120	..	+20
Chalmers Motor Co. pfd.	98	..	+8
Continental Motor Co. com.	38¼	39¼	+2¼
Continental Motor Co. pfd.	9½	10½	..
Ford Motor Co. of Canada	285	305	+15
General Motors Co. com.	800	889	+25
General Motors Co. pfd.	124½	127½	+1½
Maxwell Motor Co. com.	87	90	+3
Maxwell Motor Co. 1st pfd.	85½	88½	— ½
Maxwell Motor Co. 2d pfd.	54	57	—1
Packard Motor Car Co. com.	..	177	..
Packard Motor Car Co. pfd.	100	101½	..
Paige-Detroit Motor Car Co.	41	42	+5
W. K. Prudden Co.	49	51	+1
Reo Motor Car Co.	46	47	+2½
Studebaker Corp. com.	132	135	—2½
Studebaker Corp. pfd.	109	..	..
C. M. Hall Lamp Co.	28½	31	..

INACTIVE STOCKS

Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd.	18	..	..

Gryphon Tire Co. To Expand

$221,000 in 7 Per Cent. Cumulative Preferred To Be Marketed

NEW YORK CITY, Oct. 25—The Gryphon Rubber & Tire Corp., this city, in order to take care of expansion, is offering through Boughton & Co., this city, $221,000 in 7 per cent cumulative preferred stock. Ten shares of preferred, $100 par, and two shares of common, $100 par, are being offered for $1,000. Gross earnings are estimated at $1,856,280.40. Operating expenses, including taxes, etc., are placed at $1,312,279.80, giving a surplus applicable to dividends of $544,000. The company's factory is now fully equipped and will be turning out 300 tires a day by Dec. 1.

This company was formed in 1915 to manufacture a tire manufactured extensively throughout Europe, the patentee being I. S. McGiehan of London, England. The American patent is No. 1,110,451, filed May 15, 1911. The tire is composed of a fabric carcass or foundation and a tread portion composed of layers of rubber-filled fabric of different widths formed into a crescent band, united thereto by an interposed film of softer rubber, all homogeneously vulcanized.

The company is capitalized with $650,000 common and $350,000 preferred. The directorate includes S. A. Cunningham, president of the Bankers Safe Deposit Co.; C. W. Hunt, secretary of the American Society of Civil Engineers; J. W. Jones, president of the Jones Speedometer Co.; P. S. Jones; R. M. Owen, president of the R. M. Owen Co.; N. W. Peters; H. W. Schuette; H. A. Weatherbee, president of Arnold, Constable & Co., and D. W. Whipple.

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Amazon Tire Enlarges Plant

AKRON, OHIO, Oct. 28—The Amazon Tire & Rubber Company, Akron, Ohio, have found it necessary to increase its floorspace. The factory is at present turning out about forty-five tires a day, and when the new four-story brick building is completed the production will average 300 tires daily. The company is building a standard tire with an extra side wall breaker strip, or blowout protection, added.

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New Plant for Racine Tire

RACINE, WIS., Oct. 28—The Racine Auto Tire, Racine, Wis., organized 7 years ago to manufacture tires, tubes and rubber goods, will undertake the construction and equipment of a large new plant during the winter months to enable it to handle the fast growing volume of business. The present quarters at Fourteenth and Clark Streets have been overcrowded for many months, but not until this week was it possible for the company to purchase a desirable site. A deal was closed for the 4-acre tract on North High Street and the Chicago & North-Western tracks, known as Racine Baseball park, and approximately $100,000 will be expended in the erection of a group of new buildings. When this is completed, the present force of 125 workmen will be doubled, and the production of 250 tires and tubes per day increased to 600 of each. Plans for the factory will be prepared early in November, and contracts awarded, so that occupancy can be taken on or before July 1, 1917.

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Tire Plant for Toronto

NEW YORK CITY, Oct. 27—A factory in which pneumatic tires of both the fabric and the cord type will be made has just started to operate in Toronto. This is owned by the van der Linde Rubber Co. and is backed by several men who have been interested in the Canadian developments of Bakelite by the firm of Plastics, Ltd. It is understood that the two concerns will work together although they will have separate financial organizations. Deliveries of tires are due to commence about the middle of January and only the fabric type will be made at first.

The company has a new design of cord tire in which the threads are arranged almost radially instead of at the considerable angle customary in cord tire construction. This is claimed to give the casing a greater strength and also to increase its resiliency from 2 to 5 per cent. A special form of tube is being made of red rubber treated so that there is little tendency for it to split should a blowout occur. It is stated that in the event of the shoe failing the damage to the tube is confined to the same size as, or smaller than, the hole in the casing, this making it easier to repair the tube.

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Gillette Tire to Operate Dec. 1

EAU CLAIRE, WIS., Oct. 28—The Gillette Safety Tire Co., Eau Claire, Wis., will not be able to commence operations in its new plant until Dec. 1, because labor troubles at Akron, Ohio, have delayed the completion of the extensive factory and equipment. The original plan was to be ready to start production July 1, and the date then was deferred to Oct. 1, but further delays were encountered in getting the equipment. The buildings are completed and ready for the installation of machinery, which will begin shortly after Nov. 1, according to assurances received by the company.

Bradley on Italian Front

The Automobile Correspondent Doing Ambulance Work—Studies Trucks

NEW YORK CITY, Oct. 31—W. F. Bradley, European correspondent for THE AUTOMOBILE, is now doing ambulance work with the British ambulance unit on the Italian front where he has been for several months and where he will be for several months to come. Mr. Bradley is making a very close study of motor truck use in all stages of army work on the Italian front and is very close in touch with transportation matters in general in that zone. When his service with the ambulance unit is completed he will devote his time to a series of articles for THE AUTOMOBILE, covering this field of the work. His work as ambulance driver takes him well to the front, in fact, he is operating most of the time in advance of the Italian artillery. His work is removing the wounded from the front to depots 10 to 20 miles to the rear according to the nature of wounds.

In this work he has an excellent opportunity of observing the mechanical defects and shortcomings shown by the different makes of vehicles in actual service. The vehicles employed include American, French, Italian, English and German. It is questionable if at any other point in the European war zone motor vehicles are receiving more severe service. On the Italian-Austrian front there is a combination of mountains, bad roads and extremes of climate which severely tax all motor equipment.

No European war correspondent has had a better opportunity of first-hand study of motor apparatus in the war zone than W. F. Bradley. Besides being a correspondent of the first rank he is an engineer of standing and is familiar with European practice in automobile and motor truck construction. He is acquainted personally with 75 per cent of the European engineers, has visited each year for several years the majority of the French, Italian and English factories, and has driven over the greater part of these countries. There is no one in the technical line better qualified to report the status of various automobiles and trucks in war service than he. During the past year he has been in the ambulance and other services on the Flanders front and has been over all of the fighting zone in France. His articles covering the Italian front should begin during the months of February or March.

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Colonial Motors Making Deliveries

DETROIT, MICH., Oct. 31.—The Colonial Motors Co. is now making deliveries of

motors at a rate of 5000 a year and expects within the coming year to produce from 12,000 to 15,000. The company which was organized Sept. 1 with a capitalization of $200,000 of which $50,000 is in preferred stock and $150,000 is common stock, is now producing its motors in a four-story building of 50,000 sq. ft.

C. S. Briggs, president, was president and general manger of the Krit Motor Car Co. in 1909, and the manager of the Brush Runabout Co. in 1910. E. D. Moessner, treasurer, was formerly the treasurer of the Brush Runabout Co. and the Briscoe Mfg. Co. until he resigned in 1911 to join Mr. Briggs when he formed the Briggs-Detroiter Co.

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Texas Co. Reduces Price 1 Cent

NEW YORK CITY, Oct. 29—The Texas Co. has reduced the price of kerosene 1 cent a gallon in Texas. It has cut the price of gasoline 1 cent and kerosene 1 cent a gallon in New Mexico.

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Gasoline 1 Cent Lower in Denver

DENVER, COL., Oct. 28—Another 1-cent drop in the price of gasoline has occurred, bringing the price to 21 cents at all the filling stations and many garages. Some garages charge a few cents more, on the ground that they handle gasoline mainly as an accommodation and cannot afford to bother with such a small volume of business for the 2-cent margin of profit maintained by the regular filling stations. The wholesale price to the filling stations and garages is 19 cents, while the price direct to consumer from the oil company's tank wagons in 25-gal. lots or more is 20 cents.

This is the fifth reduction of 1 cent within the last 3 months, following a long period when the retail price stood at 25 cents. The other changes took place on Aug. 14, Sept. 8 and Sept. 26.

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Harroun Motors Begins Building

DETROIT, MICH., Oct. 27—The Harroun Motors Corp. has broken ground for its first building at Wayne County. The structure will be 550 by 75 ft., two stories high and will have a wing of saw-tooth construction 140 by 600 ft. and one-story high. Both buildings will be built of brick and steel.

The Harroun corporation, according to officials of the company, have already signed applications for more than 50,000 cars from dealers throughout the United States. In addition more than $1,000,000 worth of cars have been contracted for for export.

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Plank Shaft Co. to Enlarge

GRAND RAPIDS, MICH., Oct. 25—The Plank Flexible Shaft Machine Co., this city, is considering plans of reorganization with a capital of $200,000 for the manufacture of a new flexible shaft for automobile work.

S. A. E. Day Success Assured

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516 Tickets Sold for Frolic Performance and 294 for Annual Dinner

NEW YORK CITY, Nov. 1—It is now assured that Thursday, Jan. 11, which is S. A. E. Day of New York show week, will be a success, not only from a business and professional standpoint, but also from the social side. To date 516 tickets have been sold for the special performance of the Ziegfeld Frolic for that evening, or two-thirds of the entire seating capacity of the theater. The annual dinner to be held in the grand ballroom of the Hotel Biltmore promises to outdo any similar occasion in the history of the society, 294 tickets having been sold up to the present. Last year no campaign for disposing of the tickets to the dinner was undertaken until 6 weeks before the event occurred, so this year it looks as though the grand ballroom will be filled to capacity.

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Metropolitan S. A. E. Meets Nov. 16

NEW YORK CITY, Oct. 28—The Metropolitan Section of the Society of Automobile Engineers will hold a meeting Nov. 16 at 8 p. m. at the Automobile Club of America. "Some Present and Future Scientific Problems of the Automobile" will be the subject of C. F. Kettering's address. Mr. Kettering is vice-president and general manager of the Dayton Engineering Laboratories Co., Dayton, Ohio.

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Truck Converter Contract in Dispute

CHICAGO, ILL., Nov. 1—Whether a binding contract has been negotiated between the Smith Form-A-Truck Co. of this city and the Redden Motor Truck Co., of New York, with regard to a truck converter patent issued to Albert E. Cook and controlled by the Redden company, is a matter in dispute to-day and one which apparently the courts will have to settle. Some weeks ago the Redden Motor Truck Co. announced that it had a signed contract with the Smith Form-A-Truck Co., whereby the latter concern signed to recognize the validity of the Cook patent and to pay royalties, the contract giving the Smith Form-A-Truck Co. the right to manufacture under the Cook patent.

This contract matter is now in dispute, the Smith Form-A-Truck Co. contending that the so-called contract is not in reality a contract, but only a memorandum which was signed by E. I. Rosenfeld, vice-president and treasurer of the Smith Form-A-Truck Co. The Smith company repudiates this alleged contract and has filed suit against Albert E. Cook and Chas. W. Hills, attorney for Cook and Redden, to restrain the latter from representing that they have a valid contract with the Smith Form-A-Truck Co. in which the Smith organization agrees to pay royalties. The suit entered by Smith also asks that the defendants be restrained from intimidating dealers and agents of the Smith company.

The Redden Motor Truck Co. claims that the so-called agreement or memorandum is a binding contract and that Mr. Rosenfeld declared himself authorized by the board of directors of his company to conclude such agreement.

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Watson Heads Pennsylvania S. A. E.

PHILADELPHIA, PA., Oct. 27—John W. Watson, president of the American Bronze Co., Berwyn, Pa., was elected chairman of the Pennsylvania section of the Society of Automobile Engineers at its annual meeting held here last night. A. K. Brumbaugh, assistant engineer, Autocar Co., Ardmore, Pa., was elected secretary and T. Y. Olsen, vice-president the Tinius-Olsen Testing Machine Co., Philadelphia, treasurer.

Herbert Chase, chief engineer of the Automobile Club of America, read a paper on the Otto versus the constant pressure cycle, supplementing his paper on the same subject presented before the Summer meeting of the society.

The next meeting of the section will be held Nov. 23, when John Younger, chief engineer, motor truck department Pierce-Arrow Motor Car Co., Buffalo, N. Y., will present a paper on brakes.

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Detroit Motor Lock Co. Formed

DETROIT, MICH., Oct. 30—The Detroit Motor Lock Co. has been incorporated with a capitalization of $30,000 to manufacture and license others to manufacture, automobile parts. C. R. Kerns, G. M. Conner and R. W. Muir are among the incorporators.

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Webster, Gramm Truck Man Dies

DETROIT, MICH., Oct. 27—J. K. Webster, formerly secretary and treasurer of the Gramm Motor Truck Co., who was forced to retire from the company because of ill health died here today.

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Silver to Give Up Peerless

NEW YORK CITY, Nov. 1—The Peerless business in this city will be handled after Jan. 1 by a factory branch. C. T. Silver, who has had the agency since Jan. 1, 1914, is relinquishing it to concentrate on the Chalmers and Dort lines, which he recently took over. The Peerless branch will be in the former Paige location at Broadway and West Sixty-third Street and will handle both wholesale and retail.

A. A. A. Disqualifies Two Makers

Grant and Lozier Come in for Disqualification—New Rules for 1917

NEW YORK CITY, Oct. 31—At to-day's meeting of the contest board of the American Automobile Assn. two automobile manufacturers were disqualified and fined for not advertising in accordance with A. A. A. rules as governing performances of cars in contests. The Grant Motor Car Co., Findlay, Ohio, was disqualified for 1 year, beginning Oct. 1, 1916, for advertising in connection with the performance of its car at the recent Pike's Peak Hillclimb. In addition to disqualification for 1 year a fine of $500 was imposed. The disqualification prevents it from competing in sanctioned events during the period stated. The Hal Motor Car Co., Cleveland, Ohio, was given the same punishment for advertising in connection with the hillclimb recently held at Giant's Despair, Wilkes-Barre. Other cases of advertising not being in accordance with results of contests are being investigated by the contest board, and decisions are expected at the next meeting of the board.

The Kalamazoo Motor Speedway, Kalamazoo, Mich., was permanently disqualified due to checks covering cash prizes, etc., going to protest. This is the speedway where the fatal accident happened at its 100-mile race on Aug. 27, in which three men were killed and eleven cars wrecked. The disqualification applies to the officers of the association.

To Revise Rules

The question of revising speedway rules for the coming year was taken up. Several changes were made in the rules, all for the betterment of racing. The suggestion that more cars, namely, forty, be permitted to start on a 2-mile speedway was overruled, and the number of starters in any race will remain as it was this year. The objection to more starters was largely due to the difficulty of scoring greater numbers.

The position of assistant starter was eliminated. A new position known as Clerk of Course was created. The clerk of course will have complete supervision of the track during the race, as well as immediately previous thereto.

The use of judges in connection with races has been discontinued largely because there have not been specific duties for them and too frequently they have gotten on the track and increased the congestion there.

The question of qualifying trials for speedway races has not been satisfactory this year. Speedways have charged admission to spectators for qualifying trials and frequently spectators have spent nearly an entire afternoon without getting any show for their money. This has been due to few cars presenting themselves for qualification. To avoid this speedways will be requested to have only one day for qualifying trials at which admission can be charged.

Cars will continue to start in races in order of their qualifying speeds. The cars that qualify will only be given one chance, providing they meet the qualifying speed for the race. Should they not show qualifying speed they will be given two additional trials. Cars qualifying after the official date set for trials lose their starting positions which the regular qualifications would have entitled them to.

The board practically accepted many of the recommendations which had been discussed at a recent meeting of the speedway managements, drivers, and the contest board. These included the following:

A—For 1917 no speedway championship events will be for distances less than 100 miles.

B—The minimum purse for championship events will be at the rate of $100 per mile.

C—No sanctions will be issued for Sunday races of any character.

D—In case a race is prematurely terminated due to accident the disposition of prize money rests with the contest board and the referee.

E—All prize money in excess of $5,000 must be in office of contest board not later than 10 days before scheduled date of race. It must be deposited as a certified check or satisfactory bond. Prizes of $5,000 or less must be deposited in cash or certified check with contest board representative not later than 10 days before scheduled date of contest.

F—No driver shall work on his car between the hours of 8 p. m. and 6 a. m. the night previous to a speedway race.

G—Drivers and cars will be assigned 1917 registration numbers according to championship standing in 1916. The car will carry its same racing number throughout the season.

H—Pit supplies must be on the speedway grounds not later than 5 hr. before scheduled start of the race and in the pits not later than 3 hr. before the start.

I—Speedways will pay the contest board $10 for each car which qualifies and starts in a championship event. The fund so obtained will be added to the championship award fund.

J—The 1917 championship award fund will be divided into five parts. First five drivers must appear at all championship events, unless excused by chairman of contest board, on certificate from technical representative of board, or from physician.

Numerous other minor changes were made in connection with the rules. One was to the effect that all timing and scoring records of any race must immediately after the completion of the race be turned over to the representative of the contest board or the referee.

Chairman Richard Kennerdell of the contest board has decided to visit California for the Vanderbilt and Grand Prize races.

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Estep Goes to Salonica

NEW YORK CITY, Oct. 26—E. R. Estep, formerly in charge of the Packard advertising, sailed last month for Salonica to furnish war news to a syndicate of daily papers. Mr. Estep has been much interested in the war and last autumn visited Verdun and other points on the western front.

Chevrolet's Great Development

New Departments, Increased Floorspace, Additional Machinery and Buildings

FLINT, MICH., Oct. 30—Two large buildings completed, two more in process of construction, several new departments, installation of hundreds of lathes, presses and milling machines, and double the number of workmen are some of the recent developments at the factory of the Chevrolet Motor Co.

One new building 150 by 1000 ft. has just been completed and is now used for an axle plant, engine works, transmission assembly and heat treating plant on the lower floor and as a tool room on the second floor. Next to it and of the same dimensions, is another structure recently finished which serves as an engine works and stockroom. The machinery is erected in the center of the floor, the stockrooms running along one wall with numerous doors from which the tubing, raw castings and other material can be fed directly to the workmen. Both plants are built entirely of steel, brick and glass and embody a novel and valuable lighting and ventilating system. The two walls in each structure, 1000 ft. long, are constructed of glass supported by steel and the thousands of windows are arranged on shifting mechanisms allowing them to be opened at will and throwing a powerful light into every corner of the interior, besides providing excellent ventilation. This system is supplemented by additional glass built in V shape on the roof which also has the sliding shaft allowing each window to be opened. Both structures are equipped with hundreds of new lathes, presses, milling machines and ovens.

A large building constructed in U shape with two sections each 80 by 1000 ft. and three stories high with a court 50 ft. wide in between, is in process of erection and will be used for the assembly of the "four ninety" model when completed. It is built of brick, glass and steel and will probably be ready for occupancy Dec. 1. Directly behind it the company is building a four-story structure which will serve as a power house and heating plant thus giving all necessary power from within the institution.

466,000 Sq. Ft. Added

The new buildings give the company 466,000 sq. ft. of floorspace in addition to their present equipment. There are now double the number of workmen employed 1 year ago and the completion of all buildings in process of construction will witness the addition of 1000 more men.

Many other interesting and important

features have been introduced. There is a large top department where the company paints and attaches Winter tops for the "four ninety" model when so ordered. Many new ovens have recently been purchased and installed for the paint department which have been found to greatly facilitate that work. The frames with the engines and gasoline tanks attached are placed upon trolley conveyors and sent through the first ovens following a coat of paint put on by the flow system. They emerge and pass a short distance, by which time they dry and are ready for varnishing and the second series of ovens. The varnishing is done by spraying machines. All painting is accomplished by the flow method. In the body room one may see a number of bodies arranged upon roller wheeled trucks and standing directly under a long heavy pipe filled with paint. Numerous short thin pipes feed from the main line and each is attached to rubber tubing which ends in a nozzle from which the paint flows by gravity force. Each nozzle is directed by a workman so that the paint reaches all parts of the body flowing from the upper edges to every section below.

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Stutz Wins Tucson Race

TUCSON, ARIZ., Oct. 30—R. H. Delno of Tucson, driving a Stutz, won the 50-mile free-for-all race at the Southern Arizona Fair on Oct. 27 in 51:28. Charles Miller, in a Fiat, took second place. The race was marred by a series of accidents in which three cars were wrecked and four men were injured. There were only five cars entered in the race.

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Hupp United America Car in California

DETROIT, MICH., Oct. 28—The Hupmobile United America car left Salinas, Cal., yesterday bound for Santa Barbara. The party reached Salinas, en route for Universal City on Oct. 26, coming directly by way of San José and San Francisco.

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Baldwin Is Saxon Service Manager

DETROIT, MICH., Oct. 28—G. O. Baldwin has been appointed service manager of the Saxon Motor Car Corp. Mr. Baldwin was formerly connected with the service department of the Studebaker Corp.

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Tractor Demonstration by Bullock Co.

DETROIT, MICH., Oct. 30—The Bullock Tractor Co. has secured 2000 acres of land in Schoolcraft County, Mich., and will demonstrate tractors in farming operations. Practically all of the work on the farm, of every character, will be done by motor power.

Maxwell Issues Open Challenge

All Cars at $1,000 or Less Eligible for Speed and Economy Tests

DETROIT, MICH., Oct. 28—The Maxwell Motor Co. has issued an open challenge to all companies making automobiles to sell for $1,000 or less to compete in speed or economy contest.

The challenge states that the tests are to be conducted by newspaper men or other disinterested parties, and that the tests for speed and economy are to be held between Detroit and any other cities in Michigan. Results of the contests are to be made public through the newspapers. The only provisions specified are that the car must be a stock machine selling for $1,000 or less and that the maker or his authorized agent stands sponsor for the car.

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Accepts Maxwell Defi

G. H. Maines, Flint, Mich., has notified the Cunningham Auto Sales Co., this city, that he accepts its challenge to pit a Maxwell stock car against any other car selling for $1,000 or less, in a speed and economy race in Michigan. Mr. Maines accepts in behalf of the Chevrolet four-ninety, and suggests a race from Detroit to Pontiac, Flint, Lansing and return to Detroit by way of Jackson.

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September Exports Lower

(*Continued from page* 729)

9 months of this year they were 47,246 cars, valued at $32,291,633. There was also a big gain in the exports of parts, not including engines and tires, which showed a gain in value from $10,994,859, in 1915, to $17,322,349, in 1916.

In point of value among the purchasers of American-built cars among the warring nations of Europe during September last Russia held first place, that country's imports of American cars amounting to 670 cars, valued at $1,957,287, while the United Kingdom was second with purchases amounting to 700 cars, valued at $1,684,579. Russia did not figure in the export returns in September a year ago, but the United Kingdom was there to the extent of 2650 cars, valued at $3,119,806, while during the 9 months of last year the latter imported from this country 19,434 cars, valued at $28,648,749. Russia does not figure in the 9 months 8 returns of this year.

653 for France

France imported 653 cars, valued at $1,523,761, from this country in September last, as against 421 cars, valued at $916,830, in September a year ago. That country's purchases during the 9 months' period showed a gain from 4885 cars, valued at $12,126,628, in 1915, to 6497 cars, valued at $16,529,055, in 1916.

Little Denmark figured to the extent of 177 cars, valued at $139,301, in September, last, and 936 cars, valued at $714,412, during the 9 months of this year, Denmark not being included separately in last year's returns. There were 1144 cars, valued at $3,341,676, exported to "other Europe" in September a year ago, as against 248 cars, valued at $232,579, shipped there in September last. For the 9 months' period these shipments decreased from 6688 cars, valued at $18,082,964, in 1915, to 3102 cars, valued at $3,867,419, in 1916. Of course it is to be understood that some of the exports to "other Europe" are included in the figures given elsewhere.

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Black and White Taxicabs in New York

NEW YORK CITY, Nov. 1—The Black & White Cab Co. is now running its full force of taxicabs on the local streets. At the present time there are about 200 of these in service. This company is featuring its service with much lower rates, regardless of number of passengers up to five, which are 20 cents for the first one-third mile and 10 cents for each additional one-third mile. Thus the first mile will cost 40 cents, and all miles thereafter will be 30 cents. These new taxis have electric lighting and an electric device on the outside of the car which illuminates the numbers on the houses and assists the driver in readily finding places. The car presents the appearance of a private limousine. In the Winter it will be equipped with heating apparatus and rugs.

—

24-Hr. Endurance Run in New Jersey

NEWARK, N. J., Oct. 30—A 24-hr. endurance run will be held by the New Jersey Automobile and Motor Club, this city, on Nov. 24 and 25. The run will start and end in this city, and the course will be through North Jersey, covering 250 miles. The competing cars will be divided into two classes. One class will be composed of touring cars and the other of runabouts.

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94 Car Exhibitors at Los Angeles

LOS ANGELES, CAL., Oct. 28—The second annual show of the Los Angeles Motor Car Dealers' Assn. opened this afternoon with ninety-four exhibitors, displaying 226 cars. There are twenty-one accessory exhibits. Fifty makes of gas cars, twenty-two trucks and two electrics are shown. A three-story building and two tents provide more than 55,000 ft. of floor and 6000 visitors were admitted this afternoon.

The Automobile

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Truck Progress

THE outstanding feature of 1916 from the viewpoint of the truck industry is the immense increase in production. The truck bearing the 1917 stamp is, on the average, a better truck than its immediate prodecessor; there have been many engineering developments of a character which show that the truck is settling down into a condition of engineering stability far greater than has ever been the case before. But these lesser things sink into insignificance beside the production figures and the record of factory expansion.

The truck business has been coming for years and it has hardly yet "arrived" in a final sense. The truck industry, as distinct from the passenger automobile business, is not yet beginning to stir the imagination of the financiers, and perhaps this is just as well. The automobile industry had to go through some hard times before it became a staple industry; its finance has often been none too sound in character, in fact it will be some years yet before it is on a really permanent basis. If the truck industry as a separate thing can be allowed to grow more slowly and consolidate itself as it goes, it will be so much the better for it in the end.

The truck industry is a part of the automobile industry in one way, but it is a separate thing in many others; so separate that men experienced in passenger car work, either engineering, sales or in some other capacity, may actually be less fitted for similar positions in a truck firm than outsiders who have no passenger car experience behind them. One might almost liken the two to the army and the navy, sister services, but with totally different duties and procedures. For this reason the financial handling of truck businesses ought usually to be distinct, and the present indications are that this will be so.

Power Braking

WHETHER the device described elsewhere in this issue of THE AUTOMOBILE provides an ideal method of using the engine power to apply the brakes of a car, or whether it has some drawback yet to be discovered, it marks a step in the right direction. That the power of the driver's leg should be utilized to apply the whole retarding force to an automobile is just as absurd as to require hand starting for an engine already provided with an electric generator.

We have eliminated hand cranking, we have electric transmissions and electric gearshifts, we have reduced the pedal pressure necessary for the clutch manipulation, but brakes have not been made any easier to apply. Thus a power brake is a logical step, as logical for an automobile as for a street car. The electrically applied brake has been with us for some time, and it is a remarkable thing that it has not been appreciated. Perhaps it will be now that we have this new vacuum brake which unquestionably will be tried out on a large scale. Directly any number of manufacturers begin to experiment with these devices we shall see the engineering brains of the profession turned to the consideration of brakes in general and the result cannot be otherwise than to cause a great improvement to take place.

Credit Where Due

AFTER the Astor Cup race at Sheepshead Bay THE AUTOMOBILE criticised the management of the track somewhat severely, particularly with respect to allowing the crowd to get on the speedway itself. Last Saturday the Harkness Trophy race was handled much better, the worst feature being the tardiness in the announcement of times and speeds, though this was better than on the last occasion. Better facilities must be used to quickly advise the grandstand of times, incidents, etc. The track guards were as efficient as could be desired.

The pitiable thing was the meager sprinkling of people. It was a great day and there was great racing, yet to look at the stand there might have been a cutting northeaster blowing and only a half-dozen second rate cars on the track. New York has not yet been awakened to the existence of the speedway. It is not apathy on the part of the public, but lack of sufficient means to let that public know when races will take place and what sort of races they will be. The New York public has a thousand attractions thrust before it every day and the speedway needs a few good thrusters to help draw in the crowds that would come if they thought of it.

The Truck's Emancipation

Truck Engineering Now Separated from Passenger Car Design—Many Factors Have Contributed to Evolution — Early Originality Choked by Passenger Car Influence Now Reasserting Itself

By A. Ludlow Clayden

THE design of commercial chassis is not yet as far advanced as that of passenger cars. The motor truck is not yet quite so good for its specific purpose as is the passenger car for its particular class of service. The reason is that the requirements of a motor truck are so much more difficult to meet; the task of the truck engineer is harder than that of his passenger car brother.

The history of the truck has been very interesting. It was the earliest ideal and, if we eliminate the very first years of all, it is safe to say that the success of the railroad in cheapening and expediting the transport of goods inspired a great number of men with the idea that mechanical power ought to be used similarly upon the roads. It is an undoubted fact that the engineering profession generally looked upon the development of the motor truck as quite reasonable at a time when it was ridiculing the passenger car movement.

Practical Trucks Fairly Recent Product

However, despite the greater age of the motor truck idea, it is only within the last few years that we have had really practical machines, and the advance since about 1908 has been greater than in the whole of the previous century. There have been several stages in the modern development of the truck. Sixteen years ago Europe had a number of quite good steam vehicles, and there was some tendency in America to follow the foreign lead. How strong this movement was in England particularly, can be seen by the fact that the heavy vehicle section of the London show in 1904 contained but three gasoline machines, while there were ten exhibits of steam lorries, and of the three one was a very light van.

At the same period in America there was no marked tendency in truck engineering, unless it was toward the electric. Neither for commerce nor for pleasure has the electric ever been more than a curiosity in Europe, but America, thanks to her magnificent electric power stations, was able to build quite good battery cars of all sizes at an early date. There was little or no trouble even in 1900 in making a chassis that would stand up, nor in designing satisfactory electric motors; the battery was the weak spot. Still in the early days of this century electric vehicles were operating with reasonable economy, and the struggle to produce steam or gasoline machines was stimulated as much by a desire to increase the speed and possible operating radius as to overcome any lack of reliability in the electric. It is not easy to draw an exact parallel, but it is not far from the truth to say that in 1905 the steam lorry in Europe and the electric truck in America occupied about the same position in usefulness and public estimation.

Both in Europe and in America, but more especially in the latter country, a very curious situation was to be observed in the years between 1900 and 1907. The manufacturers of passenger cars were provided with two pioneer examples or models, these being the Daimler as originally produced in Stuttgart and the Panhard in Paris. Almost every European manufacturer copied one or other of these two and the majority copied both. In America there was greater originality, but the passenger car men soon turned to copying Europe, except for a small minority of whom Charles E. Duryea was probably the leader. On the whole, however, the passenger car manufacturer has never changed his engineering in such a way that it cannot be traced back to Panhard or to Daimler.

Not so with the truck industry. There seems to have been a fixed impression up to about 1903 in Europe and till a much later date in America that the truck had essentially to be something quite different from the passenger car. The Panhard sliding gear transmission, for example, while admitted for a passenger car was regarded as quite unsuitable for heavy work, and the quickly attained agreement that four cylinders was the minimum for pleasure cars had little effect upon truck engine design. As late as 1906 the typical American gasoline truck, if there was such a thing, had a two-cylinder engine, under the body frequently in conjunction with a planetary transmission and often a single chain drive to a live rear axle. This was partly owing to a strong idea that the ideal truck had the maximum of body space with the minimum of overall dimensions, and accessibility of engine and running gear was sacrified in order to get short wheelbase. Of course the makers of gasoline vehicles had the electric as an example in this respect which may be another reason why so few firms in 1906 or so were developing the type of truck almost universal to-day which had the general layout of the passenger car chassis despite great differences in detail.

Worm Drive at First Truck Show

At the first commercial vehicle show held in America at Chicago in December, 1907, an analysis of the twenty exhibits shows that nine firms were using sliding gear transmission, three planetary gearing and three friction drive: four were electrics and one a gas-electric car. It is also worthy of note that a "startling novelty" was the Mitchell truck with worm drive. Only one of the trucks exhibited had the engine under a bonnet. This show took place at the end of 1907, so to jump to the New York exhibition of January, 1912, is to leap a period of 4 years. Between the machines here shown and those at the 1907 exhibition there is surprisingly little difference, judging by exterior views. *The Commercial Vehicle* published specification tables for the 1912 show, similar to those appearing in this issue of THE AUTOMOBILE, and in them is seen that the majority of light trucks had one, two or even *three*-cylinder engines, at a time when the passenger car was not much different from what it is to-day. Certainly the larger trucks had four-cylinder engines, but friction gearing and planetary gears

were still popular in all sizes and very common for the lighter vehicles. The beginning of the engine under bonnet era is quite noticeable in the machines of this date. The previous year, 1911, is also noteworthy in truck history, because it was in the summer of that year that the Pierce-Arrow worm-drive truck came upon the market, this being a European design so far as layout went and American in all matters of strength. This Pierce-Arrow vehicle certainly marked a definite point in American truck engineering, because it was the pioneer of a type that is in wide employment to-day.

The influence of the manufacturers of passenger cars upon truck engineering has been very considerable. Some of the leading passenger car makers made a success immediately upon entering the truck field, others did not do so, but in the first category must be mentioned Pierce, who had a complete new design in 1911 and White, Peerless and Packard who adopted a more usual method and an easier one, of getting into the second branch of the automobile industry. Knox also should be mentioned as an example of a concern which gradually dropped passenger cars altogether and became truck makers only.

By 1910 or thereabouts most of the leading passenger car builders had developed engines of a very rugged character which were quite reliable and fit for somewhat heavier duty than they normally received. A good number had transmissions arranged amidships which were stout enough to withstand constant gearshifting and possessed a high degree of reliability.

Converted Passenger Cars

The makers of such cars argued with themselves that the essential difference between a passenger car and a truck laid in the strength of the frame and axles, it being essential that these should be able to support a greater load and be able to withstand more severe road shocks. It was therefore a very natural and a very easy development to take the existing transmissions and engines and mount them on a channel steel frame and to provide the transmission with a jackshaft, propelling the rear wheels by means of a pair of chains. Subsequent development has shown that the passenger car engines and transmissions of about this date were really too massive and for this reason they were well able to stand up under the severer conditions of commercial service. To make forged axles of sufficient strength and to build a frame which would not bend were neither of them difficult achievements, so that the established passenger car maker using his already well-tried powerplant and having only frames and axles as new parts was in a somewhat better position than a specialist on truck manufacture who had to develop engines, transmissions and everything simultaneously.

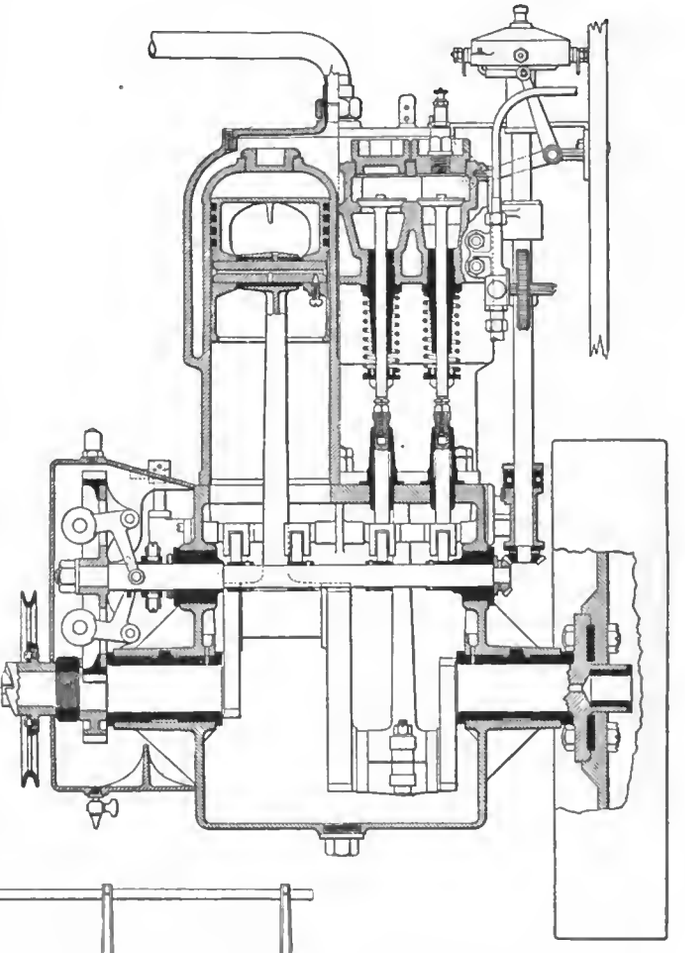
Packard was one of the earliest of manufacturers to add a truck to an existing passenger car line, bringing out a two cylinder vehicle in 1904. This had an engine which was practically half the four-cylinder touring car motor, which was then new, and the transmission was identical with the passenger machine. The illustrations of this car taken from *Motor Age* of 1904 show that the truck of 12 years ago had some points of resemblance to that of to-day.

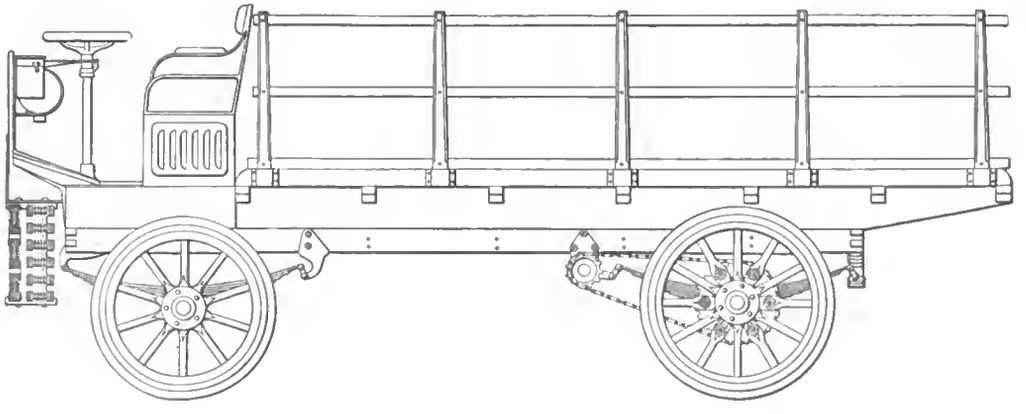
Stock Parts Makers Enter Field

Some of the machines originally created by this method are still being made in practically the same form in which they were originated. Others have but lately been changed by a complete redesign and, meanwhile, the makers of stock engines and other stock parts have entered the commercial vehicle field making large use of their passenger car experience while so doing.

The action of the first passenger car makers breaking into the new field coupled with the development of the stock part manufacturers has completely altered the general makeup of the truck. It was said at the beginning of this article that the majority of passenger cars could always be traced back to Daimler or Panhard and this has now come to be true in the majority of trucks.

Analyzing the development of the truck in this way one is faced with a problem impossible of solution, and this is





Drawings of the first Packard truck with two-cylinder engine and the same transmission as was used at the time for the Packard touring car. Packard used touring car parts in trucks for many years quite successfully

whether the average truck has a four-cylinder vertical engine under a bonnet and sliding gear transmission and some kind of live rear axle, due to the fact that these details comprise the best machine, or whether it is due to the fact that the entrance of passenger car makers into the truck field exercised an overpowering influence on truck design.

For example, the reliability of the present-day truck is extremely good. It is so good that the necessity for placing the engine under a bonnet and so wasting 2 or 3 ft. of frame is still debatable. The passenger car makers used a bonnet because it was their practice, thus following in the footsteps of their European predecessors. We do not know for certain whether it might still be worth while to seat the driver on top of his engine.

Original Design Still Existing

It is unfortunate that so many of the very early truck makers went out of business, for had they continued to exist we should have been better able to judge the real virtues of different types of design. Just to mention one outstanding example the case of the Autocar company may be taken. This concern produced its first truck with a horizontal engine, not under bonnet, in 1908 and it is still making a machine which follows the same general lines. The Autocar truck has a high reputation and the fact that the company has not abandoned their type of power plant is not due to conservatism, since they did experiment with the vertical four but returned to the original construction as preferable.

Again, with respect to transmissions, the planetary types which were abandoned one by one in favor of sliding gear transmissions had not had a tenth of the experience and knowledge put into them which has been given the sliding gear. The planetary transmission, all other things being equal, ought to be more durable than the sliding gearset. The sliding gear is easier to make right. Is it not probable that this is why it is the commonest type to-day? At the present moment the speed change mechanism is regarded as the weakest point in the passenger car. For really efficient operation it calls for considerable skill on the part of the driver. It is noisy, the gears require occasional replacement and there is a quite perceptible drop in efficiency when the indirect ratios are in use. These facts have led passenger car engineers to produce cars with enormously more engine power than is necessary for the work they have to do. Interest in electrical variable speed transmissions is growing very steadily, if not very rapidly, and that the passenger car industry will try out various forms of electrical transmission on a large scale is now assured. It may be next year, it may be the year following, it may not be for 4 years, but the electric transmission year is coming just as surely as the six-cylinder engine was coming in 1911.

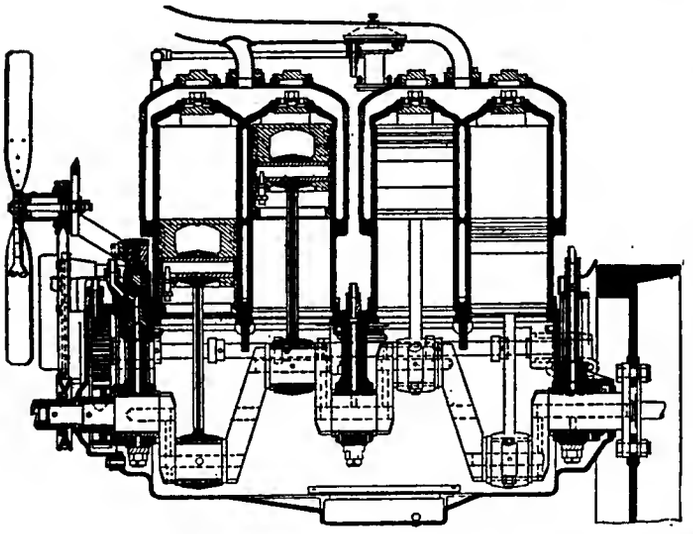
If this happens, what is going to be the reaction on the design of trucks? If the passenger car trade still largely controlled the truck industry it would be natural to assume that any really vital change in passenger car engineering would be followed by a corresponding change in truck design. But it appears now as likely that the big producers of trucks will be truck makers exclusively. It seems more likely that the successful firm making both trucks and passenger cars will split its business into two separate organizations than is it probable that more passenger car makers will enter the commercial vehicle industry. Furthermore, we are now training a large number of truck engineers and in a few years' time there will be hundreds of men who commenced their automobile career in the commercial field, who have never had any passenger car experience, and the effect of this is bound to be noticeable.

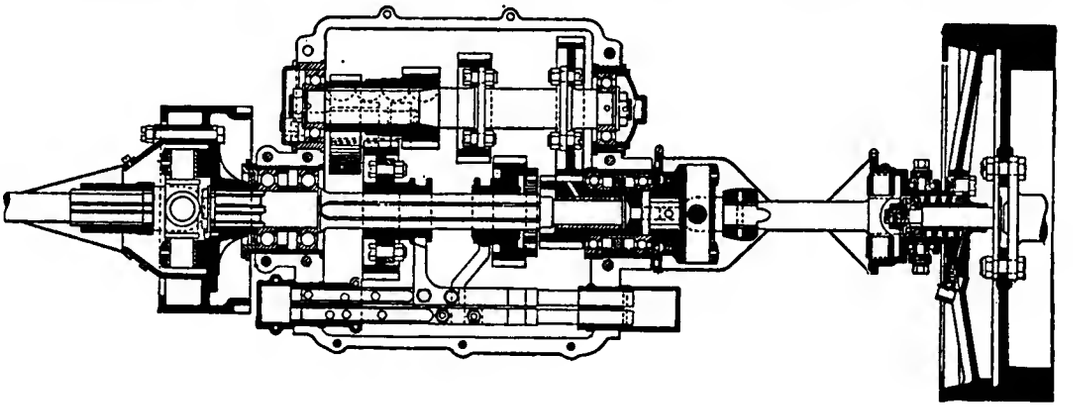
Truck and Car Essentially Different

For one thing it is already quite obvious that there are essential differences between the passenger car engine and the truck engine. They are tending at the moment to grow more different rather than more alike. The majority of truck engines to-day work at their maximum power for a large proportion of the time they are in use, whereas the passenger engine but rarely does this. Consequently, the truck engine needs larger bearings in proportion to the internal stresses at maximum horsepower, its cooling requires to be, if anything, more thorough, and all parts of the engine must be proportioned to resist shocks which need not be allowed for in designing passenger car engines. Again, fuel and oil efficiency are vital factors with a truck engine whereas they are secondary to smoothness and quietness in a passenger car power unit.

It is almost possible to sum up the situation briefly by saying that the truck industry is developing the large, highly efficient four-cylinder engine simultaneously with the abandonment of this type by the passenger car industry.

Turning to transmissions there is very little demand in the pleasure car field for anything except three-speed gearsets of comparatively cheap construction and this is because the bulk of the running is done on high gear. This is not true





The engine and transmission of the first Pierce-Arrow 5-ton truck introduced in 1910-1911. This machine was a combination of American and British practice, the engine being almost entirely American

of a truck and it is only recently that entirely satisfactory gearboxes for trucks have been purchasable as stock parts. Here again difference in ideals is apparent. In a passenger car gearset quietness is much desired. In a truck efficiency, long life and ease of gear shifting all come far ahead of quietness in the list of desired qualities. It is easy to make a good passenger car gearset because the passenger car transmission is used only occasionally. With a truck it is difficult because the transmission is in use for a large proportion of the time.

Of course, when we come to the final drive the truck has always been essentially different from a passenger vehicle. As soon as chains were abandoned on passenger cars and the bevel driven rear axle replaced then it was obvious that the truck of the future would have a different final drive. As long as we continue to use road wheels between 30 and 40 in. diameter it will be impossible to use a rear axle for heavy vehicles with a single bevel gear reduction, solely because of the available space and the great gear reduction required.

Enter the Worm

The rapid development of final drives alternative to the chain dates from the introduction of the worm drive in the Pierce-Arrow in 1911 so far as American engineering is concerned. Of course there had been plenty of rear axle constructions in use before that time, but it was the action of the Pierce company in adopting the worm which really started the great general movement away from the chain. Here again it is extremely difficult to discover the true reasons for various obvious facts. The chain drive, if laid out properly, if chains are good and particularly if the chains are inclosed, has many advantages not possessed by any other form of rear axle drive. The worm axle, the internal gear axle and the double reduction type all have special points in their favor. They are alternative methods of arriving at the same end. On the whole, it is less surprising that we should have four different forms of final drive all giving much the same result than that we should have many more than 400 different kinds of carbureter between one and another of which there is very little to choose.

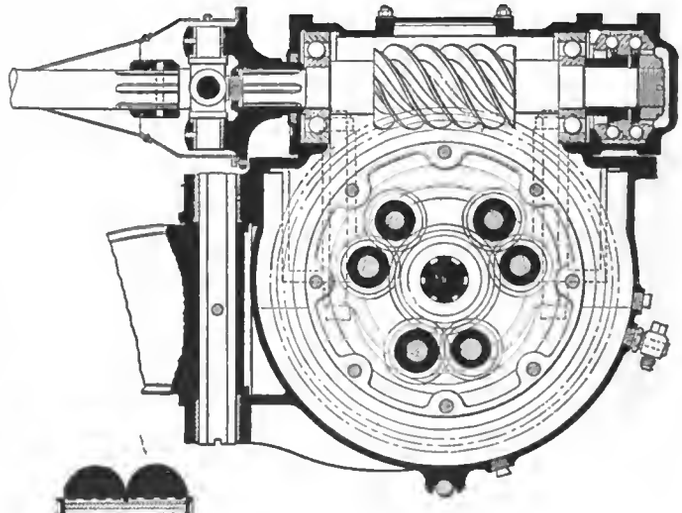
The important fact, however, which it is desired to emphasize, is that whatever the ultimate answer may be with the final drive problem it has got to be worked out by truck engineers, and the passenger car industry can give no help whatever.

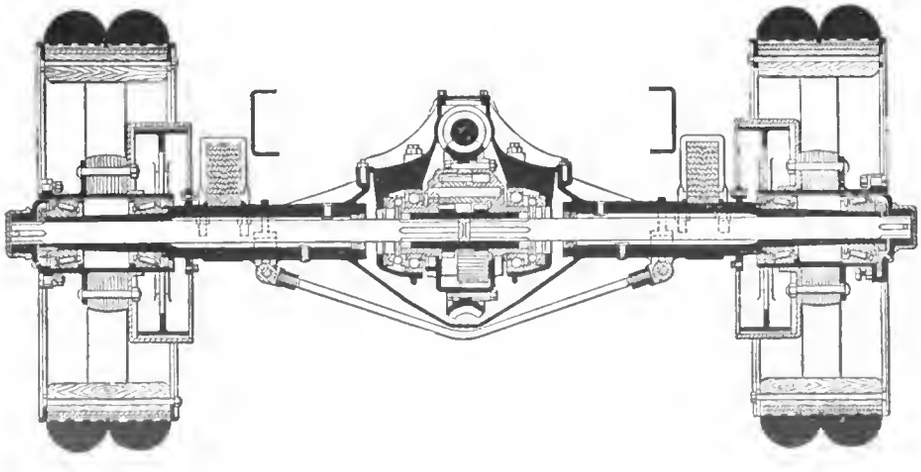
In a sense it may be said that this question of final drive is the first problem the truck industry has had to decide for itself. Previously it has always been able to look for assistance from the accumulated experience of the passenger car manufacturers. Some people occasionally voice surprise at the extraordinary vehemence of the protagonists of the various forms of final drive now being used in trucks, expressing wonder that we have not seen the same situation with regard to the position of the engine, the number of cylinders and every other point of truck construction which has been debatable in the past. The explanation most probably is that a young industry is very much like a young man and is extremely positive when it makes any assertion. The final drive is the first highly debatable subject which has arisen since the truck industry existed as a strong and healthy individual, since it was freed from the apron strings of the passenger car.

Final Drive Petty Question

Actually the question of final drive is one of the least important which the truck industry has to face. Efficient transmission between the engine and the rear axle is far more important, the economic value of trailers is perhaps more important still, while the utilization of fuels cheaper than gasoline is so much the greatest problem that all others sink into insignificance beside it.

To use the oldest metaphor, to argue about the detail design of rear axles is a magnificent instance of the tendency of men to fiddle while Rome burns. It is a fact that the electric power situation interests anticipate a greatly increased use of electric vehicles as a result of price of gasoline. It is also a fact that it is perfectly practical and possible to run engines on fuel far less refined than gasoline. Even though the price of gasoline may fall again it seems incontestable that something a little heavier must always be cheaper than gasoline itself. The automobile industry throughout the world has refused to face the problem of fuel supply right up to the present year but that it has to be faced now is at last realized and work is commenced which ought to have been begun 10 years ago. The user of a passenger car reckons his fuel bill as important, although actually it is but a small proportion of his total expenditure. To the truck user the fuel cost is *vitally* important, so important that the user will find means to employ some cheap fuel even if the manufacturer neglects to tackle the question.





The first 5-ton Pierce-Arrow truck axle with worm drive. This was a purely British design and the worms were at first imported from England but later made here

At the present time there are actually on the market, or about to come upon it, all kinds of devices for utilizing kerosene in engines designed to operate gasoline. Like most specialities of this sort put out by irresponsible people with no reputation to lose, a majority of these heavy fuel devices are of negligible value. The most extravagant claims are made for them, they will be sold in fairly large quantities and they will encourage in the truck user a belief that the successful burning of kerosene in a truck engine is impossible. Perhaps of all the special vaporizers just two or three will give good results. For the *industry* to find out which two or three deserve notice would not be difficult, would not take long, would not call for much expenditure of money. The *private user* will never find out except by happy accident. If 2 per cent of the kerosene-burning attachments advertised are really capable of doing the work claimed for them, this means that 98 per cent of private purchasers of kerosene vaporizers will be disappointed.

The industry, if it likes to take the trouble by finding out which is a good kerosene carbureter and then fitting it as stock or as alternative stock on its trucks, could go far toward reversing these percentages, changing the proportion of satisfied truck users from 2 to 98 per cent.

Another matter which is pure engineering and yet one which hardly any truck engineers having opinions on, is the question of what should determine the width of tire. There is no really good rule for determining the width as to the most economical method of tiring a truck. Some claim that very large tires will have an enormous life and therefore be the best. Others say it is better to use smaller tires and renew them frequently. This is the kind of thing which ought not to be a matter of opinion. It is simply a question of fact and to prove the case needs merely the collection of sufficient data.

Spring Suspension Faulty

Quite a different matter, which is an example of a surprising neglect of an opportunity for ingenious engineering, is to be found in the spring suspension. It is recognized that a truck is more easily damaged by being run light than run loaded. If a truck has springs which are correct for the loaded weight they are bound to be so stiff when unloaded that they become practically solid bars of steel. If we had only the two cases of full load and no load there would be reason enough for endeavor to improve upon the system of springs. But when we remember that the truck must frequently operate in a half loaded condition the importance of spring design becomes even more obvious.

For the sake of the goods which the truck is carrying, if these are of a fragile nature, and for the sake of the truck itself at all times, it is vitally important that the spring should be just right for the load whatever the load may be within the limits of no load and maximum load. Many engineers have evolved systems which will increase the stiffness of the spring automatically as the load increases but these men are usually looked upon as cranks.

Here, undoubtedly, the passenger car is exercising a vicious influence. On a passenger car a fixed spring is satisfactory, but this is no more reason why it should be satisfactory on a truck than does the suitability of beefsteak as an article of human diet prove its suitability for horse feed.

Possibly these strictures on present-day truck engineering may be thought needlessly severe. If this should be the case let it be remembered that the truck as applied to the service of industry is only just emerging from the experimental stage. It is only within the last 2 years that the public of the business world has realized the truck has come to stay. Three years ago the majority of business men in America would have bought horses and wagons with possibly just a passing thought about the truck. If the truck salesman happened to catch them just at the psychological moment the deal was sometimes engineered. To-day the situation is entirely changed, and a man who has goods to transport thinks of the motor truck first of all. We are reaching the stage where the question to be answered is more *which* motor truck than *whether* a motor truck. Before the passenger car had reached the stage of reasonable reliability and efficiency many hundreds of thousands were in the hands of private users. It was the accumulated experience of the individual owner which changed the passenger car from what it was in 1906 to what it was in 1912. It was in the trouble department of the factories that the engineers were able to discover wherein their designs were wrong.

Looking back through the years you can see some of the big things which were done in those 6 years. First, axle breakage was practically ended, spring breakage was very much reduced and last, if not least, the drawback of hand cranking was abolished. To-day we realize that to expect the owner to continually indulge in the athletic performance of cranking his engine was ridiculous, but one would have hesitated in 1906 to say that the absence of a self-starter was an absurdity.

Particular Problems of Truck Engineering

The truck industry has only just been given the opportunity of waking up to the peculiar particular problems which concern it vitally and have nothing whatever to do with the passenger car, and one of these is variable spring suspension. There is nothing so risky as prophecy, but there are just three things in truck engineering which seem bound to come:

One is the variable springing just mentioned.

Another is the use of cheap fuels.

The third is an improvement in the transmission system so that a wider range of variation is obtainable with even less skilled operators.

The four-cylinder engine does its work so well that there is little reason to anticipate any early change with regard to the power unit.

In frame design we may see still greater care, for flexibility we may see something like a three-point suspension for the body on the chassis or we may see flexible bodies which will weave with the frame.

A little detail which is coming, and not before it is needed, is a better protection for the driver. A high dashboard with a cowl excluding side doors and even windshield are things which tend to increase the comfort of the operator and therefore increase his efficiency. The cost is very small and there is no reason save custom why they should not be provided.

Of the debatable points in truck futures none stands forth more prominently than the trailer. Is it a real advantage or will it prove an economio mistake on a large scale? Manufacturers and users are divided on the question just now, but it will only take a year or two to prove the issue. Almost certainly we shall find that trailers pay under some conditions and do not do so under others. There is a chance here, though, that we shall make a discovery that may not be altogether anticipated, and this is that there is a real field in ordinary commerce for some form of road train.

The road train has hitherto usually been too complicated and too costly to permit it to be tried out on a large scale, and no small scale experiment can prove anything very much, but road trains could be built much simpler, especially gas-electric road trains. In Europe development is continuing steadily, which means that data are being collected and that we may one day wake up to find the road train a factor to be reckoned with. On the other hand it may die out in competition with the tractor and plain trailers. The thought just now is that the situation ought to be watched carefully; the truck is breaking away from the passenger car in engineering as in many other things and no man yet can tell how wide a breach the future is to show.

1916 Output 98,000 Trucks

58,000 Built in First 6 Months of Year—116,000 Predicted for 1917—Better Manufacturing Methods Overcome Increased Materials Cost and Higher Wages

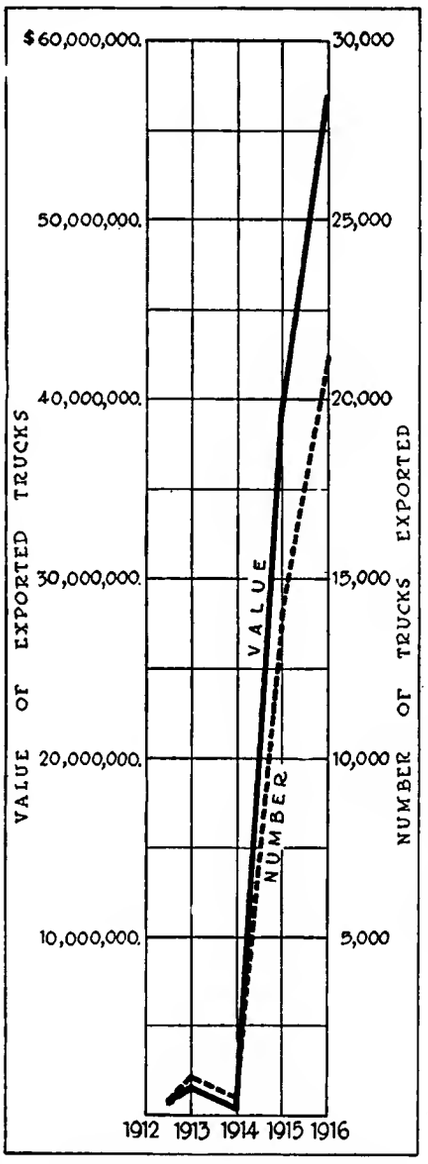
By Donald McLeod Lay

ALL production records in the history of the American motor truck industry will be shattered by the output of 1916, a total of 98,000 commercial vehicles being scheduled for the year. Of these approximately 58,000 were built during the 6 months covering the period from Jan. 1 to July 1. As compared with the number of trucks built in 1915, the current year will show an increase of 25,000, the total for the 12 months preceding Jan. 1, 1916 being 74,000 vehicles. For 1917, still greater expansion is promised, an estimate for the total output based on data furnished by the manufacturers being 116,000 machines.

In contrast with the big development of the motor truck industry in 1915, when production more than doubled over that of the previous year, jumping from 35,000 to 74,000, war business has played a decreasing part in the still greater volume of business which characterizes 1916. Although thousands of trucks are still pouring from our factories in response to orders from the belligerent governments of Europe, our manufacturers have realized that this business is at best merely temporary and are bending their efforts to widening the domestic field and building up new markets for export. And as war orders are being completed, production does not decline throughout the industry as a whole because the enlarged requirements of the business men of the United States and other countries keep the factories working at top speed. Unlike the war order business, this increased demand means permanent benefit to the manufacturers and practically all of them realize this fact. This is one reason why the estimate of motor truck production for 1917 is nearly 20,000 higher than that for the present year and it must not be forgotten that war orders are not reckoned as a factor in the business of the coming year.

From data furnished by the manufacturers approximately 50 per cent, or 49,000, of the 98,000 trucks, to be built during 1916, will be of 1500-lb. capacity or under; 25 per cent, or 24,500, will be of the 1, 1½ and 2-ton types; 20 per cent, or 19,600, will be of 3 and 3½-ton capacity; and the remaining 5 per cent, or 4900, will be vehicles of 5-ton capacity and over.

The field for the light delivery vehicle has been considerably widened this year by the introduction of numerous devices and attachments for converting Ford chassis into machines of this type. There has been a normal proportion of increase in the demand for practically all the various capacities, although the large numbers of the vehicles of medium capacity ordered for military purposes in Europe and by the United States Government for service on the Mexican border have greatly increased the production of these types. It must not be overlooked, however, that another cause for the striking acceleration in the manufacture of light delivery cars is the tremendous development of its field in the small towns and semi-rural communities where the grocers, butchers, dry goods stores, plumbers, and others have at length awakened to the possibilities of broadening their businesses by means of these machines. This year has also seen remarkable progress in the adaptation of the heavy commercial vehicles to numerous branches of industry, contractors, lumbermen, road builders and others finding these types of enormous value both as time and labor savers.



Number and value of motor trucks exported in the past 5 years

While the motor truck industry profited considerably by the European war, which not only increased the demand for commercial vehicles for war purposes but also opened new avenues of trade in the export field, the high materials prices caused by the conflict constituted the most serious hindrance to the increase of production during the year. When it is considered that malleable iron is 33 1/3 per cent higher than before the war, steel bars 40 per cent higher and alloy steel 100 per cent higher, it is no wonder that a number of our manufacturers have been obliged to increase the prices of their vehicles. Nor are the materials mentioned the only ones which are used in motor truck construction that have been increased in price due to war conditions. Among others may be mentioned cold roll steel 60 per cent higher in price than in normal times, forging billets 90 per cent, carbureters and brass work 25 per cent each and woodwork 20 per cent. Leather is much higher, aluminus more than double its previous price and many other materials which are used directly or indirectly cost the manufacturer far more than was formerly the case. In addition to the increased cost of materials the motor truck manufacturer has had to contend with labor difficulties due to demands for higher wages, shortage of skilled mechanics and factory workers

and higher costs of transportation. Improved manufacturing methods such as systematic layout of plants, progressive assembly methods, better equipment and higher general efficiency have enabled the truck builders to successfully overcome the difficulties presented by higher production expense in almost every instance and it is solely due to the development of these factors that the prices of motor trucks of all types have not been considerably advanced. Moreover it is the continued use and more advantageous adaptation of these methods which will enable the American commercial vehicle manufacturer to compete with the European product in the export field after the war is over. From the reports of the progress made during 1916 in the direction of reducing expense of manufacture another feature which promises to be of value in this connection is the policy of many companies to produce as much as possible of each vehicle in their own plants. A number of parts which were formerly purchased outside are now manufactured at much lower cost, thus doing away with not only the additional expense necessarily entailed by having them made in another plant, but also with the cost of transportation and frequently of unpacking, handling, etc.

In keeping with the more settled character of the industry, the manufacturc of motor trucks is getting away from the seasonal activity which characterized its early years. Demand is of course not yet entirely coordinated with production, but it is much more uniform throughout the year than was formerly the case and indications are that a steady improvement will take place from year to year. July and August seem to be the only months when the truck factories show any tendency to slacken the pace of production and even at this time of year they are far from idle, many of them being obliged to work night and day to keep up with their orders.

Refinancing to provide for factory and general business expansion has not as yet become as general in the motor truck industry as with the passenger car builders, but during 1916 several large companies have been obliged to expand their plants so rapidly and to such an extent that additional working capital was imperative. Entire new factories have been built this year and factory additions costing millions of dollars have been erected and others are still under construction, machinery and other plant equipment has been ordered in prodigious quantities and yet the working forces of the various factories have been only slightly increased, showing that better manufacturing methods and improved facilities have played an important part in this year's record. As an example of the heightened efficiency which is typical of truck factory operation, twenty-three of the leading manufacturers reported an increase in production for the year just double the increase in the number of men employed.

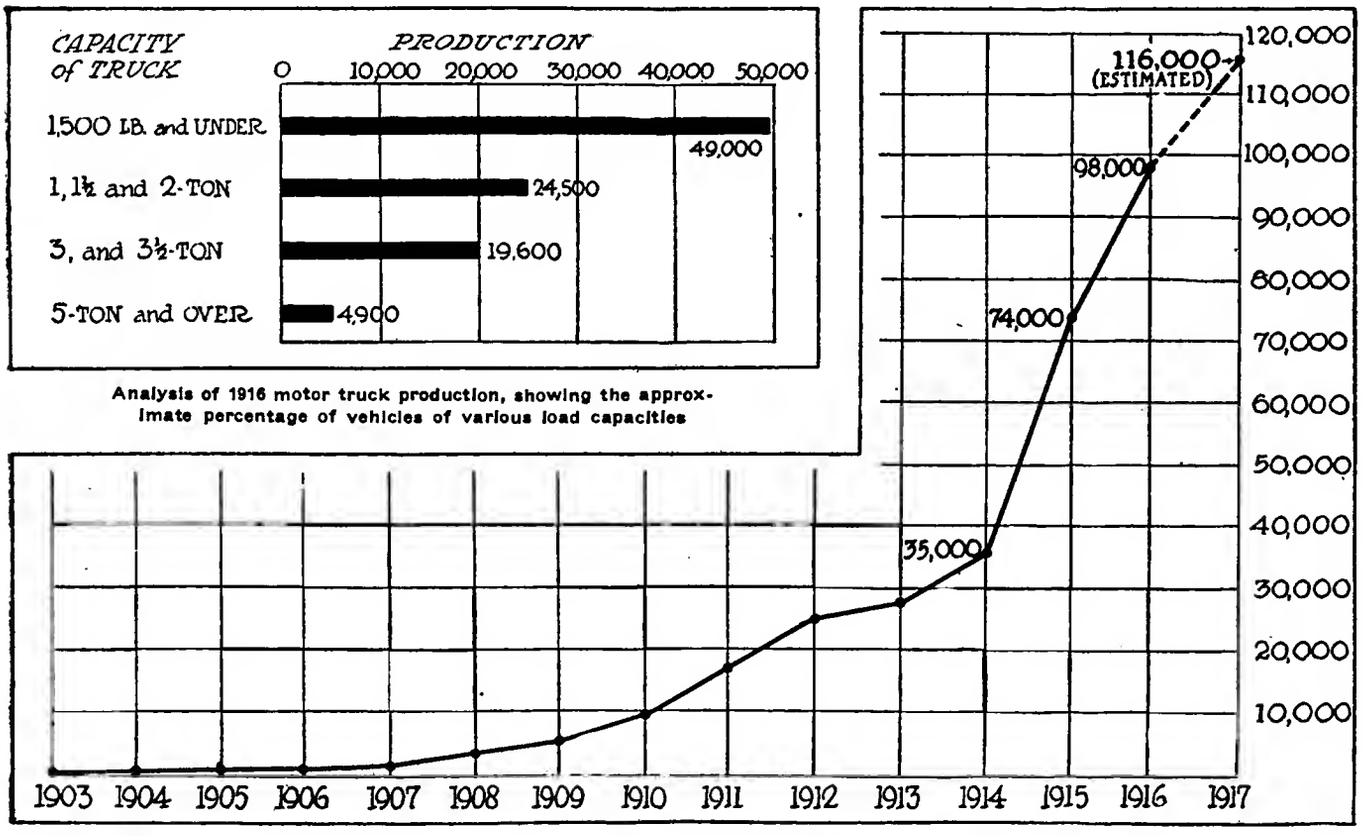
The increased difficulty of obtaining materials had a marked influence in holding up deliveries of trucks from the factory as well as interfering with production schedules, frequently making it impossible to run a plant on an even basis. Gear-sets and shafts, alloy steels, aluminum forgings, wood, tires

(*Continued on page* 780)

Distribution of Truck Makers

State	Truck Makers
California	17
Colorado	..
Connecticut	4
Dist. of Columbia	1
Georgia	2
Illinois	42
Indiana	13
Iowa	9
Kansas	1
Kentucky	3
Louisiana	1
Maine	1
Maryland	2
Massachusetts	13
Michigan	40
Minnesota	35
Missouri	10
Nebraska	2
New Jersey	7
New York	44
North Carolina	1
Ohio	46
Oregon	..
Pennsylvania	24
Rhode Island	1
Texas	1
Virginia	1
Washington	6
West Virginia	2
Wisconsin	13
Total	342

Analysis of 1916 motor truck production, showing the approximate percentage of vehicles of various load capacities



Curve of motor truck production in the United States each year from 1906 to 1916, with an indicated estimate for 1917

Few Changes in Truck Design

Some Expected Developments Arrive But Others Fail to Appear —Light Delivery Machines More Ruggedly Constructed—Hint of Return to Right Steering—Electrical Equipment Gaining Fast

AN analysis of the alterations in truck design made from the specification tables published elsewhere in this issue indicate a settling down in design rather than much that is new. It shows that some tendencies observed a year ago have proved to be permanent, but it also shows that some things which threatened were not true indications. Summing up everything, it is possible to state positively that the main indication is that the engineering of the truck is getting more away from that of the passenger car.

It is especially to be observed that the lightest commercial vehicles are being produced as purely truck designs, although a majority may still be passenger car chassis, which is due to the fact that delivery vehicles are never called upon to sustain such high speeds as are demanded for passenger cars while they are required to cover very much more ground in a day. Ruggedness and greater weight are, therefore, much to be desired for delivery vehicles which are to see severe service.

Two years ago, the 1000-lb. truck was much in the public favor and a great number were built. Some of them were very light and were designed for package work where the weight of the load was a negligible factor and cheapness and speed were the prime requisites. Others were very elaborate and were designed for the severest sort of service, including overloading.

Experience has shown that many of these were used for ¾-ton loads and that their owners preferred them to 1500-lb. cars because they were lighter and cheaper to operate. This has resulted in minor changes in the design of many of these to adapt them to 1500-lb. loads with a corresponding increase in their capacity ratings.

Overloading Less Habitual

Somewhat the same change is noticeable all through the range of capacities, accountable largely to the fact that owners are a little less prone to overloading their vehicles, having learned from experience. Dealers are learning to gage the requirements of buyers better and to recommend fearlessly trucks of ample capacity instead of claiming unreasonable overload capacity for their wares. Manufacturers are building more intermediate capacities so that the owner is not tempted to choose the smaller of two trucks for a load midway between their capacities.

In the design of trucks there have been several contradictory tendencies. For example, after a three-year period during which the left-steering-wheel position came into prominence and bade fair to oust the right drive entirely, this rapid progress has been stayed and a smaller percentage of trucks have left drive for 1917 than was the case for 1916.

Among those who have forsaken left steer either throughout their lines or on their newer models are the makers of the Chase, the Koehler, Krebs, Little Giant, Selden, U. S., Universal and Watson.

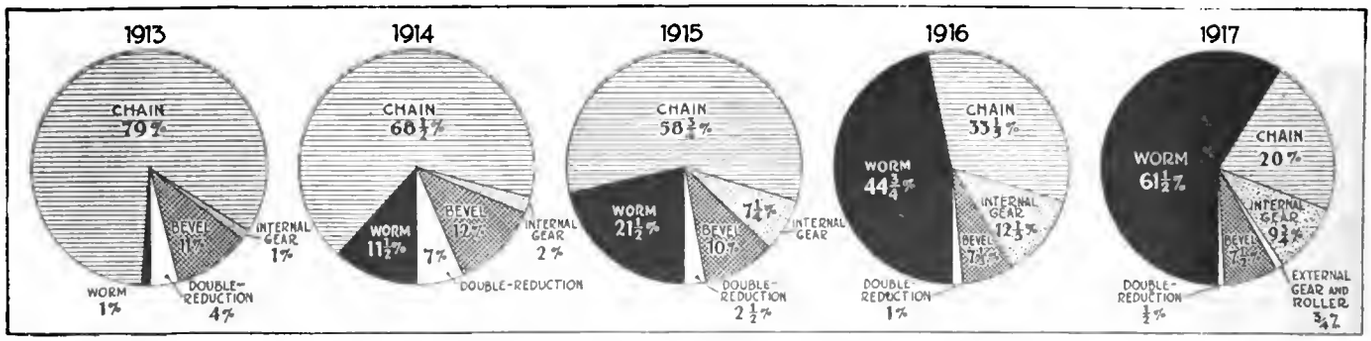
This condition has been influenced to some extent by European orders, which, of course, require right steering, but there has been a well defined insistence on the part of American buyers in some classes for right steering. This is especially the case with those who operate their trucks on country roads, since it is very difficult for the driver of a left-steered truck to determine how closely he may approach the ditch on the right side, and with the present prevalent narrowness of improved country roads and the concealed ditches this argument becomes a weighty one.

Frames More Flexible

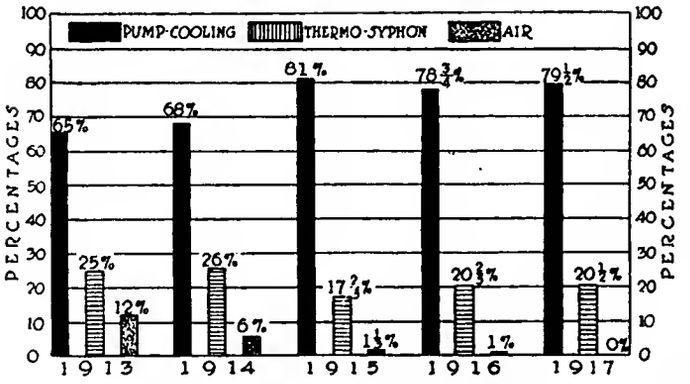
The improvement of truck design has extended even to the framework. In former years few gave any special thought to the frame of a motor truck, deeming that its office was to be strong enough to carry the load and stiff enough to keep the parts in their proper relation. Lately, however, the advantages of the flexible type of construction have been realized to a greater extent, and while many makers still adhere to rigid construction, relying on the springs entirely for compensation for axle movement, there is an increasing number who are adopting the flexible forms. The majority of makers are using what may be termed the semi-flexible form of frame, usually of pressed steel and yielding to severe stresses while remaining stiff against minor ones.

The steel wheel is once more in evidence, this time in a fewer number of forms, the cast type predominating. Doubtless the difficulty of getting wood wheels for part of the time this year has had its influence, but it is safe to predict a growing application of steel wheels to the heavier capacities.

Federal, Gramm-Bernstein, Knox, Republic, Walter and Zeitler & Lamson trucks have recently had steel wheels substituted for wooden ones as standard construction.



Diagrams showing decline of chain drive and rise of worm. Internal gear seems to have replaced the double reduction type meanwhile, and the plain bevel is dying out



Fluctuations in Cooling System Design

In wood wheels, the square spoke is the most popular type, since it affords a wider bearing on the felloe and is actually cheaper to manufacture than the older oval type.

The dual tire, after being outnumbered by the single, on the rear wheel, in the year 1915, has regained its advantage in the 1917 models. This is hard to account for, but no doubt is due to popular prejudice against wide single tires. The single rear tire, however, is gaining, nevertheless, in a way that does not show itself in the tables. Users of trucks all over the country are replacing dual tires with singles and many of the manufacturers who provide dual tires as standard equipment find many users who are willing to pay a slight additional charge for single-tire equipment all around.

Failure of more manufacturers to put large pneumatics on trucks from 1 ton upward is disappointing, although with the great activity and favorable opinion on the part of many of the tire makers there are good grounds for the expectation that before 1918 a number of models of 1½- and 2-ton capacity will appear with pneumatic equipment.

Electric Lighting and Starting Increases

A development which has been long in coming but which may be said to be with us to-day is the provision of automatic starting means for the truck and of electric lights. This comes as an expected development, if not one somewhat overdue. Formerly electric lighting and starting was principally confined to the lighter vehicles, but for 1917, out of thirty-eight manufacturers fitting electric lighting or starting and lighting systems as stock equipment, more than half are of medium to heavy capacity.

Automatic spark advance which it seemed at one time would become prevalent has not progressed of late, due probably to its cost, although appliances of lower cost are being developed. It would also seem a simple matter to use the same centrifugal governor which most trucks use to control the engine speed to take on the extra duty of advancing the spark.

That both hand advance and fixed-spark systems continue to have strong adherents seems to show that each has advantages not possessed by the other, and only combined in the automatic system. The hand advance permits greater economy of fuel if properly handled, than the fixed spark does, and permits the engine to pull better in difficult going. The fixed spark, however, is fool-proof and does not subject the engine to the wasteful abuse incident to improper handling of a hand-spark advance.

Hotchkiss drive has been steadily coming and to-day it is in the majority. There are a number of makers who use Hotchkiss drive, even on 5-ton and 6-ton trucks; but in the majority of instances its use is confined to trucks of medium capacity. This is because the thrust or propulsive duty on the spring assumes such great proportions in a heavy truck that nothing but the best type of spring with especially large and rugged pinning at the driving end can give satisfaction. During the year, several makers have removed radius rods from some of their models, however, due, possibly, to a better understanding of requirements for Hotchkiss drive.

Most of the new makes which have appeared during 1916 have had Hotchkiss drive in addition to which new models of the following makes, most of which formerly employed radius rods or torque members or both, have incorporated drive through the springs: Commerce, Dart, Hurlburt, Jeffery, Kisselkar, Little Giant, Moreland, Old Reliable, Republic, Royal, Selden, Stegeman, Stewart, Tiffin and Wilcox.

Associated with this trend has been development in regard to driveshafts. It has been the ideal of many designers for some time to reduce the truck chassis to the same simplicity which is noticeable in the newer designs of passenger cars, by means of unit power plant grouping of the engine, clutch and gearset and final drive by a single shaft with two universals.

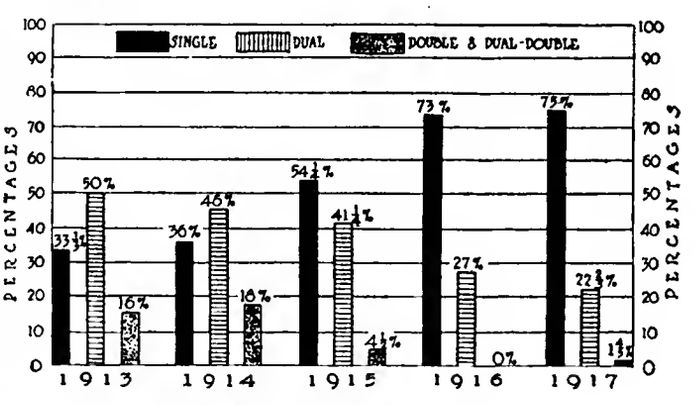
Difficulties, however, have been encountered in the excessive length of such driveshafts due to the long wheelbases possessed by the medium to larger trucks. Passenger car methods cannot be pursued here as small, solid shafts of such length are prone to whip and whirl, rapidly playing havoc with the universals, axle bearings and gearbox bearings. Accordingly much experimenting has been done with shafts made of large-diameter tubing, which with greater strength and little if any greater weight, are much stiffer than solid shafts. Remarkably good results have been achieved on wheelbases of considerable length, but for the longest wheelbases it has so far been imperative that the shaft be cut into two lengths with a stationary bearing between the sections.

Divide Propeller Shaft

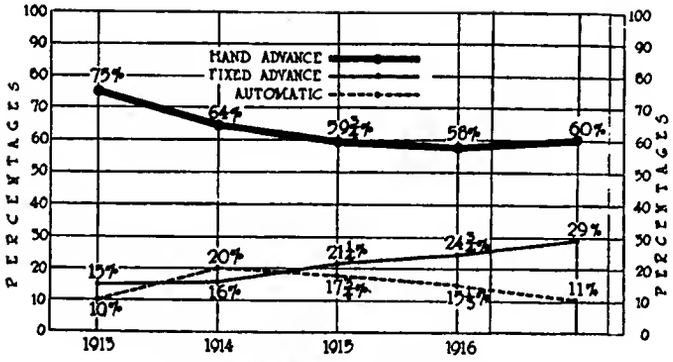
Some makers have provided this bearing at about the middle of a two-part shaft, others splitting the shaft by interposing the gearbox between its two sections. This latter practice has given rise to a decrease in unit powerplant assemblies and increased the percentage of makers who locate their gearsets amidships. Some of these, who have recently brought out new models with amidships gearsets where formerly they favored unit powerplant assembly are: Old Reliable, signal, Wilcox, Dayton and Diamond-T.

The disinclination of the American operator to shift gears more often than avoidable is reflected in the failure of the four-speed gearset to make more progress. It has, in fact, lost slightly in favor of the three-speed, despite the recognized fact that four-speed gearsets give the truck greater ability in difficult going and particularly in hilly country.

Somewhat of the same effect has been accomplished, however, by a slight increase in the size of engines and slightly greater gear reduction. More of the makers than ever are fitting governors, their undoubted tendency to restrict power on the lower speeds being avoided in an increasing number of cases by controlling from the driveshaft instead of the engine or by using the combination drive from both the engine and driveshaft.



Steady gain in single ignition



Hand advance still usual spark control

For example, Armleder, Old Reliable and Service models which formerly did not have governors, have for 1917 been equipped with the driveshaft-driven type. The Couple-Gear and Studebaker, formerly without governors, are now provided with the front-wheel driven type. New models of the Commerce, Globe, Old Reliable and Denmo have driveshaft-driven forms and duplex-driven governors have been adopted recently by Old Reliable, Thomas and Zeitler & Lamson.

During 1916, however, the situation in both the material and labor markets has resulted in sharp increases in the production costs of motor trucks. Prices have not increased in anything like equal proportion with the increased cost of material and labor, in fact, not even in proportion to actual production costs.

Production costs also have not increased as much as costs of material and labor for the reason that with increased production most of the factories have been able to use both more effectively, and particularly labor, and, with a greater output, in many cases with very little increase in overhead, they have been able to afford a smaller margin of profit on each truck, with increased gross earnings notwithstanding.

The range of models of motor trucks continues about as it has been for years past except that there are more of the intermediate capacities, while the average capacity of models produced remains about 2½ tons, as it has been for several years.

In the range of models from less than ½ ton up to 7½ tons and tractors, there is a definite division into two classes, the first being the delivery vehicle class and the second the heavy-duty truck.

The former embraces capacities up to and partially including the 1-tonner and the latter begins with the ¾-tonner and goes up. Production of delivery chassis outnumbers that of trucks two to one, and of the heavier trucks, those which might fall into a medium class, that is, from ¾ to 2 tons, represent a number equal to all of the balance, including tractors.

Light Chassis Means Quantity Production

Hence it is plain that the light chassis business is one of quantity production, and it is easy to understand why 50 per cent of the vehicles are built by 10 per cent of the producers. Delivery vehicles are usually mounted on pneumatic tires, each year witnessing a lesser percentage of chassis in this class equipped with solids. This is because only with pneumatic tires is it possible to run a vehicle at high-delivery speeds, without rapid tire and mechanical depreciation.

Capacities change but little year by year, due to the necessary conservatism in making radical changes in this respect, but a survey of developments in the last 5 years shows that the greatest gains have been made in two intermediate models, the 2½-tonner, a comparatively recent development, and the 3½-tonner which has been gaining steadily for years. The 3-tonner and the ¾-tonner have been losing steadily, since these capacities were set arbitrarily by manufacturers before the industry had built sufficient trucks really to know what was demanded.

The price change this year has only amounted to an average of $137, most of the models being increased but little. It is the trucks of less than ½-ton and of ¾-ton capacity whose prices have undergone the greatest increases because of the abandonment of many antique designs in these capacities in the face of the popular demand for better quality and stamina in the low capacities. These trucks average much higher, but they are also immeasurably better vehicles than were formerly offered, and to-day one may buy a truck of ½- or ¾-ton capacity which will give the same reliable and enduring service as the best of the heavy trucks.

That it has principally been the small to medium assembler who has been obliged to increase his prices is an instructive phase of the situation. This is undoubtedly because the large manufacturers, building a considerable percentage of their trucks in their own plants, such as Packard, Pierce-Arrow, Peerless, Riker and White have been able to secure raw materials sufficiently in advance to prevent any serious shortage, and, making their own parts, have not been affected by the shortage of some of the components occasioned by labor troubles in the plants of parts manufacturers.

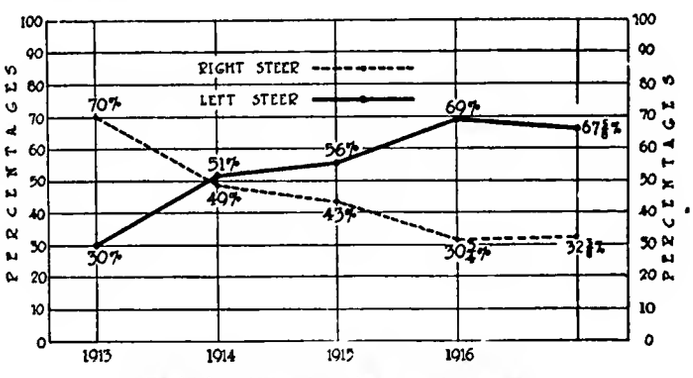
Large Producers Less Affected

The large assemblers have also in most cases escaped serious curtailment of production or delay of deliveries because their orders were of such size as to give them precedence over smaller concerns in the parts markets. Not all the big assemblers have had this good fortune, however, and some have found the supplies of parts too precarious for comfort.

As a possible avoidance of this danger, a few have undertaken to do more manufacturing in their own plants and even the smaller builders have installed more machinery for the simpler machining operations instead of having this work done outside on contract.

It may be questioned whether this is a permanent state of affairs, for the supply difficulty cannot be more than temporary; yet it is argued that a manufacturer of trucks who is equipped for the production of a good many parts is in a stronger position than one who does nothing except assemble his vehicles.

It seems unlikely that the ultimate situation will be an exact parallel of conditions in the passenger car trade, at least not for some years to come. It is going to take a good long time for the parts makers to develop their truck business to vie with their passenger car trade, and design being less fixed makes it harder for them to supply the precise needs of the moment. Thus we see instances of motor truck firms exerting their influence upon the design of the parts they buy. Some have designed engines which they are now having made for them; others have their own ideas in rear axles or universals and so on. Probably this means that the truck manufacturer is doing his best to help the parts maker and this cannot be otherwise than to their mutual advantage.



Right hand steering shows an increase

British Favor Gasoline Tractor

Experiments Being Made in England are Encouraging—Need for Cheap Machines After War

AMERICAN farmers are liable to look upon the diminutive farm of England as more like a garden than a real producer of crops, and to some extent they are right. Still cultivation in England has never been what it might be and there is a great change coming. During the past summer a paper on tractor farming was read by C. B. Fisher before the agricultural section of the British Assn., a scientific body of an eminently practical nature. The following digest of this paper taken from *The Engineer*, London, shows that there is plenty of interest in the subject and suggests a good market for the less expensive American tractors after the war. That there is a splendid market in France is already assured:

"The author claimed that motor traction had now got past the experimental stage, and the present need of the agriculturist was for advice as to the best types of machines to employ for particular cases. Comparisons of different tests under different circumstances on different soils, without further accurate information, both as regards the horse *vs.* mechanical power, of cable *vs.* tractor, or of various makes of machines, were practically worthless. In the first place, the variation of the dynamometer effort required to move different soils was enormous, and it was useless to compare a machine tested on a good soil, on which the pull required for a single-furrow plough, 9 in. wide and 5 in. deep, was approximately 500 lb., with another make of machine ploughing heavy clay, which required generally 1000 lb. pull, but which when really hard and dry would register 1200 lb., and would be heavy work for four horses to one plough.

Steam Plow Costs $15,000

"Equally important was the question of horsepower. Every maker stated the horsepower of his engine, and the intending purchaser compared the price and weight per horsepower of various makes of machines, and possibly the consumption of fuel per horsepower for work done, in order to arrive at their comparative value, but this was worse than useless in the absence of a uniform basis for calculation. It would be of great assistance if some uniform system of rating were adopted and insisted on by the Board of Agriculture for motor tractors. Care should also be taken to base calculations on equal prices for fuel and labor. The cost of a set of steam ploughing and cultivating tackle was about $15,000, and although the life of it was from 20 to 30 years, it was an outlay too heavy for the individual farmer.

"The author's personal experience had been acquired with a 20-brake-hp. universal tractor, made by Saunderson and Mills,* and the only appliance specially purchased to go with it was a three-furrow plough, all the others being the ordinary farm implements with the attachments altered. The duties to which the tractor was put were ploughing, threshing, and hauling. In ploughing three furrows the fuel consumption was 3 to 4 gal. of kerosene, 1 qt. of gasoline, and 3 pt. of lubricating oil to the acre. Threshing operations with a full-sized machine, with straw trusser attached, or the engine working the elevator, took approximately 2 gal. of kerosene an hour, 1 qt. of gasoline, and 3 pt. of lubricating oil per day, and the owners recently threshed one rick of oats, 66 quarters, in one day. The motor tractor showed a saving as compared with the ordinary method of threshing of 28 cents per quarter, and, in addition, it drew water. There would be a less saving when threshing wheat, but it might be taken at 12 cents a quarter. There was an enormous advantage in having the machine always ready when required, and only those who had formerly hired threshing machines could fully appreciate the benefit. The tractor had displaced horses for hauling. It would draw 5 tons at 5 m.p.h. on the road, doing three journeys, totaling 18 miles a day, on about 7 gal. of kerosene.

*A British machine.

Uses 1 Gallon per Acre

"The use of the tractor with self-binders was a striking illustration of its satisfactory employment. Two binders, which were easily pulled by the tractor, would call for the use of twelve horses for a full day's work. With the motor tractor and two binders up to 30 acres could be cut in a day, and the kerosene consumption was about 1 gal. per acre. The tractor had been used with equally satisfactory results for scuffling, rolling, and harrowing, and he had no doubt it could be used for drilling and mowing. He believed that Mr. Saunderson, the maker of the machine, had recently purchased a heavy clay land farm of 240 acres in Bedfordshire, which was being entirely operated by motor power, for experimental purposes. The full statistics were to be published shortly.

"With regard to the life of a high-speed engine employed on farm work, while much depended on the person who had charge, he would be inclined to base calculations for depreciation on a period of 6 years. He had referred to only one type, of which he had personal experience, but he believed that the value of other makes had been demonstrated. The motor ploughs in use were the Fowler-Wyles, the Wyles, the Martin, and the Crawley, which ranged in power from 10 to 30 hp. The tractors available were Weeks' Dungey Simplex, Big Bull, Mogul, Daimler, Universal, Sanduskey, Overtime, Ivel, Fairbanks Morse, Emerson and Omnitractor. The best known steam tractors were the Mann and the Ransome. He knew the users of some of the different makes, and in no case, under present circumstances, had they regretted their purchase. There was difficulty, however, in obtaining delivery, particularly of English machines.

Criticizes American Design

"British makers had made a particular study of the requirements of the agriculturist. One particular feature in which many of the American machines were lacking, was their unsuitability for haulage. He was personally in favor of a 20 to 25-brake-hp. engine for the farm machine. It should weigh from about 3920 lb. up to about 5600 lb., and should cost from $1,250 to $1,750. It should be fitted with three speeds forward and reverse. The motor tractor opened up possibilities of solving the question of reconverting the strong wheat land to its proper purpose, and thereby increasing the power of employment. It could and would raise the standard of wages by turning the agricultural laborer into a skilled mechanic. If the nation had decided that one of the chief lessons of the war was the necessity for a greater production of foodstuffs at home, the makers of motor tractors had a great opportunity of supplying the needs of the agriculturist. The farmer, before outlay of capital, would, however, require some stability in the price of wheat.

Military Truck a Complicated Problem

America Faces a Problem Quite Different from That of Any European Nation—Admixture of Engineering and Commercial Questions Makes Ultimate Solution Difficult to Forecast

By A. Ludlow Clayden

IN deciding originally upon its so-called "subsidy" specifications for motor trucks the British government called well known engineers into conference, and this plan is to be continued after the war in settling the future of military motor trucks.

There are two powerful organizations in England corresponding almost exactly to the S. A. E. and to the N. A. C. C., these being the Institution of Automobile Engineers and the Society of Motor Manufacturers and Traders. It has just been announced that all future research work relating to automobiles for government service of any kind will be taken care of by a committee having its membership made up mainly of representatives of the I. A. E. and the S. M. M. and T. with the addition of some officials directly appointed by the government.

It is common talk in England that this new committee will be started on its work before very long, and that its first task will be to draft specifications for military trucks down to the last cotter pin, determining the designs from the vast stores of experience gained in France and elsewhere during the past two years.

It is possible for a great military power to specify in this sort of way, to own huge fleets of vehicles and to hand out drawings to which manufacturers who want to contract may work; just as can be done with parts of guns or with shell and fuses, but there is a danger in adopting this system in that it may convert the military truck from a commercial article into a specialized one, which would make it just as hard to buy in large quantities suddenly as it has been for the Entente powers to buy munitions at home or abroad without immense delays while shops were being equipped for unaccustomed work.

America is not likely to become a military power within any time that need be considered at present, so whether or not a standard design of military truck down to the last nut is advisable for England, its advisability for America is very debatable indeed. An army suddenly faced with war has two desires in motor transportation. It wants as few types of truck as possible and would appreciate having only one design for each size, but it also wants quantities of trucks and wants them instantly.

Striking a Happy Mean

To get trucks in quantities without warning means that the regular product must be accepted, and this is just the situation the American army authorities had to face last summer when the call came to the Mexican border. France and England did the same thing in 1914, but since their governments have been taking nearly all the mechanical output of the two countries, it has been possible to concentrate manufacturers on special types. In Coventry to-day, for example, one automobile maker is now building chassis to the drawings of a rival firm, the latter having been ordered to produce only aeroplane engines for the time being.

It is the desire, and the very wise intention, of the United States army authorities to try to evolve a scheme which will eliminate the worst of the troubles and confusion from which they have suffered, without limiting the possible market so much that, in case of emergency, they could not obtain rapid delivery of large quantities. The Mexican experience has shown that certain things most vitally need to be standardized for interchangeability. Radiators, for example, however they may differ in detail construction, ought to fit all trucks of any one rated size. The mounting and the position of the water pipes should be absolutely limited, so that any radiator would go on any truck.

Of a different sort is the requirement that control should be standard, so that any driver would be at home on any truck, but this is almost as important, and there are scores of similar little things which can be standardized without limiting the engineering scope of any truck manufacturer.

The old British scheme was to specify just such things as these and to pay a small yearly sum to every user who bought and operated a truck with the standardized details, and most of the truck manufacturers of England found it paid to produce "subsidy type" vehicles. They found it easily possible to make these to designs which hardly appeared to have any similarity at a casual glance, and the standards were incorporated in trucks of all prices. When war came some of the standards proved good and some less desirable, but the scheme itself was vindicated, although it had not been in operation long enough for there to be any appreciable quantity of subsidy type trucks in existence by the outbreak of war.

Subsidy Not Wanted in America

The idea in granting the subsidy was to encourage the production of trucks acceptable to the army, but it may be questioned whether such encouragement is really necessary. If a manufacturer is not handicapped in any way by using specified dimensions for certain portions of his truck he would benefit the ordinary user by adopting them. We all know now that a truck with tires that are not standard size is an absurdity; we are accustomed to the use of a standard tread; the absence of a spark plug standard would produce incalculable trouble and so on.

Still there is a limit beyond which we cannot go without beginning to lose as much as we gain and the striking of a happy medium between too much standardization and not enough of it is a task which is going to tax the powers of many a committee in the next five or six years. The problem is one that will always be present, since improving knowledge will call for alterations in design and thereby every now and then we shall discover that some accepted standard has to be changed.

A military wagon can be designed with some reliance that it will be just as good 20 years hence as it is now, for there is little left to learn about horse-drawn vehicles, but motor truck specifications will have to be revised at least each third year, if the army is to keep itself supplied with the best obtainable for its purpose. This makes the situation quite complicated, and renders it very hard to steer the proper

course, but there is no question whatever that the U. S. army is proceeding along the right lines and that it will be as well served by the industry as it could possibly be as long as the present methods continue in use, and they are not likely to be altered very much.

The armies of the world have been slow to realize that the coming of motor transport has created an entirely novel situation. Previously everything which was needed by an army was either an entirely special product, such as guns and ammunition, or else an entirely ordinary one such as food, boots and clothing. When it comes to motor trucks, however, at the present time the army needs something a little different from the commercial product, but not so different that the making of it is an industry in itself as is the case of guns and munitions.

The statement that the military truck is to differ from the commercial is still debatable. It is quite possible that when definite conclusions have been reached as to what should be the specifications of a military vehicle we shall find it is also an excellent machine for the uses of commerce, but there is as yet no evidence which will enable this matter to be decided.

In England, at the outbreak of the war, the subsidy system had been in operation so short a time that there were only a few subsidy type vehicles in the hands of private users. The time elapsing between the delivery of the first few subsidy trucks and the date when they were called in for military service was too short to enable their suitability for commercial work to be gaged accurately. Since that time war service has shown that the subsidy vehicle is not necessarily ideal for military work.

In France, although there was a subsidy scheme it was not developed even so far as the British one. In Germany the total number of different makes of truck was very small, so that the effect of the German subsidy system was really to provide large fleets of a small number of designs. Thus we cannot find in Europe any parallel to America.

(*Continued on page 757*)

A Directory of Motor Truck Makers

211 Manufacturers of Commercial Vehicles for 1917—200 Gasoline—Two Steam and Nine Electric—Models Made in Tons Capacity

Name	Manufacturer	Address	MODELS IN TONS CAPACITY *Figures refer to capacity, not number of models*														
			Under ¼	¼	½	1	1½	2	2½	3	3½	4	5	5½	6	6½	7 and over
Gasoline Vehicles																	
A. & B.	American & British Mfg. Co.	Providence, R. I.								3			5				
Acason	Acason Motor Truck Co.	Detroit, Mich.						2			3½						
Acme	Cadillac Auto Truck Co.	Cadillac, Mich.				1		2			3½						
Allis-Chalmers	Allis-Chalmers Mfg. Co.	Milwaukee, Wis.											5				
American	American Motor Truck Co.	Hartford, Conn.						2									
Armleder	O. Armleder Co.	Cincinnati, Ohio						2			3½						
Atlas	Martin Carriage Wks.	York, Pa.		½													
Atterbury	Atterbury Motor Car Co.	Buffalo, N. Y.				1	1½	2			3½						
Autocar	Autocar Co.	Ardmore, Pa.					1½	2									
Available	Available Truck Co.	Chicago, Ill.				1		2			3½		5				
Avery	Avery Co.	Peoria, Ill.				1		2		3			5				
Barker	C. L. Barker	Norwalk, Conn.				1		2									
Bauer	Bauer Machine Wks. Co.	Kansas City, Mo.		½	¾												
Beech Creek	Beech Creek Truck & Auto Co.	Beech Creek, Pa.								3							
Bell	Bell Motor Car Co.	York, Pa.		¾													
Bessemer	Bessemer Motor Truck Co.	York, Pa.				1		2			3½		5				
Blair	Blair Motor Truck Co.	Newark, Ohio						2		3		4	5				
Bourne	Bourne Magnetic Truck Co.	Philadelphia, Pa.															
Brinton	Chester County Motor Co.	Coatesville, Pa.			¾				2½								
Briscoe	Briscoe Motor Co.	Jackson, Mich.		½													
Brockway	Brockway Motor Truck Co.	Cortland, N. Y.				1	1½	2			3½						
Brown	Brown Carriage Co.	Cincinnati, Ohio		½													
Bulkley-Rider	Bulkley-Rider Tractor Co.	Los Angeles, Cal.															T
Burford	H. E. Burford Co.	Fremont, Ohio						2			3½						
Carlton	Carlton-Hill Motor Car Co.	Rutherford, N. J.															
Casey	F. A. Casey	Billerica, Mass.		¾													
Chase	Chase Motor Truck Co.	Syracuse, N. Y.				1	1½		2½	3	3½						
Clyde	Clyde Motor Truck Co.	Farmingdale, L. I.															
Coleman	Coleman Carriage & Harness Co.	Ilion, N. Y.						2		3							
Collier	Collier Motor Truck Co.	Painesville, Ohio			¾												
Columbia	Columbia Motor Truck & Trailer Co.	Pontiac, Mich.						2									
Commerce	Commerce Motor Car Co.	Detroit, Mich.			¾	1											
Comet	Comet Automobile Co.	Rockford, Ill.		½													
Continental (C)	Continental Motor Truck Co.	Chicago, Ill.				1	1½	2			3½						
Corbitt	Corbitt Automobile Co.	Henderson, N. C.					1½	2	2½		3½						
Corliss	Corliss Motor Truck Co.	Corliss, Wis.		½													
Couple-Gear	Couple-Gear Freight Wheel Co.	Grand Rapids, Mich.									3½		5				
Crawford	Crawford Automobile Co.	Hagerstown, Md.								3							
Croce	Croce Automobile Co.	Asbury Park, N. J.		½													
Crown	Crown Commercial Car Co.	North Milwaukee, Wis.			¾		1½		2½								
Crowther-Duryea	Crowther Motor Co.	Rochester, N. Y.		¾													
Dain	Dain Mfg. Co.	Ottumwa, Iowa				1											
Dart	Dart Motor Truck Co.	Waterloo, Iowa			¾		1½		2½								
Dayton	Durable Dayton Truck Co.	Dayton, Ohio						2			3½		5				7½

Heavy type represents vehicles whose specifications are given in this issue.

A Directory of 211 Manufacturers of Gasoline, Steam

Name	Manufacturer	Address	MODELS IN TONS CAPACITY *Figures refer to capacity, not number of models*													
			Under ½	½	¾	1	1½	2	2½	3	3½	4	5	5½	6	6½	7 and over
D-E	Day-Elder Motors Co.	Newark, N. J.		¾													
DeKalb	DeKalb Wagon Wks. Co.	DeKalb, Ill.						2	2½								
Denby	Denby Motor Truck Co.	Detroit, Mich.				1	1½	2	2½								
Denmo	Denneen Motor Co.	Cleveland, Ohio		½		1½											
Diamond-T	Diamond-T Motor Car Co.	Chicago, Ill.			¾		1½	2			3½						
Dispatch	Dispatch Motor Car Co.	Minneapolis, Minn.		¾													
Doane	Doane Motor Truck Co.	San Francisco, Cal.							2½						6		
Dominion	Dominion Motor Truck Co.	Detroit, Mich.													6		T
Dornfield	John Dornfield Co.	Watertown, Wis.															
Dorris	Dorris Motor Car Co.	St. Louis, Mo.			¾			2									
Duplex	Duplex-Power Car Co.	Charlotte, Mich.						2		3							
Ellsworth	Mills-Ellsworth Co.	Keokuk, Iowa.		½													
Erie	Erie Motor Truck Mfg. Co.	Erie, Pa.															
Fargo	Fargo Motor Car Co.	Chicago, Ill.				1		2									
Fawick	Fawick Motor Car Co.	Sioux Falls, S. D.		½	¾	1		2									
Federal	Federal Motor Truck Co.	Detroit, Mich.				1	1½	2			3½		5				
Forschler	Forschler Wagon Co.	New Orleans, La.				1		2									
Ford	Ford Motor Co.	Detroit, Mich.				1											
Frome	R. L. Frome Mfg. Co.	Sheboygan, Wis.															
F. W. D.	Four Wheel Drive Auto Co.	Clintonville, Wis.					1½			3			5				
Gabriel	Gabriel Auto Co.	Cleveland, Ohio			¾	1	1½										
Garford	Garford Motor Truck Co.	Lima, Ohio.				1	1½	2			3½		5		6		
Gary	Gary Motor Truck Co.	Gary, Ind.			¾	1	1½	2									
G. A. Schacht	G. A. Schacht Motor Truck Co.	Cincinnati, Ohio.					1½	2		3							
Geneva	Geneva Wagon Co.	Geneva, N. Y.			¾												
Gersix	Gerlinger Motor Car Co.	Portland, Ore.							2½								
Globe	Globe Furniture Co.	Northville, Mich.				1½											
G. M. C.	General Motors Truck Co.	Pontiac, Mich.			¾	1	1½	2			3½		5				
Gramm-Bernstein	Gramm-Bernstein Co.	Lima, Ohio.				1	1½	2	2½		3½		5		6		
Great Southern	Great Southern Automobile Co.	Birmingham, Ala.						2				4					
G. V.-Mercedes	General Vehicle Co.	Long Island City, N. Y.													6		
Hahn	Hahn Motor Truck Co.	Hamburg, Pa.				1		2									
Hall	Lewis-Hall Iron Wks.	Detroit, Mich.						2			3½		5				
Harrison	Robert Harrison Co.	South Boston, Mass.									3½						
Harvey	Harvey Motor Truck Co.	Harvey, Ill.						2			3½		5				
Hawkeye	Hawkeye Mfg. & Repair Co.	Sioux City, Iowa.				1½											
Henderson	Henderson Bros.	North Cambridge, Mass.		¾		1											
Hercules	Hercules Motor Truck Co.	South Boston, Mass.															
Horner	Detroit-Wyandotte Motor Co.	Wyandotte, Mich.					1½	2		3			5				
Hurlburt	Hurlburt Motor Truck Co.	New York City.					1½	2			3½		5				7
I. H. C.	International Harvester Corp.	Akron, Ohio.			¾	1											
Independent	Independent Motors Corp.	Port Huron, Mich.				1		2									
Indiana	Indiana Truck Co.	Marion, Ind.				1	1½			3			5				
Inter-State	Inter-State Motor Co.	Muncie, Ind.	¾														
Iowa	Iowa Motor Truck Co.	Ottumwa, Iowa.				1	1½										
Jeffery	Nash Motors Co.	Kenosha, Wis.			¾		1½	2									
Kearns	Kearns Motor Car Co.	Beavertown, Pa.		½													
Kelly-Springfield	Kelly-Springfield Motor Truck Co.	Springfield, Ohio.					1½		2½		3½	4	5		6		
King	A. R. King Mfg. Co.	Kingston, N. Y.									3½						
KisselKar	Kissel Motor Car Co.	Hartford, Wis.			¾	1		2	2½			4	5				
Kleiber	Kleiber Co., Inc.	San Francisco, Cal.				¾	1½	2	2½		3½		5				
Knickerbocker	Knickerbocker Motor Truck Co.	New York City.									3½		5				
Knox	Knox Motors Co.	Springfield, Mass.								3							T
Koehler	H. J. Koehler Motors Corp.	Newark, N. J.				1											
Koenig & Luhrs	Koenig & Luhrs Wagon Co.	Quincy, Ill.															
Krebs	Krebs Commercial Car Co.	Clyde, Ohio.					1½	2			3½						
Kressler	Kressler Auto Co.	Fostoria, Ohio.		½													
Lambert	Buckeye Mfg. Co.	Anderson, Ind.				1											
Landshaft	William Landshaft & Son.	Chicago, Ill.				1		2									
Lane	Lane Motor Truck Co.	Kalamazoo, Mich.			¾												
Lange	Lange Motor Truck Co.	Pittsburgh, Pa.					1½		2½								
Larrabee	Larrabee-Deyo Motor Truck Co.	Binghamton, N. Y.				1	1½		2½								
Lawson	Lawson Mfg. Co.	Pittsburgh, Pa.		½													
Lenox	Lenox Motor Car Co.	Boston, Mass.															
Lima	Lima Light Car Mfg. Co.	Lima, Ohio.		½													
Lincoln	Lincoln Motor Truck Co.	Detroit, Mich.				1											
Lippard-Stewart	Lippard-Stewart Motor Car Co.	Buffalo, N. Y.		½	¾	1	1½	2									
Little Giant	Chicago Pneumatic Tool Co.	Chicago, Ill.			¾	1	1½	2									
Lombard	Lombard Auto Tractor-Truck Corp.	New York City.											5				
Lord Baltimore	Lord Baltimore Motor Truck Co.	Baltimore, Md.				1		2									
Maccar	Maccar Co.	Scranton, Pa.					1½		2½		3½			5½			
Mack	International Motor Co.	New York City.				1	1½	2			3½			5½			7½
Manly	Manly Motor Corp.	Chicago, Ill.					1½		2½								
Maxwell	Maxwell Motor Co.	Detroit, Mich.	½														
Menominee	D. F. Poyer Co.	Menominee, Mich.			¾	1	1½	2			3½						
Mercury-Bulley	Mercury Mfg. Co.	Chicago, Ill.															T
Metropolitan	Metropolitan Motors, Inc.	New York City.															
Metz	Metz Co.	Waltham, Mass.		½													
Modern	Bowling Green Motor Car Co.	Bowling Green, Ohio.				1	1½	2			3½						
Mogul	Mogul Motor Truck Co.	St. Louis, Mo.					1½	2	2½		3½						
Moon	Jos. W. Moon Buggy Co.	St. Louis, Mo.					1½										
Moreland	Moreland Motor Truck Co.	Los Angeles, Cal.				1	1½		2½			4	5				
Morton	Morton Truck & Tractor Co.	Harrisburg, Pa.								3							
Nelson & LeMoon	Nelson & LeMoon.	Chicago, Ill.				1		2		3							
Netco	New England Truck Co.	Fitchburg, Mass.						2									
New York	Tegetmeier & Reipe.	New York City.					1½										
Niles	Niles Car & Mfg. Co.	Niles, Ohio.				1		2									
Old Hickory	Kentucky Wagon Mfg. Co.	Louisville, Ky.		¾													
Old Reliable	Old Reliable Motor Truck Co.	Chicago, Ill.					1½	2	2½	3		4	5				7
Overland	Willys-Overland Co.	Toledo, Ohio.	¾	¾													

Heavy type represents vehicles whose specifications are given in this issue.

and Electric Commercial Vehicles for 1917—Continued

Name	Manufacturer	Address	MODELS IN TONS CAPACITY *Figures refer to capacity, not number of models*													
			Under ½	½	¾	1	1½	2	2½	3	3½	4	5	5½	6	6½	7 and over
Packard	Packard Motor Car Co.	Detroit, Mich.				1	1½	2		3		4					
Packet	Packet Motor Truck Co.	St. Paul, Minn.	¾														
Palmer	Palmer-Meyer Motor Car Co.	St. Louis, Mo.				1		2									
Palmer-Moore	Palmer-Moore Co.	Syracuse, N. Y.			¾	1											
Paulding	Anchor Auto Co.	St. Louis, Mo.			¾	1	1½	2									
Peerless	Peerless Motor Car Co.	Cleveland, Ohio						2		3		4	5				
Pennsy	Pennsy Motors Co.	Pittsburgh, Pa.		½													
Phoenix Centiped	Phoenix Mfg. Co.	Eau Claire, Wis.											5				
Pierce-Arrow	Pierce-Arrow Motor Car Co.	Buffalo, N. Y.						2					5				
Pullman	Pullman Motor Car Co.	York, Pa.		½													
Rainier	Rainier Motor Corp.	New York City		½													
Reo	Reo Motor Car Co.	Lansing, Mich.			¾			2									
Republic	Republic Motor Truck Co.	Alma, Mich.			¾	1	1½	2		3							
Riker	Locomobile Co.	Bridgeport, Conn.								3		4					
Robinson	Robinson Fire Apparatus Co.	St. Louis, Mo.															T
Robinson	Golden West Motors Co.	Sacramento, Cal.						2									
Rocco	Rocco Motor Co.	Hannibal, Mo.															
Rowe	Rowe Motor Truck Co.	Downington, Pa.				1		2		3			5				
Royal	Royal Motor Truck Co.	New York City				1		2			3½		5		6		7
Rush	Rush Motor Truck Co.	Philadelphia, Pa.		½													
Salvador	Mansur Motor Truck Co.	Haverhill, Mass.						2									
Sandow	Sandow Motor Truck Co.	Chicago Ill.					1½	2		3							
Sanford	Sanford Motor Truck Co.	Syracuse, N. Y.				1	1½	2									
Saurer	International Motor Co.	New York City											5			6½	
Schleicher	Schleicher Motor Vehicle Co.	New York City								3			5				
Selden	Selden Motor Vehicle Co.	Rochester, N. Y.			¾	1		2			3½						
Service	Service Motor Truck Co.	Wabash, Ind.				1	1½	2			3½		5				
Signal	Signal Motor Truck Co.	Detroit, Mich.				1	1½	2			3½		5				
Sphinx	Sphinx Motor Car Co.	York, Pa.		½													
Standard	Standard Motor Truck Co.	Detroit, Mich.						2			3½	4	5				
States	States Motor Co.	Kalamazoo, Mich.		½													
Steele	W. M. Steele	Worcester, Mass.						2		3		4	5				
Stegeman	Stegeman Motor Car Co.	Milwaukee, Wis.					1½		2½		3½		5				
Sterling	Sterling Motor Truck Co.	Milwaukee, Wis.							2½		3½		5				7
Stewart	Stewart Motor Corp.	Buffalo, N. Y.		½	¾	1½											
Studebaker	Studebaker Corp.	Detroit, Mich.		½		1											
Sullivan	Sullivan Motor Car Co.	Rochester, N. Y.					1½	2									
Superior	E. G. Willingham's Sons.	Atlanta, Ga.				1		2									
Thomas	Thomas Auto Truck Co.	New York City							2½								
Tiffin	Tiffin Wagon Co.	Tiffin, Ohio			¾	1	1½		2½				5		6		
Tower	Tower Motor Truck Co.	Greenville, Mich.						2									
Transit	Transit Motor Car Co.	Louisville, Ky.				1		2			3½		5				
Transport	Transport Tractor Co.	Long Island City, N. Y.											5				
Tulsa	Tulsa Auto & Mfg. Co.	Tulsa, Okla.															
Twin City	Brasie Motor Car Co.	Minneapolis, Minn.				1		2									
Union	Union Motor Truck Co.	Bay City, Mich.							2½								
United	United Motors Co.	Grand Rapids, Mich.						2			3½	4	5				
Universal	Universal Service Co.	Detroit, Mich.					1½	2		3							
U. S.	United States Motor Truck Co.	Covington, Ky.						2		3	3½		5				
Van	Van Motor Truck Co.	Newburgh, N. Y.															
Van Winkle	Van Wink e Motor Truck Co.	Atlanta, Ga.															
Velie	Velie Moto: Vehicle Co.	Moline, Ill.						2			3½						
Vim	Vim Motor Truck Co.	Philadelphia, Pa.		½													
Voltz	Voltz Bros.	Chicago, Ill.								3			5				
Walter	Walter Motor Truck Co.	New York City									3½						7½
Watson	Watson Wagon Co.	Canastota, N. Y.											5				
Ware	Twin City Four Wheel Drive Co.	St. Paul, Minn.								3							
Washington	Washington Motor Car Co.	Hyattsville, Md.											5		6		7
White	White Co.	Cleveland, Ohio			¾		1½			3			5				
Wichita	Wichita Falls Motor Co.	Wichita Falls, Tex.				1	1½	2	2½		3½		5				
Wilcox	H. E. Wilcox Motor Co.	Minneapolis, Minn.			¾	1	1½	2			3½						
Wilson	J. C. Wilson Co.	Detroit, Mich.						2									
Wisconsin	Myers Machine Co.	Sheboygan, Wis.				1½			2½								
Witt-Will	Witt-Will Co.	Washington, D. C.				1		2									
W-S	Weier-Smith Truck Co.	Birmingham, Mich.							2½								
Zeitler & Lamson	Zeitler & Lamson Truck Co.	Chicago, Ill.					1½		2½		3½		5				

Steam Vehicles

Stanley	Stanley Motor Carriage Co.	Newton, Mass.			¾	1½											
Titan	American Machine Co.	Newark, Del.															

Electric Vehicles

Atlantic	Atlantic Vehicle Co.	Newark, N. J.				1		2			3½		5				
Couple-Gear	Couple-Gear Freight Wheel Co.	Grand Rapids, Mich.									3½		5				7
C. T.	Commercial Truck Co.	Philadelphia, Pa.		½		1		2			3½		5				
G. V.	General Vehicle Co.	Long Island City, N. Y.		½		1		2			3½		5				
Lansden	Lansden Co.	Brooklyn, N. Y.	¼	½		1		2			3½		5				T
Old Hickory	Kentucky Wagon Mfg. Co.	Louisville, Ky.				1											
Urban	Kentucky Wagon Mfg. Co.	Louisville, Ky.			¾		1½		2½			4					
Walker	Walker Vehicle Co.	Chicago, Ill.		½		1		2		3		4	5				
Ward	Ward Motor Vehicle Co.	Mount Vernon, N. Y.	¼	½		1		2			3½		5				

Heavy type represents vehicles whose specifications are given in this issue.

Prices of 1917 Gasoline Motor Trucks

Classified According to Load Capacity and Combined with Salient Features of Chassis

TRUCKS UNDER ½-TON CAPACITY

Name and Model	Chassis Price	Wheelbase, Inches	Tires	N.A.C.C. Horsepower	Electric System	Gearset Type	Final Drive
Maxwell.....25	$535	103	pneu....	21.08	s&l.....	selec..	bevel
Overland.....75-B	625-c	104	pneu....	18.21	s,l&i....	selec..	bevel
Packet.....	350	100	pneu....	12.08	nnne....	frict...	dbl chn

TRUCKS OF ½-TON CAPACITY

Name and Model	Chassis Price	Wheelbase, Inches	Tires	N.A.C.C. Horsepower	Electric System	Gearset Type	Final Drive
Atlas.....17	$690	106	pneu....	16.92	.....	selec..	sp-bev
Briscoe.....4-24	625	104	pneu....	16.92	s,l&i....	selec..	bevel
Corliss.....A	800-c*	100	pneu....	15.64	.....	selec..	bevel
Croce.....17	825	108	p&s.....	16.92	.....	selec..	bevel
Crowther-Duryea.....	600-c	110	pneu....	22.50	s,l&i....	roller..	roller
D-E.....Junior	895	108	pneu....	15.64	s&l.....	selec..	top wnrm
Dispatch.....G	1,150	120	pneu....	22.50	s&l.....	fric...	dbl chn
Ellsworth.....25-A	695-c	108	pneu....	16.92	s,l&i....	selec..	bevel
Lawson.....35	.....	112	pneu....	22.50	s&l-2....	selec..	bevel
Lippard-Stewart.....MW	1,000	106	pneu....	16.92	s&l-2....	selec..	top wnrm
Old Hickory.....	825	112	pneu....	16.92	s&l-2....	selec..	bevel
Overland.....75-B	725	106	pneu....	27.20	s,l&i-2...	selec..	bevel
Pannay.....15	660	98	pneu....	27.20	.....	selec..	bevel
Pullman.....4-24	.....	114	pneu....	22.50	s&l-2....	selec..	bevel
Reinier.....	850	115	pneu....	16.92	s&l.....	selec..	top wnrm
Rush.....D	695	106	pneu....	16.92	s&l-2....	selec..	bevel
Stewart.....5	695	106	pneu....	14.40	nnne....	selec..	int-gear
Studebaker.....SF	785	112	pneu....	24.22	s&l-2....	selec..	bevel
Vim.....20	635	102	pneu....	14.40	.....	selec..	bevel

TRUCKS OF ¾-TON CAPACITY

Name and Model	Chassis Price	Wheelbase, Inches	Tires	N.A.C.C. Horsepower	Electric System	Gearset Type	Final Drive
Brinton.....H	$950	115	pneu*...	16.92	lighting..	selec..	top wnrm
Collier.....M	800	118	pneu....	16.92	s,l&i....	selec..	bevel
Commerce.....N	975-c	120	pneu....	19.61	s,l&i....	selec..	bevel
Dart.....BB	1,200	124	solid....	19 61	nnne....	selec..	top wnrm
Derris.....I-B-4	1,900	132	pneu	30.65	lighting..	prog..	sp-bev
Geneva.....1	.....	96	solid....	22.10	.....	plan..	dbl chn
G.M.C.....15	1,090	122	pneu....	19.61	nnne....	selec..	bevel
I.H.C.....H	1,225	115	solid....	19.61	s&l*....	selec..	int-gear
Jeffery.....1016	965	116	pneu....	22.50	s&l-2....	selec..	sp-bev
Kisselkar.....	950	124	pneu	24.22	s&l-2*..	selec..	sp-bev
Kleiber.....AA	1,600	130*	solid*...	22.50	lighting..	selec..	top wnrm
Lane.....A	1,075	120	solid*...	16.92	.....	selec..	top worm
Lippard-Stewart.....W	1,600	125*	pneu....	22.50	s&l.....	selec..	top worm
Little-Giant.....15	1,500	138	p&s.....	19.61	lighting..	selec..	top worm
Menominee.....EW	1,295	124	cush....	22.50	none....	selec..	top worm
Palmer-Moore.....K	1,150	106	solid	19.61	s&l*....	selec..	int-gear
Reo.....F	1,000	120	pneu ..	27.20	s&l-2....	selec	sp-bev
Republic.....9	750	120	cush....	16.92	lighting..	selec.	int-gear
Selden.....G	985	110	pneu	15 64	s&l	selec	top worm
Stewart.....3	1,290	118	pneu....	19.61	s&l-2....	selec	int-gear

TRUCKS OF ¾-TON CAPACITY (Cont'd)

Name and Model	Chassis Price	Wheelbase, Inches	Tires	N.A.C.C. Horsepower	Electric System	Gearset Type	Final Drive
Tiffin.....A	$1,190	110	pneu*...	19.61	none....	selec..	int-gear
White.....GBBE	2,100	133½	pneu....	22.50	s&l.....	selec..	bevel..
Wilcox.....M	1,200	120	pneu....	19 61	lighting..	selec..	top worm

TRUCKS OF 1-TON CAPACITY

Name and Model	Chassis Price	Wheelbase, Inches	Tires	N.A.C.C. Horsepower	Electric System	Gearset Type	Final Drive
Acme.....B	$1,500	128	pneu*...	19.61	s,l&i....	selec..	top worm
Atterbury.....6B	1,775	140½	solid....	22.50	.....	selec..	top worm
Available.....1	1,700	132*	solid....	22.50	.....	selec..	top worm
Avery.....C	1,690	128	solid....	27.20	.....	selec..	dbl chn
Bessemer.....G	975	124	solid....	19.61	.....	selec..	int-gear
Brockway.....O	1,450	124*	solid*...	19.61	.....	selec..	top worm
Chase.....A	1,650	.....	solid....	19.61	.....	selec..	top worm
Commerce.....E	1,175	126	solid....	19.61	s&l-2....	selec..	int-gear
Continental (C).....FL	1,550	144	solid....	22.50	.....	selec..	top worm
D-E.....Senior	1,450	128*	solid....	19.61	.....	selec..	top worm
Denby.....R	990	119	pneu....	15.64	s&l.....	selec..	int-gear
Denmo.....10	1,385	124	p&s*....	22.50	s&l-2....	selec..	int-gear
Diamond-T.....J5	1,485	132	solid....	19.61	.....	selec..	top worm
Federal.....S	.....	132	solid*...	19.61	s,l&i*...	selec..	top worm
Forschler.....	1,650	130	solid*...	19.61	none	selec..	top worm
Gerford.....75	1,450	120	p&s.....	19.61	s&l.....	selec..	top worm
Globe.....	1,375	130*	solid....	25.39	.....	selec..	int-gear
G.M.C.....21	.....	136	solid....	22.50	none	selec..	top worm
Gramm-Bernstein.....	1,650	124*	solid....	22.50	s&l-2*...	ind-c...	top worm
Hahn.....C	1,750	136*	solid....	27.20	.....	selec..	top worm
Hawkeye.....H	1,300	136*	solid....	22.50	.....	selec..	int-gear
I.H.C.....F	1,500	128*	solid....	19.61	s&l*....	selec..	int-gear
Independent.....F	1,385	128*	solid*...	19.61	s,l&i....	selec..	top worm
Kisselkar.....	1,250	132	solid*...	24.22	s&l-2*..	selec..	top worm
Koehler.....K	895	129	solid....	19.61	none....	selec..	int-gear
Lambert.....V2	1,700	144	solid....	29.00	s&.li....	fric...	dbl chn
Larrabee.....	1,550	130	solid*...	22.50	s,l&i....	selec..	top worm
Lincoln.....L	975	122*	pneu....	19.61	s,l&i....	selec..	bevel
Lippard-Stewart.....H	2,000	145	solid....	22.50	s&l.....	selec..	top worm
Little Giant.....H	1,400	110	solid....	19.61	.....	.....	dbl chn
Mack.....AB	2,000	144*	solid....	25.60	s&l-2....	selec..	dbl chn
Mack.....AB	2,000	144*	solid....	25 60	s&l-2....	selec..	top worm
Menominee.....FW	1,575	130*	solid....	22.50	none....	selec..	top worm
Moreland.....15-D	1,650	126	solid....	22.50	lighting..	selec..	top worm
Nelson & LaMoon.....E1	1,700	npt.....	solid....	22.50	.....	selec..	top worm
Niles.....B	1,175	124	pneu....	19.61	npt.....	selec..	top worm
Packard.....1-D	2,200	126*	solid....	25.60	s&l-2....	prog..	top worm
Palmer.....	1,350	132½	solid....	22.50	nnne....	selec..	int-gear
Palmer-Moore.....M	1,350	126	solid....	22.50	s&l*....	selec..	int-gear
Republic.....10	.....	124	solid....	19.61	s&l-2....	selec..	int-gear
Royal.....	.....	124*	solid....	16.92	starting..	ind-c..	top worm
Senford.....O	1,290	120	pneu*...	19.61	.....	selec..	int-gear
Selden.....TL	1,700	126½	solid....	19 61	s&l-2	selec..	top worm
Service.....120	1,375	135	solid*...	19 61	s&l-2*...	selec..	top worm
Signal.....F	1,550	144*	solid	22.50	.....	selec..	top worm
Stewart.....4	1,390	128	solid....	19 61	.....	selec..	int-gear
Studebaker.....7	1,100	125	pneu	24 22	s&l-2....	selec..	bevel
Superior.....A	1,350	124*	solid....	19.61	nnne....	selec..	int-gear
Tiffin.....AW	1,450	112	solid....	19.61	.....	selec..	top worm
Wichita.....A	1,350	110*	solid	16.92	s&l-2....	selec..	dbl chn
Wichita.....K	1,650	118*	solid....	19 61	s&l-2....	selec..	top worm
Wilcox.....S	1,600	128	pneu* ...	22 50	lighting..	selec..	tnp wnrm
Witt Will.....WD16	2,000	120	solid*...	22 50	.....	selec..	top wnrm
Wisconsin.....B	1,650	136	solid....	19.61	.....	selec..	top wnrm

ABBREVIATIONS: General, *, *with other options;* npt, *optional.* **Tires, Kind,** pneu, *pneumatic;* cush, *cushion;* p&s, *pneumatic in front, solid in rear;* p&c, *pneumatic in front, cushion in rear;* c&s, *cushion in front, solid in rear.* **Electric System** s&l, *starting and lighting;* s. l & i, *starting; lighting and ignition;* l&i, *lighting and ignition;* s&i, *starting and ignition;* -2, *two unit.* **Gearset Type,** prog, *progressive sliding gear;* selec, *selective sliding gear;* plan, *planetary;* ind-c, *constant-mesh individual clutch;* fric, *friction;* elec, *electric.* **Final Drive,** bevel, *direct bevel;* sp-bev, *spiral bevel;* doub-red, *double-reduction, bevel and spur;* int-gear, *internal-gear;* ext-gear, *external gear;* top worm, *worm gear with worm on top;* dbl chn, *double chain;* sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.*

TRUCKS OF 1½-TON CAPACITY

Name and Model	Chassis Price	Wheel-base, Inches	Tires	N.A.C.C. Horse-power	Elec-tric System	Gear-set Type	Final Drive
Atterbury....6R	$1,875	140½	solid....	22.50	.....	selec..	top worm
Brockway....J-2	1,825	124	solid....	22.50	.....	selec..	top worm
Chase....C	1,950	138	solid....	19.61	.....	selec..	top worm
Continental (C)....HL	1,750	144	solid....	22.50	.....	selec..	top worm
Corbitt....D	2,150	138	solid....	22.50	.....	selec..	top worm
Dart....E	1,800	130	solid....	22.50	.....	selec..	top worm
Denby....G	1,575	120*	solid....	19.61	s&l-2....	selec..	int-gear
Diamond-T....J4	2,050	154*	solid....	22.50	.....	selec..	top worm
Federal....J-M	1,800	144*	solid....	27.20	s&l-2....	selec..	top worm
Garford....66	1,800	142*	solid....	22.50	s&l.....	selec..	top worm
G. A. Schacht	2,650	138*	solid....	29.00	.....	selec..	top worm
G.M.C....31	1,900	144*	solid....	22.50	none....	selec..	top worm
Gramm-Bernstein	2,000	130*	solid....	22.50	s&l-2*...	ind-c..	top worm
Horner	2,250	145	solid....	27.20	.....	selec..	top worm
Hurlburt	2,250	136*	solid....	22.50	lighting..	selec..	top worm
Jeffery....2016	1,465	130	p&s.....	22.50	s&l-2....	selec..	int-gear
Kelly-Springfield....K-31	2,000	144*	solid*...	22.50	s&l-2....	selec..	dbl chn
Kelly-Springfield....K-32	2,000	144*	solid*...	22.50	s&l-2....	selec..	top worm
Kleiber....A1	2,250	140*	solid....	27.20	lighting..	selec..	top worm
Krebs....40	2,050	146	solid....	22.50	.....	selec..	top worm
Lange....C	1,850	130*	solid....	22.50	none....	ind-c..	dbl chn
Larrabee	2,000	140*	solid....	27.20	s,l&i-2...	selec..	top worm
Lippard-Stewart....F	2,300	145*	solid....	27.20	s&l.....	selec..	top worm
Little Giant....H	1,500	110	solid....	19.61	.....	selec..	dbl chn
Maccar....L	2,100	150	solid....	27.20	none....	selec..	worm
Mack....AB	2,350	162*	solid....	25.60	s&l-2....	selec..	top worm
Mack....AB	2,350	162*	solid....	25.60	s&l-2....	selec..	dbl chn
Menominee....H	1,775	130*	solid....	22.50	none....	selec..	top worm
Moreland....15-B	1,950	126*	solid....	27.20	lighting..	selec..	top worm
Moon....B	1,600	140*	solid....	22.50	none....	selec..	dbl chn
New York....M	2,200	144*	solid....	27.20	.....	ind-c..	top worm
Old Reliable	1,950	150*	solid....	22.50	lighting..	selec..	top worm
Packard....1½-D	2,500	126*	solid....	25.60	s&l-2....	prog..	top worm
Republic....11	.....	144	solid....	22.50	s&l-2....	selec..	int-gear
Sanford....R	1,370	138	solid*...	19.61	.....	selec..	dbl chn
Service....130	1,950	150	solid....	27.20	s&l-2*...	selec	top worm
Signal....H	1,800	144*	solid....	27.20	.....	selec	top worm
Stegeman	1,900	150	solid....	25.39	s&l-2....	selec	top worm
Sullivan....G	1,650	129	solid....	22.50	.....	selec..	dbl chn
Tiffin....GW	1,790	135	solid....	22.50	.....	selec..	top worm
Universal....G	1,950	133*	solid....	22.50	lighting..	selec..	top worm
White....TBC	3,000	145½	pneu....	22.50	s&l.....	selec	db-red...
Wichita....L	1,800	118*	solid....	19.61	s&l-2....	selec..	top worm
Wilcox....R	1,800	134	solid....	29.00	lighting..	selec..	top worm
Zeitler & Lamson	1,850	150*	solid....	25.60	l&i*....	ind-c..	top worm

TRUCKS OF 2-TON CAPACITY

Name and Model	Chassis Price	Wheel-base, Inches	Tires	N.A.C.C. Horse-power	Elec-tric System	Gear-set Type	Final Drive
Acason....2	.....	150	solid....	29.00	.....	selec..	top worm
Acme....A	$2,100	148*	solid....	27.20	lighting..	selec.	top worm
Armleder....HW-2	2,800	166*	solid....	27.20	lighting..	selec	top worm
Atterbury....6C	2,375	153½	solid....	27.20	.....	selec	top worm
Autocar....21F	1,650	97*	solid*...	18.10	.....	prog	db-red
Availablo....2	2,250	156*	solid....	27.20	.....	selec	top worm
Avery....B	2,700	128	solid....	36.15	.....	selec..	dbl chn
Bessemer....D	2,200*	146*	solid....	27.20	.....	selec	top worm
Blair....C	2,850	121*	solid....	29.00	.....	ind-c..	top worm
Brockway....K-2	2,125	140*	solid....	27.20	.....	selec	top worm
Burford....O-3	2,250	144*	solid....	22.50	lighting..	selec..	int-gear
Columbia....E	1,750	144*	solid....	27.20	none....	selec	int-gear
Continental (C)....J	2,100	146	solid....	27.20	.....	selec	top worm
Corbitt....C	2,400	148	solid....	27.20	.....	selec..	top worm
Dayton....H	2,650	.....	solid....	29.00	.....	selec..	dbl chn
DeKalb....D-1½	2,100	134*	solid....	27.20	none....	selec.	top worm
Denby....H	1,790	144*	solid....	22.50	s&l-2....	selec..	int-gear
Diamond-T....J3	2,200	154*	solid....	27.20	.....	selec	top worm
Dorris....I-B-W	1,990	132	pneu....	30.65	.....	selec..	top worm
Federal....O-P	2,100	144*	solid....	27.20	s&l-2....	selec	top worm
Forschler	2,250	140*	solid*...	27.20	none....	selec.	top worm
Garford....70	2,300	142*	solid....	29.00	s&l.....	selec	top worm
G. A. Schacht	2,800	144*	solid....	29.00	.....	selec	top worm
G.M.C....41	2,375	158*	solid....	27.20	none....	selec	top worm
Gramm-Bernstein	2,300	146*	solid....	22.50	s&l-2*...	ind-c.	top worm

TRUCKS OF 2-TON CAPACITY (Cont'd)

Name and Model	Chassis Price	Wheel-base, Inches	Tires	N.A.C.C. Horse-power	Elec-tric System	Gear-set Type	Final Drive
Hahn....E	$2,250	144*	solid....	32.40	.....	selec..	top worm
Hall	2,000	132	solid....	27.20	lighting..	selec..	top worm
Harvey....W-F	2,250	150	solid....	29.00	s&l-2....	selec..	top worm
Horner	2,650	145	solid....	27.20	.....	selec..	top worm
Hurlburt	3,300	148	solid....	27.20	lighting..	selec..	top worm
Independent....G	1,850	144	solid....	27.20	.....	selec..	top worm
Jeffery....4016	2,850	124*	solid....	29.00	s&l-2....	ind-c..	int-g-4
Kisselkar	1,875	144*	solid....	29.00	.....	selec..	top worm
Kleiber....A2	2,400	145*	solid....	27.20	lighting..	selec..	top worm
Krebs....60	2,375	162	solid....	27.20	.....	selec..	top worm
Lange....B	2,450	136*	solid....	27.20	none....	ind-c..	dbl chn
Lippard-Stewart....G	2,600	158*	solid....	27.20	s&l.....	selec..	top worm
Little Giant....16	2,500	144	solid....	27.20	.....	selec..	top worm
Mack....AB	2,700	162*	solid....	25.60	s&l-2....	selec..	top worm
Mack....AB	2,700	162*	solid....	25.60	s&l-2....	selec..	dbl chn
Menominee....D	2,240	144*	solid....	27.20	none....	selec..	top worm
Nelson & LeMoon....E2	2,250	opt...	solid....	27.20	.....	selec..	top worm
Netco....D	2,350	144*	solid....	27.20	s,l&i....	selec..	top worm
Netco....E	2,600	144*	solid....	33.75	s,l&i....	prog..	top worm
Niles....E	1,875	140*	solid....	27.20	opt.....	selec..	top worm
Old Reliable	2,450	150	solid....	25.60	lighting..	selec..	top worm
Packard....2-D	2,800	144*	solid....	25.60	s&l-2....	prog..	top worm
Palmer	1,975	144	solid....	27.20	none....	selec..	top worm
Peerless....TC2	.....	145	solid....	32.40	.....	selec..	top worm
Pierce-Arrow	3,000	150*	solid....	25.60	.....	selec..	top worm
Reo....J	1,650	146	solid....	27.20	.....	selec..	dbl chn
Republic....12	.....	144*	solid....	27.20	s&l-2....	selec..	int-gear
Sanford....S	2,100	150*	solid....	29.00	.....	selec..	int-gear
Selden....TC	2,000	150	solid....	22.50	s&l-2....	selec..	top worm
Selden....JWD	2,250	150	solid....	27.20	s&l.....	selec..	top worm
Servico....140	2,250	160*	solid....	27.20	s&l-2*...	selec..	top worm
Signal....J	2,100	150*	solid....	27.20	.....	selec..	top worm
Standard....70	2,000	140	solid....	27.20	.....	selec..	top worm
Steele....C	2,250	115*	solid....	27.20	lighting..	ind-c..	dbl chn
Sullivan....E	2,250	150	solid....	27.20	.....	selec..	top worm
Superior....C	1,800	144	solid....	22.50	none....	selec..	int-gear
United....BSW	2,250	144*	solid....	27.20	s&l.....	selec..	top worm
U.S....E	2,200	132*	solid....	27.20	.....	ind-c..	dbl chn
U.S....H	2,500	144*	solid....	27.20	.....	ind-c..	top worm
Universal....D	2,800	132*	solid....	25.60	lighting..	selec..	dbl chn
Velie....25	2,250	150*	solid....	27.20	starting..	selec..	top worm
Wichita....B	2,100	118*	solid....	19.61	s&l-2....	selec..	dbl chn
Wilcox....Q	2,000	150*	solid....	29.00	lighting..	selec..	top worm
Wilson....E	2,350	144	solid....	27.20	.....	selec..	top worm
Witt-Will....WD16	2,500	144	solid....	27.20	.....	selec..	top worm

TRUCKS OF 2½-TON CAPACITY

Name and Model	Chassis Price	Wheel-base, Inches	Tires	N.A.C.C. Horse-power	Elec-tric System	Gear-set Type	Final Drive
Brinton....F	$2,250	138	solid....	27.20	lighting..	selec..	top worm
Chase....B	2,475	160	solid....	27.20	.....	selec..	top worm
Corbitt....B	2,650	148	solid....	27.20	.....	selec..	top worm
Dart....CC	2,470	150	solid....	27.20	none....	selec..	top worm
DeKalb....D-2½	2,450	136*	solid....	27.00	none....	selec.	top worm
Denby....K	2,090	144*	solid....	22.50	s&l-2....	selec.	int-gear
Doane	3,000-c	150	solid....	29.00	.....	selec..	dbl chn
Gersix....C	2,500	150*	solid....	33.75	s&l-2....	ind-c..	top worm
Gramm-Bernstein	2,700	156	solid....	29.00	s&l-2*...	ind-c..	top worm
Kelly-Springfield....K36	2,750	144*	solid*...	22.50	s&l-2....	selec..	top worm
Kelly-Springfield....K35	2,750	144*	solid*...	22.50	s&l-2....	selec..	dbl chn
Kisselkar	2,250	166	solid....	29.00	s&l-2*...	selec..	top worm
Kleiber....B	2,750	150*	solid....	27.20	lighting..	selec..	top worm
Lange....B	2,450	136*	solid....	27.20	none....	ind-c.	dbl chn
Larrabee	2,300	152*	solid....	27.20	s&l-2....	selec..	top worm
Maccar....H	2,600	162	solid....	32.40	none....	selec..	top worm
Moreland....15-C	2,550	144*	solid....	32.40	lighting..	selec..	top worm
Old Reliable	2,750	.....	solid....	29.00	.....	selec..	dbl chn
Royal	.....	132*	solid....	25.60	starting..	ind-c.	top worm
Stegeman	2,500	144*	solid....	29.45	s&l-2....	selec..	top worm
Sterling	2,800	156*	solid....	29.00	lighting..	selec..	top worm
Thomas....40	2,700	150*	solid....	27.20	lighting..	selec	top worm
Tiffin....MC	2,360	140	solid....	27.20	.....	selec.	dbl chn
Tiffin....MW	2,500	140	solid....	27.20	.....	selec.	top worm

**ABBREVIATIONS: General, *, *with other options;* opt, *optional.* Tires, Kind, pneu, *pneumatic;* cush, *cushion;* p&s, *pneumatic in front, solid in rear;* p&c, *pneumatic in front, cushion in rear;* c&s, *cushion in front, solid in rear.* Electric System, s&l, *starting and lighting;* s, l & i, *starting, lighting and ignition;* l&i, *lighting and ignition;* s&i, *starting and ignition;* -2, *two unit.* Gearset Type, prog, *progressive sliding gear;* selec, *selective sliding gear;* plan, *planetary;* ind-c, *constant-mesh individual clutch;* fric, *friction;* elec, *electric.* Final Drive, bevel, *direct bevel;* sp-bev, *spiral bevel;* doub-red, *double-reduction, bevel and spur;* int-gear, *internal-gear;* ext-gear, *external gear;* top worm, *worm gear with worm on top;* dbl chn, *double chain;* sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.*

TRUCKS OF 2½-TON CAPACITY (Cont'd)

Name and Model	Chassis Price	Wheel-base, Inches	Tires	N.A.C.C. Horse-power	Elec-tric System	Gear-set Type	Final Drive
Union.....B	$1,875	150	solid....	25.60	.....	selec..	int-gear
Wichita.....R	2,350	144	solid....	22.50	s&l-2....	selec..	top worm
Wisconsin.....C	2,500	156*	solid....	25.60	.....	selec..	top worm
W.S.....4	2,975	154	solid....	32.40	.....	.....	top worm-4
Zeitler & Lamson.....	2,450	160*	solid....	25.60	l&i*.....	ind-c..	top worm

TRUCKS OF 3-TON CAPACITY

A & B.....3T	$4,500	144	solid	42.76	.....	elec...	int-g-f
Avery.....A	2,500-c	140	wood....	36.15	.....	selec..	dbl chn
Avery.....B	3,200	128	solid....	36.15	.....	selec..	dbl chn
Beech Creek.....3A	3,850	132	solid....	29.00	.....	selec..	bevel-4
Blair.....D	3,250	121*	solid....	29.00	.....	ind-c..	top worm
Chase.....X	.....	160	solid....	27.20	.....	selec..	top worm
Duplex.....D	.....	130*	solid....	32.40	s,l&i....	selec..	int-gear-4
F.W.D.....B	4,000	124	solid....	36.15	s&l.....	ind-c..	bevel-4
G. A. Schacht.....	3,200	168*	solid....	29.00	.....	selec..	top worm
Horner.....	3,200	145	solid....	32.40	.....	selec..	top worm
Nelson & LeMoon.....E3	2,050	opt.....	solid....	32.40	.....	selec..	top worm
Old Reliable.....	3,250	150	solid....	29.00	lighting..	selec..	top worm
Peerless.....TC3	.....	151*	solid....	32.40	.....	selec..	dbl chn
Republic.....T	.....	165*	solid....	29.00	s&l-2....	selec..	int-gear
Riker.....	3,500	150*	solid....	29.00	s&l-2....	selec..	top worm
Schleicher.....	3,500	150*	solid....	29.00	none	.....	dbl chn
Steela.....B	3,000	127*	solid....	40.00	lighting..	ind-c..	dbl chn
U.S.....D	2,700	144*	solid....	32.40	.....	ind-c..	dbl chn..
Universal.....A	3,400	132*	solid....	25.60	lighting..	selec..	dbl chn
White.....TAD	3,700	163	solid....	22.50	.....	selec..	dbl chn

TRUCKS OF 3½-TON CAPACITY

Acason.....	.....	168	solid....	29.00	.....	selec..	top worm
Acma.....C	.....	168*	solid....	32 40	lighting..	selec..	top worm
Armleder.....K-W	$3,500	156*	solid....	32.40	lighting..	selec..	top worm
Atterbury.....6D	3,175	167½	solid....	32.40	.....	selec..	top worm
Available.....3	3,300	168*	solid....	32.40	.....	selec..	top worm
Bessemer.....E	3,100	150*	solid....	32.40	.....	selec..	top worm
Brockway.....R	.....	164*	solid....	32.40	lighting..	selec..	top worm
Burford.....D-3	3,600	175*	solid....	32.40	lighting..	selec..	top worm
Couple Gear.....H-C	5,000	144*	solid....	53.00	light'g*..	elec ..	bevel-4
Chase.....O	3,300	175	solid....	29.00	.....	selec..	top worm
Continental (C).....M	3,000	168*	solid....	32.40	.....	selec..	top worm
Corbitt.....A	3,200	168	solid....	32.40	.....	ind-c..	top worm
Dayton.....	3,400	.....	solid....	29.00	.....	selec..	worm
Dayton.....K	3,400	.....	solid....	36.15	.....	selec..	dbl chn
Diamond-T.....L	3,300	170*	solid....	32.40	.....	selec..	top worm
Federal.....L	2,800	146*	solid....	32.40	lighting..	selec..	top worm
Garford.....77-B	3,400	128*	solid....	29.00	s&l.....	selec..	top worm
G.M.C.....71	3,300	163*	solid....	32 40	none	selec..	top worm
Gramm-Bernstein.....	3,400	158*	solid....	29 00	s&l-2*...	ind-c..	top worm
Hall.....	2,800	144	solid....	32.40	lighting..	selec..	top worm*
Harrison.....C	.....	.....	solid....	32.40	.....	selec..	dbl chn
Harrison.....F	.....	.....	solid....	32 40	.....	selec..	dbl chn
Harvey.....W-H	2,950	160*	solid....	29.00	s&l-2....	selec..	top worm
Hurlburt.....	3,500	146*	solid....	29.00	lighting..	selec..	top worm
Kelly-Springfield....K-40	3,400	150*	solid*....	32 40	s&l-2....	selec..	dbl chn
King.....	2,600	120	solid....	32 40	.....	ind-c..	dbl chn
Kleiber.....C	3,500	160*	solid	32 40	lighting..	selec ..	top worm
Knickerbocker.....A	3,500	128	solid....	32 40	lighting..	selec..	dbl chn
Krebs.....90	3,250	180	solid....	32 40	.....	selec..	top worm
Maccar.....M	3,250	174	solid	32 40	none....	selec..	top worm
Mack .....AC	3,400	156*	solid	40 00	s&l-2....	selec..	dbl chn
Menominee.....G	2,775	160*	solid....	32 40	none....	.....	top worm
Packard.....3-D	3,400	156*	solid....	32 40	s&l-2...	prog..	top worm
Royal.....	.....	158*	solid ..	29 00	starting..	ind-c.	top worm

TRUCKS OF 3½-TON CAPACITY (Cont'd)

Name and Model	Chassis Price	Wheel-base, Inches	Tires	N.A.C.C. Horse-power	Elec-tric System	Gear-set Type	Final Drive
Selden.....N	$2,950	164	solid....	32.40	s&l-2....	selec..	top worm
Service.....170	3,000	170*	solid....	29.00	s&l-2*...	selec..	top worm
Service.....175	3,250	170*	solid....	32 40	s&l-2*...	selec..	top worm
Signal.....M	3,000	168	solid....	32 40	.....	selec..	top worm
Standard.....60	2,850	144*	solid....	32.40	.....	selec..	top worm
Stegeman.....	3,000	156	solid....	33.75	s&l-2....	selec..	top worm
Sterling.....	3,400	158*	solid....	29.00	lighting..	selec..	top worm
United.....CSW	2,900	144*	solid....	32.40	s&l.....	selec..	top worm
U.S.....J	3,150	156*	solid....	32.40	.....	ind-c..	top worm
Velie.....26	3,350	172*	solid....	32.40	none....	selec..	top worm
Walter.....C	4,200	132*	solid....	30.65	.....	selec..	ext-g-4
Wichita.....O	3,250	165*	solid....	32.40	s&l-2....	selec..	top worm
Wilcox.....P	2,900	154*	solid....	29.00	lighting..	selec..	top worm
Zeitler & Lamson.....	3,150	170*	solid....	36.15	l&i.....	ind-c..	top worm

TRUCKS OF 4-TON CAPACITY

Blair.....E	$3,750	144*	solid....	32.40	.....	ind-c..	top worm
Kelly-Springfield....K-45	3,600	150*	solid*....	32.40	s&l-2....	selec..	dbl chn
Kisselkar.....	2,850	168*	solid....	29.00	s&l-2*...	selec..	top worm
Moreland.....15-G	3,400	162*	solid....	36 15	lighting..	selec..	top worm
Old Reliable.....	3,750	.....	solid....	36.15	lighting..	selec ..	top worm
Old Reliable.....	3,750	.....	solid....	36 15	lighting..	selec..	dbl chn
Packard.....4-D	3,800	156*	solid....	32.40	s&l-2....	prog..	top worm
Peerless.....TC4	.....	151*	solid....	32.40	.....	selec..	dbl chn
Riker.....	3,650	150*	solid....	29.00	s&l-2....	selec..	top worm
Standard.....40	3,025	144*	solid....	32.40	.....	selec..	dbl chn
Steele.....BA	3,500	127*	solid....	40.00	lighting..	ind-c..	dbl chn
United.....DSW	3,300	144*	solid....	36.15	s&l.....	selec..	top worm

TRUCKS OF 5-TON CAPACITY

A & B.....5T	$4,750	144	solid	42.76	.....	elec...	int-g-f....
Available.....5	4,400	168*	solid....	32.40	.....	selec..	top worm
Avery.....B	4,500	128	solid....	44.20	.....	selec..	dbl chn
Bessemer.....H	3,600	150	solid	32 40	.....	selec .	top worm
Blair.....F	4,250	144*	solid....	32.40	.....	ind-c..	top worm
Couple Gear.....AC	5,350	144*	solid....	53.00	light'g*.	elec...	bevel-4
Dayton.....M	4,500	.....	solid....	44.20	.....	selec..	dbl chn
Diamond-T.....R	4,200	170*	solid....	32 40	.....	selec..	top worm
Federal.....W	.....	156*	solid....	29.00	s,l&i*...	selec..	top worm
Garford.....68	4,300	128*	solid....	36.15	none....	selec.	dbl chn
G.V. Mercedes.....FV	.....	192½	solid	29 00	.....	selec.	int-gear
G.M.C.....101	3,850	163*	solid	32 40	none....	selec.	top worm
Gramm-Bernstein.....	4,300	168*	solid....	32.40	s&l-2*...	ind-c..	top worm
Hall.....	3,400	144	solid	32.40	lighting..	selec..	dbl chn
Harvey.....W-K	3,600	160*	solid .	32 40	s&l-2....	selec.	top worm
Horner.....	4,200	156	solid .	44 20	.....	selec..	top worm
Hurlburt.....	4,250	156*	solid	33 75	lighting..	selec..	top worm
Kelly-Springfield....K-50	4,250	150*	solid*.	32 40	s&l-2....	selec .	dbl chn
Kisselkar.....	3,350	180	solid	29 00	s&l-2*...	selec.	top worm
Kleiber.....D	4,500	170*	solid .	44 20	lighting..	selec..	top worm
Knickerbocker.....C	4,500	148*	solid	32.40	lighting..	selec..	dbl chn
Moreland.....16-J	3,800	180*	solid....	36.15	lighting..	selec..	worm
Old Reliable.....	4,500	150*	solid....	36.15	lighting..	selec..	dbl chn
Peerless.....TC5	.....	151*	solid ..	32 40	.....	selec .	dbl chn
Pierce-Arrow.....	4,500	168*	solid	38.25	.....	selec..	top worm
Royal.....	.....	168*	solid....	36.15	starting..	ind-c..	top worm
Saurer.....L	4,800	153½	solid ..	34.28	none....	selec..	dbl chn
Schleicher.....	4,500	150*	solid	40 00	none	selec .	dbl chn
Service 200	4,000	170*	solid	32.40	s&l-2*...	selec .	top worm
Signal .....R	4,000	180	solid	32 40	.....	selec .	top worm
Standard.....50	3,400	144*	solid	29 00	.....	selec .	top worm
Steele .....A	4,000	127*	solid .	40 00	lighting..	ind-c..	dbl chn
Stegeman.....	4,000	170	solid	33 75	s&l-2....	selec..	top worm
Sterling.....	4,500	168	solid .	36 15	lighting..	selec..	top worm

**ABBREVIATIONS: General, *, *with other options;* opt, *optional.* Tires, Kind, pneu, *pneumatic;* cush, *cushion;* p&s, *pneumatic in front, solid in rear;* p&c, *pneumatic in front, cushion in rear;* c&s, *cushion in front, solid in rear.* Electric System, s&l, *starting and lighting;* s, l & i, *starting, lighting and ignition;* l&i, *lighting and ignition;* s&i, *starting and ignition;* -2, *two unit.* Gear-set Type, prog, *progressive sliding gear;* selec, *selective sliding gear;* plan, *planetary;* ind-c, *constant-mesh individual clutch;* fric, *friction;* elec, *electric.* Final Drive, bevel, *direct bevel;* sp-bev, *spiral bevel;* doub-red, *double-reduction, bevel and spur;* int-gear, *internal-gear;* ext-gear, *external gear;* top worm, *worm gear with worm on top;* dbl chn, *double chain;* sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.*

TRUCKS OF 5-TON CAPACITY (Cont'd)

Name and Model	Chassis Price	Wheelbase, Inches	Tires	N.A.C.C. Horsepower	Electric System	Gearset Type	Final Drive
Tiffin.....RW	$4,250	168	solid....	33.75	s&l-2....	selec..	top worm
United.....ESW	3,900	144*	solid....	41.62	s&l-2*...	selec..	top worm
U.S.....K	4,000	168*	solid....	36.15	.....	ind-c..	top worm
White.....TCD	4,500	160	solid....	29.00	.....	selec..	dbl chn
Wichita.....Q	3,850	165*	solid....	32.40	s&l-2....	selec..	top worm
Zeitler & Lamson.....	4,150	180*	solid....	41.62	l&i*.....	ind-c..	top worm

TRUCKS OF 5½-TON CAPACITY

Name and Model	Chassis Price	Wheelbase, Inches	Tires	N.A.C.C. Horsepower	Electric System	Gearset Type	Final Drive
Maccar.....U	.....	186	solid....	32.40	.....	selec..	top worm
Mack.....AC	$4,000	156*	solid....	40.00	s&l-2....	selec..	dbl chn

TRUCKS OF 6-TON CAPACITY

Name and Model	Chassis Price	Wheelbase, Inches	Tires	N.A.C.C. Horsepower	Electric System	Gearset Type	Final Drive
Deane.....	$4,500-c	178	solid....	36.15	.....	selec..	dbl chn
Garford.....60	4,500	128*	solid....	41.61	none....	selec..	dbl chn
Gramm-Bernstein.....	4,500	168*	solid....	32.40	s&l-2*...	ind-c..	top worm
G.V.-Mercedes.....S.V.	.....	192½	solid....	29.00	.....	selec..	int-gear
Kelly-Springfield....K-60	4,500	150*	solid*...	32.40	s&l-2....	selec..	dbl chn
Peerless.....TC6	.....	151*	solid....	32.40	.....	selec..	dbl chn
Royal.....	.....	158	solid....	42.20*	.....	ind-c..	top worm*
Tiffin.....SW	4,550	168	solid....	33.75	s&l-2....	selec..	top worm

TRUCKS OF 6½-TON CAPACITY

Name and Model	Chassis Price	Wheelbase, Inches	Tires	N.A.C.C. Horsepower	Electric System	Gearset Type	Final Drive
Saurer.....M	$5,800	156½	solid....	34.28	none....	selec..	dbl chn

TRUCKS OF 7-TON CAPACITY AND OVER

Name and Model	Chassis Price	Wheelbase, Inches	Tires	N.A.C.C. Horsepower	Electric System	Gearset Type	Final Drive
Dayton.....E	$4,950	.....	solid....	44.20	.....	selec..	dbl chn
Hurlburt.....	5,000	156*	solid....	33.75	lighting..	selec..	top worm
Mack.....AC	4,500	156*	solid....	40.00	s&l-2....	selec..	dbl chn
Old Reliable.....	5,000	150	solid....	41.62	lighting..	selec..	dbl chn
Royal.....	.....	158*	solid....	44.20	.....	ind-c..	dbl chn
Sterling.....	4,750	168	solid....	36.15	lighting..	selec..	dbl chn
Walter.....B	4,750	162*	solid....	30.65	.....	selec..	ext-g

TRACTORS

Name and Model	Chassis Price	Wheelbase, Inches	Tires	N.A.C.C. Horsepower	Electric System	Gearset Type	Final Drive
Knox.....35	$4,500	108½	solid....	40.00	s&l-2....	selec..	dbl chn
Knox.....36	5,000	108½	solid....	40.00	s&l-2....	selec..	dbl chn
Mack.....AC	3,400	119	solid....	40.00	s&l-2....	selec..	dbl chn
Mack.....AC	4,000	119	solid....	40.00	s&l-2....	selec..	dbl chn
Mack.....AC	4,500	119	solid....	40.00	s&l-2....	selec..	dbl chn
Mercury-Bulley.....A	3,400	71	solid....	29.00	lighting..	ind-c..	dbl chn
Transport.....T	2,500	80	solid....	19.61	.....	selec..	top worm
Watson.....	3,600	80	solid....	32.40	.....	selec..	top worm

ABBREVIATIONS: General, *, *with other options;* opt, *optional.* Tires, Kind, pneu, *pneumatic;* cush, *cushion;* p&s, *pneumatic in front, solid in rear;* p&c, *pneumatic in front, cushion in rear;* c&s, *cushion in front, solid in rear.* Electric System, s&l, *starting and lighting;* s, l & i, *starting lighting and ignition;* l&i, *lighting and ignition;* s&i, *starting and ignition;* -2, *two unit.* Gearset Type, prog, *progressive sliding gear;* selec, *selective sliding gear;* plan, *planetary;* ind-c, *constant-mesh individual clutch;* fric, *friction;* elec, *electric.* Final Drive bevel, *direct bevel;* sp-bev, *spiral bevel;* doub-red, *double-reduction, bevel and spur;* int-gear, *internal-gear;* ext-gear, *external gear;* top worm, *worm gear with worm on top;* dbl chn, *double chain;* sing chn, *single chain;* -f, *to front wheels;* 4, *to all four wheels.*

Military Truck a Complicated Problem

(*Continued from page* 751)

We have already gained a great deal of knowledge regarding the good and bad points in design from Europe and from the Mexican border. When more news comes from France and England we shall know still more than we do at present, but even then there are conditions in America which differ from any to be found in Europe, so whatever volume of information may come from across the Atlantic, America will still have to depend mainly upon her own engineers.

Years ago the Glidden Tours did much to take the conceit out of the passenger car engineering profession, as year after year they brought out weak spots in design. Until the last 2 years the motor truck had had no corresponding test, which means that truck engineers have never had any real large collection of data relating to tests to destruction. No one here can make much progress by relying entirely upon his own experience; or, putting it another way, the larger the amount of the experience upon which any engineer can draw the faster is his progress likely to be.

The military authorities have nearly 3000 trucks in use along the border and know the good, bad and indifferent features of each design and they are making analyses which will be a wonderful help in specifying the army requirements in the future. The engineers of the industry have access to much of this information and when told of a particular kind of failure they can probably get to the original cause of it quicker than any one else. It would be a wonderfully instructive thing to take six of the leading truck engineers and have them individually, and without co-operation, each design his ideal military truck. When the six machines were made and put in service it would certainly be found that each had its points of fitness and each had its weaknesses, while it is also certain that amalgamation of the virtues of the six into a seventh new design would produce a truck as near the ideal as anything the engineering profession can produce at present.

The Society of Automobile Engineers is trying to obtain the broad specifications for a hypothetical seventh truck in a quicker and perhaps an even more thorough manner.

In the truck industry there are many men whose vehicles have gone to the border and these men each know just what is wrong with his own particular designs; each of them has already formed an idea as to what he would design were he to build the machine solely for army work.

The S. A. E. believes it possible to amalgamate the knowledge of all these men, obtaining therefrom one ideal specification for a military truck which will stand better chance of being really correct than would the ideal of any one engineer alone. The method which has been adopted is to draft the specification which was published in THE AUTOMOBILE for Oct. 9, and discussing this original draft, in committee and by correspondence, detail by detail, it will soon be seen upon what points the engineers, as a whole, are agreed.

When a man is doubtful about his politics he talks to others, discovers their ideas and eventually makes up his mind; similarly the work the S. A. E. has set out to do is to make up the mind of the truck engineers as a body by facilitating discussion between the individual members thereof. Unofficially, the S. A. E. is going to obtain a great deal of assistance in this work from some of those who have had charge of the trucks on the border and who have, therefore, first-hand knowledge.

Technical Specifications of Gaso

Details of 386 Gasoline and Gasoline-Electric Motor Truck Chassis Engine, Transmission, Control and Equipment

Name and Model	Capacity in Pounds	Price of Chassis	Wheelbase in Inches	FRAME		TIRES			Wheels	MOTOR							IGNITION		
				Material	Construction	Kind	SIZES IN INCHES Front	SIZES IN INCHES Rear		No. of Crankshaft Bearings	Bore and Stroke	N.A.C.C. Hp.	Cylinders Cast	Valves Placed	COOLING Water Circulation	COOLING Radiator Core and Case	Type	Make	Spark Advance
A & B.....3 T	6,000	$4,500	144	rolled-c..	semi-flx	solid....	48x3½d	48x3½d	wood-ov.	3	4-5½x4½	42.76	pairs....	right...	gear...	fin-sheet...	dual..	Bosch.....	hand....
A & B.....5 T	10,000	4,750	144	rolled-c..	semi-flx..	solid....	48x3½d	48x5d	wood-ov.	3	4-5½x4½	42.76	pairs....	right...	gear...	fin-sheet...	dual..	Bosch.....	hand....
Acason.....2	4,000	.....	150	pr-steel..	semi-flx..	solid....	34x4	36x3½d	wood-ov	3	4-4½x5½	29.00	pairs....	left....	cent...	fin-cast....	sing...	Eisemann..	hand....
Acason.....	7,000	.....	168	pr-steel..	semi-flx..	solid....	36x5	38x5d	wood-ov.	3	4-4½x5½	29.00	pairs....	left....	cent...	fin-cast....	sing...	Eisemann..	hand....
Acme.....B	2,000	1,500	128	pr-steel..	semi-flx..	pneu	34x3	34x4	wood-sq.	3	4-3½x5	19.61	block...	left....	thermo.	fin-sheet...	sing...	Eisemann..	hand....
Acme.....A	4,000	2,100	148*	pr-steel..	semi-flx..	solid....	36x4	36x6	wood-sq.	3	4-4½x5½	27 20	block...	left....	cent...	fin-sheet..	sing...	Eisemann..	fixed....
Acme.....C	7,000	.....	168*	rolled-c..	semi-flx..	solid....	36x5	40x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	fin-cast....	sing...	Eisemann..	fixed....
Armleder.....HW2	4,000	2,800	166*	pr-steel..	semi-flx..	solid....	36x4	36x7*	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	cell-sheet..	sing...	Bosch.....	hand....
Armleder.....KW	7,000	3,500	156*	rolled-I..	semi-flx..	solid....	36x5	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left	cent...	fin-cast....	sing...	Bosch.....	hand....
Atlas.....17	1,000	600	106	pr-steel..	.....	pneu....	30x3½	30x3½	wood-ov.	2	4-3½x5	16.92	block...	right...	thermo.	fin-sheet....	sing...	Dixie.....	hand....
Atterbury.....6B	2,000	1,775	140½	pr-steel..	flexible..	solid....	36x3½	36x5	wood-sq.	3	4-3½x5½	22.50	block...	left...	cent...	fin-cast....	sing...	Bosch.....	fixed....
Atterbury.....6R	3,000	1,875	140½	pr-steel..	flexible..	solid....	36x3½	36x5	wood-sq	3	4-3½x5½	22.50	block...	left..	cent...	fin-cast....	sing...	Bosch.....	fixed....
Atterbury.....6C	4,000	2,375	153½	pr-steel..	flexible	solid....	36x4	36x4d	wood-sq	3	4-4½x5½	27 20	block...	left....	cent...	fin-cast....	sing...	Bosch.....	fixed....
Atterbury.....6D	7,000	3,175	167½	pr-steel..	flexible	solid....	36x5	40x5d..	wood-sq	3	4-4½x5½	32.40	pairs....	left....	cent...	fin-cast ..	dual..	Bosch.....	hand....
Autocar.....21F	4,000	1,650	97	rolled-c.	.....	solid*...	34x4*	34x5*	wood-ov.	2	2-4¾x4½	18.10	sing.....	top....	cent...	cell-sheet..	sing...	Bosch.....	fixed....
Available.....1	2,000	1,700	132*	rolled-c..	semi-flx..	solid....	36x3½	36x4	wood-ov.	3	4-3¾x5	22.50	block...	right ..	thermo.	cell-sheet..	sing...	Bosch.....	fixed....
Available.....2	4,000	2,250	156*	rolled-c..	semi-flx..	solid....	36x4	36x7	wood-ov.	3	4-4¼x5½	27.20	block...	left....	cent...	cell-sheet..	sing...	Bosch	fixed....
Available.....3	7,000	3,300	168*	rolled-c..	semi-flx..	solid....	36x5	40x5d	wood-ov.	3	4-4½x5½	32.40	pairs....	left....	cent...	cell-sheet..	sing...	Bosch.....	fixed....
Available.....5	10,000	4,400	168*	rolled-c..	semi-flx..	solid....	36x6	40x6d	wood-ov.	3	4-4½x5½	32.40	pairs....	right....	cent...	cell-sheet..	sing...	Bosch.....	fixed....
Avery.....C	2,000	1,600	128	.....	.....	solid....	34x3½	34x5	.....	.....	4-4¼x5½	27.20	block...	left....	cent...	fin-sheet...	dual..	Heinze....	hand....
Avery.....B	4,000	2,700	128	.....	.....	solid....	36x4	36x3½d	.....	.....	4-4½x5	36.15	sing. ..	left....	cent...	fin-sheet ..	dual..	Eisemann..	auto....
Avery.....B	6,000	3,200	128	.....	.....	solid ..	38x5	38x4d	.....	.....	4-4½x5	36.15	sing. ..	left....	cent...	cell-sheet ..	dual..	Eisemann..	auto ....
Avery.....A	6,000	2,500-c	140	.....	.....	wood ...	38x5	38x4d	.....	.....	4-4½x5	36.15	sing. ..	left....	cent...	fin-sheet....	dual	Eisemann..	auto....
Avery.....B	10,000	4,500	128	.....	.....	solid....	38x6	38x5d	.....	.....	4-5¼x5½	44.20	pairs...	opp....	cent...	cell-sheet..	dual..	Eisemann..	auto....
Beech Creek.....3A	6,000	3,850	132	rolled-c..	flexible..	solid....	36x6	36x6	wood-sq.	3	4-4¼x5¾	20.00	pairs....	left...	cent...	cell-sheet..	sing...	Eisemann..	hand....
Bessemer .....G	2,000	075	124	pr-steel..	semi-flx..	solid....	35x3	35x3½	wood-sq.	3	4-3½x5	19.61	block...	right...	thermo	cell-sheet	sing...	Bosch.....	hand....
Bessemer .....D	4,000	2,200*	146*	pr-steel..	semi-flx..	solid....	37x4	37x4d	wood-sq	3	4-4¼x5½	27.20	block...	left ..	cent...	cell-cast ..	sing...	Bosch	hand ....
Bessemer.....E	7,000	3,100	150*	pr-steel..	semi-flx..	solid....	37x5	37x5d	wood-sq.	3	4-4¼x5½	32.40	pairs ..	left..	cent...	cell-cast ..	sing...	Bosch.....	hand ....
Bessemer.....H	10,000	3,600	150	pr-steel..	semi-flx..	solid....	37x6	37x6d	wood-sq.	3	4-4½x5½	32.40	pairs...	left....	cent...	cell-cast ..	sing...	Bosch.....	hand....
Blair.....C	4,000	2,850	121*	pr-steel..	flexible..	solid....	34x4	34x3½d	wood-sq.	3	4-4¼x5¾	29 00	pairs...	left....	cent ..	z-z-t-sheet	dual..	Bosch.....	fixed ....
Blair.....D	6,000	3,250	121*	pr-steel..	flexible	solid....	36x4	36x4d	wood-sq.	3	4-4¼x5½	29 00	pairs	left....	cent..	z-z-t-sheet	dual..	Bosch.....	fixed ....
Blair.....E	8,000	3,750	144*	pr-steel..	flexible..	solid ...	36x5	36x5d	wood-sq.	3	4-4½x6½	32.40	pairs....	left....	cent..	z-z-t-sheet	dual..	Bosch.....	auto ....
Blair.....F	10,000	4,250	144*	pr-steel..	flexible	solid....	36x6	36x6d	wood-sq.	3	4-4½x6½	32.40	pairs....	left....	cent...	z-z-t-sheet	dual..	Bosch.....	auto ....
Brinton .....H	1,500	050	115	.....	.....	semi-flx..	pneu* ..	33x4	33x4*	wood-ov.	2	4-3½x5	16.92	block...	left....	gear...	cell-sheet..	sing...	.....	fixed....
Brinton.....F	5,000	2,250	138	.....	.....	semi-flx..	solid....	36x4	36x6	wood-ov.	3	4-4⅛x5	27.20	block...	left....	gear...	cell-sheet..	sing...	.....	fixed....
Briscoe.....4-24	1,000	625	104	pr-steel..	rigid....	pneu....	30x3½	30x3½	wood-ov.	2	4-3½x5½	16.92	block...	right...	thermo.	z-z-t-sheet.	sing...	Splitdorf...	hand....
Brockway.....O	2,000	1,450	124*	pr-steel..	flexible..	solid....	34x3½	34x4	wood-sq.	3	4-3½x5	19.61	block...	right...	thermo.	fin-cast.	sing...	Bosch.....	fixed....
Brockway J-2	3,000	1,825	124*	pr-steel..	flexible	solid....	36x3½	36x5	wood-sq.	3	4-3½x5	22.50	block	right	thermo.	fin-cast ..	sing..	Bosch.....	fixed....
Brockway.....K-2	4,000	2,125	140*	pr-steel..	flexible..	solid....	36x4	36x6*	wood-sq	3	4-4½x5½	27.20	block	left .	cent...	fin-cast ..	sing..	Bosch.....	fixed....
Brockway.....R	7,000	.....	164*	pr-steel..	semi-flx..	solid....	36x5	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	fin-cast....	sing...	Bosch.....	hand....
Burford.....O-3	4,000	2,250	144*	pr-steel..	rigid....	solid....	36x3½	36x3½d	wood-sq.	3	4-3¾x5½	22.50	block...	right	cent...	fin-cast ..	sing..	Eisemann..	fixed....
Burford D-3	7,000	3,600	175*	pr-steel..	rigid....	solid....	38x5	38x5d	wood-sq.	3	4-4½x6¾	32.40	block..	left....	cent...	fin-cast....	sing...	Eisemann..	fixed....
Couple Gear.....HC	7,000	5,000	144*	rolled-c..	semi-flx..	solid....	36x4d	36x4d	pr-steel-d	5	4-5½x6	53.00	sing.....	opp....	gear ..	cell-sheet..	dual..	Eisemann..	2-pt.-fix.
Couple Gear .....AC	10,000	5,350	144*	rolled-c..	semi-flx..	solid....	36x5d	36x5d	pr-steel-d	5	4-5½x6	53.00	sing.....	opp....	gear ..	cell-sheet..	dual..	Eisemann..	2-pt.-fix.
Chase.....A	2,000	1,650	.....	pr-steel.	.	solid ...	36x3½	36x5	wood-ov.	3	4-3½x5½	19 61	block....	.....	cent...	fin-sheet..	sing..	Bosch.....	fixed ....
Chase.....C	3,000	1,950	138	pr-steel.	....	solid ...	36x3½	36x3½d	wood-ov.	3	4-3½x5½	19 61	block....	.....	cent ..	fin-cast ..	sing..	Bosch.....	fixed ....
Chase .....B	5,000	2,475	160	pr-steel.	. .	solid ...	36x4	36x4d	wood .	3	4-4¼x5½	27.20	block ..	.....	cent ..	fin-cast ..	sing..	Bosch.....	fixed ....
Chase.....X	6,000	. .	160	pr-steel.	. .	solid....	36x4	36x5d	wood ..	3	4-4¼x5½	27 20	block....	.....	cent ..	fin-cast....	sing...	Bosch.....	fixed ....
Chase.....O	7,000	3,300	175	pr-steel.	.....	solid....	36x5	36x5d	wood-ov.	3	4-4¼x6	29.00	block....	.....	cent...	fin-cast....	sing...	Bosch.....	fixed....
Collier.....M	1,500	800	118	rolled-c.	semi-flx..	pneu ...	33x4	33x4	wood-ov.	3	4-3½x5	16.92	block...	right	thermo.	z-z-t-sheet.	sing...	Conn.....	hand....
Columbia.....E	4,000	1,750	144*	pr-steel..	. .	solid....	36x4	36x6	wood-sq.	3	4-4½x5½	27.20	block .	right .	cent . .	z-z-t-cast..	sing...	Eisemann..	hand....
Commerce .....N	1,500	975	120	pr-steel.	flexible	pneu ..	34x4	34x4	wood-sq	3	4-3½x5	19 61	block	left	thermo.	fin-cast....	sing...	Eisemann..	fixed....
Commerce.....E	2,000	1,175	126	pr-steel..	flexible	solid....	34x3	34x4	wood-sq	3	4-3½x5	19.61	block..	left....	thermo.	fin-cast....	sing...	Remy.....	hand....
Continental (C).... FL	2,000	1,550	144	. .	. .	solid ..	34x3	36x4	. .	3	4-3¾x5½	22.50	pairs ...	left....	cent ..	fin-cast ...	sing...	Bosch*....	fixed....
Continental (C).... HL	3,000	1,750	144	.	.	solid.	34x3½	36x5	.	3	4-3¾x5½	22.50	pairs ..	left....	cent ..	fin-cast ...	sing...	Bosch*....	fixed....
Continental (C)... J	4,000	2,100	146	.	.	solid	36x4	36x4d	.	3	4-4¼x5½	27.20	pairs	left	cent ..	cell-cast...	sing...	Bosch*....	fixed....
Continental (C).....M	7,000	3,000	168*	.	.	solid .	36x5	36x5d	. . .	3	4-4½x5½	32.40	pairs..	left....	cent...	cell-cast...	sing...	Bosch*....	fixed....
Corbitt. ....D	3,000	2,150	138	pr-steel..	rigid .	solid .	36x3½	36x5	wood-sq	3	4-3¾x5½	22 50	block..	right	cent...	fin-cast ..	sing...	Eisemann..	hand ....
Corbitt C	4,000	2,400	148	pr-steel.	rigid	solid	36x3½	36x3½d	wood-sq.	3	4-4 x5½	27 20	block...	right	cent ..	fin-cast	sing...	Eisemann..	hand ....
Corbitt.....B	5,000	2,650	148	pr-steel.	rigid	solid ..	36x4	36x4d	wood-sq	3	4-4¼x5½	27 20	block...	right	cent...	fin-cast....	sing...	Eisemann..	hand....

ABBREVIATIONS: **General**, *, *with other options*; opt, *optional*; **Price**, -c, *complete with body*. **Frame, Material**, pr-steel, *pressed steel*; rolled-c, *rolled steel, channel section*; rolled-I, *rolled steel, I section*; **Frame Construction**, semi-fix, *semi flexible*. **Tires, kind**, Pneu, *pneumatic*; cush, *cushion*, p & s, *pneumatic front, solid, rear*; s & st, *solid rubber front, steel in rear*. **Tire Sizes**, -d, *dual*. **Wheels**, pr-steel, *pressed steel*; -ov, *oval spokes*; -sq, *square spokes*; -d, *disk or web type*; -hol, *hollow spokes*; -cr, *cruciform spokes*; -x, *cross-shaped solid spokes*. **Cylinders cast**, sing, *singly or individually*. **Location of valves**, opp, *opposite, T-head motor*; r & h, *one valve at right, the other in head, L-head motor*; l & h, *one valve at left the other in head, L-head motor*. **Water circulation**, cent, *centrifugal pump*; thermo-, *thermo-syphon or natural circulation*; gear, *gear pump*. **Radiator Type**, fin, *individually finned tubes*; sq-t, *square-tubular, resembling cellular, sometimes known as flat-tubular*; z-s-t, *zig-zag tubular, resembling cellular*, cell, *cellular or honeycomb type*; tube, *plain tubes without fins*; ring, *tubes arranged in ring about blower fan*. **Radiator Case**, -sheet, *sheet metal*; -cast, *cast metal, built up*. **Ignition Type**, sing, *single*; doub, *double*, dual-d, *dual-double*. **Make of Magneto** (or other sparking device), Conn., *Connecticut*; storage, *storage battery*; Westghs, *Westinghouse*; G & D, *Gray & Davis*; At Kent, *Atwater Kent*. **Spark Advance**, auto, *automatic*; 2-pt-fix, *two-point fixed, battery circuit in retard, magneto in advance*. **Electric System Type**, s, l & i, *starting, lighting and ignition, combination unit*; s & l, *starting and lighting, combination unit*; s & l-2, *starting and lighting, two-unit*; l & i, *lighting and ignition, combination unit*. **Electric System, Make**, Splitdf, *Splitdorf*; Al-Chal,—(Abbreviations Continued on Opposite Page.)

line Commercial Vehicles for 1917

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Produced by 137 American Manufacturers, with Full Particulars of —Two Steam Models of One Maker Included

MOTOR											TRANSMISSION								BRAKES		CONTROL		
ELECTRIC SYSTEM			GOVERNOR			SPEED		FUEL SYSTEM				GEARSET											
Type	Make	Extra Cost	Type	Drive	Make	Motor in r. p. m.	Truck in m. p. h.	Carbureter Make	Fuel Feed	Tank Location	Clutch Type	Type	Location	Sp'ds	Total Gear Reduction in High	Final Drive	Propulsion Taken By	Torque Taken By	Hand	Foot	Steer	Levers	Name and Model
								Scheb..	grav.	seat..	none..	elec..	amid...	2	28.00–1	int-g-f..	rad-rd..	rad-rd..	ex-r-w..	ex-f-w..	right.	right.	A & B.....3T
								Scheb..	grav.	seat..	none..	elec..	amid...	2	28.00–1	int-g-f..	rad-rd..	rad-rd..	ex-r-w..	ex-f-w..	right.	right.	A & B.....5T
			cent..	motor..	Wauk'a..	1,100	17½	Scheh..	vac..		dry-d..	selec.	unit-m.	4		worm..	springs	springs	int-r-w.	int-r-w.	right.	cent..	Acason.....2
			cent..	motor..	Wauk'a..	1,100	13½	Scheb..	vac..		dry-d..	selec.	unit-m.	4		worm..	springs	springs	int-r-w.	int-r-w.	right.	cent.	Acason.....
			cent..	motor.	Pierce..	1,700	22	Ray...	vac..		dry-d..	selec.	unit-m.	3	7.75–1	worm..	springs	springs	int.....	int.....	left..	cent..	Acme.....B
lighting.		opt..	cent..	motor..	Pierce..	1,300	17	Ray...	vac..		dry-d..	selec.	unit-m.	3	8.50–1	worm..	springs	springs	int.....	int.....		cent..	Acme.....A
lighting.		opt..	cent..	motor..	Pierce..	1,200	14	Ray...	vac..		dry-p..	selec.	amid...	3	10.25–1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left..	cent..	Acme.....C
lighting.		60 00	cent..	drive-s.	Pierce*..	1,200	16	Scheh .	grav.	seat..	wet-d.	selec.	unit-m.	3	8.50–1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left..	cent..	Armleder.....HW2
lighting.		60.00	cent..	motor*.	Pierce..	1,100	14	Scheb..	grav.	seat.	wet-d.	selec.	unit-m.	3	8.75–1	worm..	rad-rd..	springs.	int-r-w.	ext-sht.	left..	cent..	Armleder.....KW
								Carter..	grav.	seat..	wet-d.	selec.	unit-m.	3	4.75–1	sp-bev..	springs.	springs.	ext-r-w.	int-r-w.	left..	cent..	Atlas.....17
			cent..	motor..	Pierce..	1,200	16½	Zenith..	grav.	seat.	dry-d..	selec.	unit-m.	4	7.75–1	worm..	springs.	springs.	int-r-w.	int-r-w.	right.	right.	Atterbury.....6B
			cent..	motor.	Pierce..	1,200	15	Zenith..	grav.	seat..	dry-d..	selec.	unit-m.	4	7.75–1	worm..	springs.	springs.	int-r-w.	int-r-w.	right.	right.	Atterbury.....6R
			cent..	motor.	Pierce..	1,200	15	Zenith..	grav.	seat..	dry-d..	selec.	unit-m.	4	8.50–1	worm..	springs.	springs.	int-r-w.	int-r-w.	right.	right.	Atterbury.....6C
			cent..	motor..	Pierce..	1,125	13	Zenith..	grav.	seat..	dry-d..	selec.	unit-m.	4	10.33–1	worm..	springs.	springs.	int-r-w.	int-r-w.	right.	right.	Atterbury.....6D
								Stmbg..		seat..	dry-p..	prog.	amid...	3	7.14–1	db-red..	springs.	springs.	int-r-w.	ext-r-w.	right.	4 right.	Autocar.....21F
			none					Stmbg.	grav.	seat..	dry-d..	selec.	unit-m.	3	7.00–1	worm..	springs.	springs.	int.....	int.....	left..	cent..	Available.....1
			none					Stmbg	grav	seat.	dry-d..	selec	unit-m.	3	7.75–1	worm..	springs	springs.	int.....	int.....	left..	cent..	Available.....2
			cent	motor..	Pierce...	1,300	15		grav.	seat..	dry-d..	selec.	unit-m.	3	10.33–1	worm..	rad-rd..	springs.	int.....	int.....	left..	cent..	Available.....3
			cent	motor..	Pierce...	1,175	12	Stmbg	grav.	seat..	dry-d..	selec.	unit-m.	3	11.75–1	worm..	rad-rd..	springs.	int.....	int.....	left..	cent..	Available.....5
			cent	motor..		1,200	15	Ray...			dry-d..	selec.	unit-m.	3	7.75–1	dblchn.		rad-rd.			left..	cent..	Avery.....C
			l-b	motor..		1,200	14½	Ray...			dry-d..	selec.	unit-j..	3	3.50–1	dblchn.		rad-rd..			right.	cent..	Avery.....B
			cent..	motor..		1,200	13	Ray...			dry-p..	selec.	unit-j..	3	3.50–1	dblchn.		rad-rd..			right.	cent..	Avery.....B
			cent..	motor..		1,200	12	Ray...			dry-d..	selec.	unit-j..	3	3.50–1	dblchn.		rad-rd..			right.	cent..	Avery.....A
			cent..	motor..		1,000	10	Scheb .			wet-d..	selec.	unit-j..	3	12.50–1	dblchn.		rad-rd..			right.	cent..	Avery.....B
			cent..	motor..	Wauk'a..	1,000	12	King...	vac..	seat..	dry-p..	selec.	amid...	6	8.03–1	bevel-4.	rad-rd..	springs.	ext-r-w.	ext-sht.	rt*...	cent..	Beech Creek.....3A
					none...			Scheb..	grav	seat..	dry-d.	selec.	unit-m.	3	7.00–1	int-g..	springs	springs	int-r-w.	ext-r-w.	left..	cent	Bessemer.....G
			cent..	motor.	Pierce...			Ray...	grav	seat.	cone..	selec.	amid ..	3	7.75–1	worm..	springs	springs	int-r-w.	int-r-w.	left..	cent..	Bessemer.....D
			cent..		Pierce...			Ray...	grav.		cone..	selec.	amid...	3	10.33–1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left..	cent	Bessemer.....E
			cent..	motor.	Pierce...				grav.	seat..	cone..	selec.	amid...	3	13.00–1	worm..	rad-rd..	t-arm..	int-r-w.	ext-sht.	left..	cent..	Bessemer.....H
			cent..	motor..	Wauk'a..	1,060	14	Scheb .	grav.	seat..	cone..	ind-c.	amid ..	3	7.67–1	worm..	sub-f...	sub-f ..	int-r-w.	ext-sht.	right.	right.	Blair.....C
			cent..	motor.	Wauk'a..	970	12	Scheb .	grav.	seat..	cone..	ind-c.	amid...	3	8.67–1	worm..	sub-f...	sub-f...	int-r-w.	ext-sht.	right.	right.	Blair.....D
			cent..	motor	Wauk'a..	870	10	Scheb .	grav.	seat..	cone..	ind-c.	amid...	3	9 33–1	worm..	sub-f...	sub-f...	int-r-w.	ext-sht.	right.	right.	Blair.....E
			cent..	motor.	Wauk'a..	870	10	Scheh..	grav.	seat..	cone..	ind-c.	amid...	3	9.33–1	worm..	sub-f...	sub-f...	int-r-w.	ext-sht.	right.	right.	Blair.....F
lighting			cent..	motor..					grav.	seat..	dry-d..	selec.	unit-m.	3		worm..		springs	int.....	ext.....		cent..	Brinton.....H
lighting.		stock...	cent..	motor..					grav.	seat..	dry-d..	selec	unit-m.	3		worm..	springs.	springs.	int.....	ext.....		cent.	Brinton.....F
s, l & i...	Spitdf..	stock ..							grav.	dash.	cone..	selec.	unit-x..	3	4.23–1	bevel...	springs.	t-arm..	int-r-w.	ext-r-w.	left..	cent	Briscoe.....4-24
			suct..	motor..	Mon'rch.	1,400	18	Scheh..	grav.	seat..	dry-d..	selec.	unit-m.	3	7.90–1	worm..	springs.	springs	int-r-w.	int-r-w.	left..	cent..	Brockway.....O
			suct.	motor.	Mon'rch.	1,250	15	Scheb..	grav.	seat..	cone..	selec	amid ..	3	8.66–1	worm..	springs.	springs	int-r-w.	ext-r-w.	left..	cent..	Brockway.....J-2
			suct..	motor.	Mon'rch.	1,250	15	Scheb..	grav.	seat..	cone..	selec.	amid...	3	8.66–1	worm..	springs.	springs	int-r-w.	int-r-w.	left..	cent..	Brockway.....K-2
ligbting.			suct..	motor.	Mon'rch.	1,200	12	Scbeb..	grav.	seat..	dry-d..	selec	amid...	3	10.33–1	worm..	rad-rd..	springs	int-r-w.	int-r-w.	left..	cent..	Brockway.....R
lighting		stock..			none....	1,200	15	Zenith..	grav.	dash.	cone..	selec.	unit-m.	3	8 50–1	int-g...	springs.	springs.	ext-sht.	ext-r-w.	right.	cent..	Burford.....O-3
lighting.		stock...	cent..	motor..	Wauk'a..	1,000	13	Zenith..	vac..	seat..	dry-d..	selec.	amid...	4	13.10–1	worm..	rad-rd..	springs.	..r-w..	int-r-w.	right.	right.	Burford.....D-3
lighting*		stock..			Her-Sp	1,500		Stmbg..	grav.	seat..		elec.		1	25.00–1	bevel-4.	rad-rd..	rad-rd..		ext-4-w.	right.	c & r	Couple Gear.....HC
lighting*		stock...	c't*..	f-whl*..	Her-Sp*	1,500		Stmbg..	grav.	seat..		elec.	amid...	1	25.00–1	bevel-4.	rad-rd..	rad-rd..		ext-4-w.	right.	cent..	Couple Gear.....AC
			suct.	motor	Mon'rch.	1,200	18	Stmbg..	grav	seat.	dry-d..	selec	unit-m.	3		worm..	springs.	springs	int-r-w	int-r-w.	right.	cent..	Chase.....A
			suct.	motor	Mon'rch.	1,000	15	Stmbg..	grav		dry-d..	selec	unit-m.	3		worm..	springs	springs	int-r-w	int-r-w.	right.	cent..	Chase.....C
			suct.	motor	Mon'rch.	1,000	15	Stmbg..	grav	seat..	dry-d..	selec	unit-m.	3		worm..	springs	springs	int-r-w	int-r-w.	right.	cent.	Chase.....B
			suct.	motor	Mon'rch.	1,000	10	Stmbg..	grav		wet-d	selec	unit-m	3		worm	springs	springs	int-r-w	int-r-w.	right.	cent..	Chase.....X
			suct..	motor.	Mon'rch.	1,000	10	Stmbg..	grav.	seat.	wet-d.	selec	unit-m.	4		worm..	springs	t-arm..	int....	int.....	right.	ceut..	Chase.....O
s, l & i...	Dyneto..	stock...			none....		35	Carter*	grav.		dry-p.	selec.	unit-m.	3	6.00–1	bevel..	springs	t-arm..	int-r-w.	ext-r-w.	left..	cent	Collier.....M
none....			suct..	motor..	Mon'rch.	1,200	14	Shkspr	grav		conc..	selec	amid...	3	9.45–1	int-g...	springs	springs	int-r-w.	ext-r-w.	left..	cent..	Columbia.....E
s, l & i...		100 00			none....	1,630	25	Zenith..	grav.	seat..	cone..	selec	unit-m.	3	6.00–1	bevel..	springs	t-arm	int-r-w	ext-r-w.	left	cent..	Commerce .....N
s & l-2...	Remy...	stock...	cent..	d-shft..	Pierce...	1,383	20	Zenith..	vac..	seat..	cone..	selec	unit-m.	3	7.00–1	int-g...	springs	springs	int-r-w.	ext-r-w.	left.	cent..	Commerce .....E
			suct..	motor.				Stmbg..			dry-d..	selec.	unit-m.	3	7 75–1	worm..	springs	springs			left*	cent..	Continental (C)..... FL
			suct.	motor				Stmbg..			dry-d..	selec	unit-m.	3	9 25–1	worm	springs	springs			left*	cent..	Continental (C)..... HL
			suct..	motor				Stmbg..			dry-d..	selec	unit-m.	3	9.25–1	worm	springs	springs			left*	cent..	Continental (C)..... J
			suct.	motor..			18	Stmbg..			dry-d..	selec	unit-m.	3	10.50–1	worm	springs	springs			left*	cent..	Continental (C)..... M
			cent..	motor..	Pierce...	1,500	14	Stmbg..	grav	seat.	dry-d..	selec	unit-m.	3	8 66–1	worm..	springs	springs	int-r-w.	ext-r-w.	left.	cent..	Corbitt ..... D
			cent..	motor..	Pierce...	1,500	14	Stmbg..	grav	seat.	dry-d..	selec	unit-m	3	8 66–1	worm	springs	springs	int-r-w.	ext-r-w.	left.	cent..	Corbitt C
			cent..	motor	Pierce..	1,500	14	Stmbg..	grav.	seat.	dry-d..	selec	unit-m.	3	8.66–1	worm.	springs.	springs	int-r-w	ext-r-w.	left.	cent.	Corbitt ..... B

ABBREVIATIONS: (continued).—*Allis-Chalmers*; G & D, *Gray & Davis*; Westghs, *Westinghouse*; N-East, *Northeast*; Huff-S, *Huff-Simms*; Spl-App, *Splitdorf-Apple*. **Governor Type** cent, c't, *centrifugal*; suct, *suction or gas velocity*; l-b, *loose-ball*; hydr, *hydraulic*. **Governor Drive** motor, *from motor*; d-shft, *from driveshaft*; duplex, *from both motor and driveshaft or front wheel*; f-wheel, f-whl, *from front wheel*. **Governor Make** Wauk'a, *Waukesha*; Mon'rch, Mon, *Monarch*; Her-Sp, *Herschell-Spillman*; Milwkee, *Milwaukee*. **Carbureter Make,** Scheb, *Schebler*; Ray, *Rayfield*; Stmbg, *Stromberg*; Shkspr, *Shakespeare*; Flech, *Flechter*; Zen, *Zenith*, Johns, *Johnson*. **Fuel Feed,** grav, *gravity*; vac, *vacuum*; pres, *pressure*. **Tank Location,** seat, *under seat*; dash, *in dash*; rear, *at rear*; r-bd, *on running-board*. **Clutch Type,** dry-d, *dry multiple disk*; dry-p, *dry plate*: wet-d, *multiple-disk in oil*; wet-p, *plate-in-oil*. **Gearset Type,** selec, *selective sliding gear*; prog, *progressive sliding gear*; ind-c, *individual clutch, constant-mesh*; plan, *planetary*; fric, *friction*; elec, *electric*. **Gearset Location,** amid, *amidships*; unit-m, *unit with motor*; unit-j, *unit with jackshaft*; unit-x, *unit with axle*. **Final Drive,** int-g, *internal-gear*; worm, *top worm*; dhl chn, *double side chains*; sp-bevel, *spiral bevel*; db-red, *double-reduction, bevel and spur gears*; ext-g, *external-gear*; -f, *to front wheels*; -4, *on all four wheels*. **Propulsion Taken By,** rad-rd, *radius rods*; tor-t, *torsion-tube*; sub-f, *sub-frame*; spg's, *springs*. **Torque Taken By,** rad-rd, *radius rods*; tor-t, *torsion-tube*; t-arm, *torque-arm*; sub-f, *sub-frame*; sp'gs, *springs*. **Brakes, Type,** ext, ex, *external contracting*; int, *internal expanding*. **Brake Location,** -r-w, *rear wheel*; -sht, *shaft*; -f-w, *front wheel*; -j-s, *jackshaft*; -4-w, *on all four wheels*. **Control, Levers,** cent, *center*; c & r, *gearsh.ft center, brake right*; c & l, *gearshift center, brake left*.

Technical Specifications of Gaso

Details of 386 Gasoline and Gasoline-Electric Motor Truck Chassis Engine, Transmission, Control and Equipment

Name and Model	Capacity in Pounds	Price of Chassis	Wheelbase in Inches	FRAME		TIRES			Wheels	MOTOR								
				Material	Construction	Kind	SIZES IN INCHES			No. of Crankshaft Bearings	Bore and Stroke	N.A.C.C. Hp.	Cylinders Cast	Valves Placed	COOLING		IGNITION		
							Front	Rear							Water Circulation	Radiator Core and Case	Type	Make	Spark Advance
A & B.....3 T	6,000	$4,500	144	rolled-c..	semi-fix .	solid....	48x3½d	48x3½d	wood-ov.	3	4-5½x4½	42.76	pairs....	right...	gear...	fin-sheet...	dual..	Bosch.....	hand....
A & B.....5 T	10,000	4,750	144	rolled-c..	semi-fix..	solid....	48x3½d	48x5d	wood-ov.	3	4-5½x4¾	42.76	pairs....	right...	gear...	fin-sheet...	dual..	Bosch.....	hand....
Acason.....2	4,000	.....	150	pr-steel..	semi-flx..	solid....	34x4	36x3½d	wood-ov	3	4-4½x5½	29 00	pairs....	left....	cent...	fin-cast....	sing...	Eisemann..	hand ....
Acason.....	7,000	.....	168	pr-steel..	semi-flx..	solid....	36x5	38x5d	wood-ov.	3	4-4½x5¾	29.00	pairs....	left....	cent...	fin-cast....	sing...	Eisemann..	hand....
Acme.....B	2,000	1,500	128	pr-steel..	semi-flx..	pneu....	34x3	34x4	wood-sq.	3	4-3½x5	19 61	block...	left....	thermo.	fin-sheet...	sing...	Eisemann..	hand....
Acme.....A	4,000	2,100	148*	pr-steel..	semi-flx..	solid....	36x4	36x6	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	fin-sheet ..	sing...	Eisemann..	fixed....
Acme.....C	7,000	.....	168*	rolled-c..	semi-flx..	solid....	36x5	40x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	fin-cast....	sing...	Eisemann..	fixed....
Armleder.....HW2	4,000	2,800	166*	pr-steel..	semi-flx..	solid....	36x4	36x7*	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	cell-sheet..	sing...	Bosch.....	hand....
Armleder.....KW	7,000	3,500	156*	rolled-I..	semi-flx..	solid....	36x5	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	fin-cast	sing...	Bosch.....	hand....
Atlas.....17	1,000	690	106	pr-steel..	.....	pneu....	30x3½	30x3½	wood-ov.	2	4-3½x5	16.92	block...	right...	thermo.	fin-sheet...	sing...	Dixie.....	hand....
Atterbury.....6B	2,000	1,775	140½	pr-steel..	flexible..	solid....	36x3½	36x5	wood-sq.	3	4-3⅞x5½	22.50	block...	left....	cent...	fin-cast....	sing...	Bosch.....	fixed....
Atterbury.....6R	3,000	1,875	140½	pr-steel..	flexible..	solid	36x3½	36x5	wood-sq	3	4-3⅞x5½	22.50	block...	left....	cent...	fin-cast....	sing...	Bosch.....	fixed....
Atterbury.....6C	4,000	2,375	153½	pr-steel..	flexible .	solid....	36x4	36x4d	wood-sq	3	4-4½x5½	27.20	block...	left....	cent...	fin-cast....	sing...	Bosch.....	fixed....
Atterbury.....6D	7,000	3,175	167½	pr-steel..	flexible .	solid....	36x5	40x5d..	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	fin-cast....	dual..	Bosch.....	hand....
Autocar.....21F	4,000	1,650	97	rolled-c.	.....	solid*...	34x4*	34x5*	wood-ov.	2	2-4⅞x4½	18.10	sing....	top....	cent...	cell-sheet..	sing...	Bosch.....	fixed....
Available.....1	2,000	1,700	132*	rolled-c..	semi-flx..	solid....	36x3½	36x4	wood-ov.	3	4-3⅞x5	22.50	block...	right....	thermo.	cell-sheet .	sing...	Bosch.....	fixed....
Availsble 2	4,000	2,250	156*	rolled-c..	semi-flx..	solid....	36x4	36x7	wood-ov.	3	4-4¼x5½	27.20	block...	left....	cent ..	cell-sheet..	sing...	Bosch.....	fixed....
Available.....3	7,000	3,300	168*	rolled-c..	semi-flx..	solid....	36x5	40x5d	wood-ov.	3	4-4½x5½	32.40	pairs....	left....	cent...	cell-sheet..	sing...	Bosch.....	fixed....
Available.....5	10,000	4,400	168*	rolled-c..	semi-flx..	solid....	36x6	40x6d	wood-ov.	3	4-4½x5½	32.40	pairs....	right....	cent...	cell-sheet..	sing...	Bosch.....	fixed....
Avery.....C	2,000	1,690	128	.....	.....	solid....	34x3½	34x5	.....	.....	4-4¼x5½	27.20	hlock...	left....	cent...	fin-sheet...	dual..	Heinze....	hand....
Avery.....B	4,000	2,700	128	.....	.....	solid....	36x4	36x3½d	.....	.....	4-4½x5	36.15	sing.....	left....	cent...	fin-sheet ..	dual..	Eisemann.	auto....
Avery..... B	6,000	3,200	128	.....	.....	solid	38x5	38x4d	.....	.....	4-4½x5	36.15	sing.....	left....	cent...	cell-sheet..	dual..	Eisemann.	auto....
Avery.....A	6,000	2,500-c	140	.....	.....	wood	38x5	38x4d	.....	.....	4-4½x5	36.15	sing.....	left	cent...	fin-sheet ..	dual..	Eisemnnn..	auto....
Avery.....B	10,000	4,500	128	.....	.....	solid....	38x6	38x5d	.....	.....	4-5⅛x5¾	44.20	pairs....	opp	cent...	cell-sheet..	dual..	Eisemann..	auto....
Beech Creek.....3A	6,000	3,850	132	rolled-c..	flexible..	solid....	36x6	36x6	wood-sq.	3	4-4¼x5¾	29.00	pairs....	left....	cent...	cell-sheet..	sing...	Eisemann..	hand....
Bessemer..... G	2,000	975	124	pr-steel..	semi-flx..	solid....	35x3	35x3½	wood-sq.	3	4-3½x5	19.61	block...	right..	thermo	cell-sheet .	sing...	Bosch.....	hand....
Bessemer ..... D	4,000	2,200*	146*	pr-steel..	semi-flx..	solid....	37x4	37x4d	wood-sq.	3	4-4¼x5½	27 20	block...	left....	cent . .	cell-cast ..	sing...	Bosch	hand ....
Bessemer..... E	7,000	3,100	150*	pr-steel..	semi-flx..	solid....	37x5	37x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	cell-cast ..	sing...	Bosch.....	hand....
Bessemer.....H	10,000	3,600	150	pr-steel..	semi-flx..	solid....	37x6	37x6d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	cell-cast ..	sing...	Bosch.....	hand....
Blair.....C	4,000	2,850	121*	pr-steel..	flexible..	solid....	34x4	34x3½d	wood-sq.	3	4-4¼x5½	29 00	pairs ..	left....	cent ..	z-z-t-sheet	dual..	Bosch	fixed....
Blair.....D	6,000	3,250	121*	pr-steel..	flexible .	solid....	36x4	36x4d	wood-sq	3	4-4½x5½	29 00	pairs	left....	cent ..	z-z-t-sheet	dual..	Bosch.....	fixed....
Blair..... E	8,000	3,750	144*	pr-steel..	flexible .	solid....	36x5	36x5d	wood-sq.	3	4-4½x6½	32.40	pairs	left....	cent ..	z-z-t-sheet	dual..	Bosch.....	nuto....
Blair.....F	10,000	4,250	144*	pr-steel..	flexible .	solid....	36x6	36x6d	wood-sq.	3	4-4¼x6½	32.40	pairs....	left....	cent...	z-z-t-sheet	dual..	Bosch.....	auto....
Brinton.....H	1,500	950	115	.....	semi-flx..	pneu* .	33x4	33x4*	wood-ov.	2	4-3½x5	16.92	block...	left....	gear...	cell-sheet..	sing...	.....	fixed....
Brinton..... F	5,000	2,250	138	.....	semi-flx..	solid....	36x4	36x6	wood-ov.	3	4-4¼x5	27.20	block...	left....	gear...	cell-sheet..	sing...	.....	fixed....
Briscoe.....4-24	1,000	625	104	pr-steel..	rigid....	pneu....	30x3½	30x3½	wood-ov.	2	4-3½x5½	16.92	block...	right...	thermo.	z-z-t-sheet	sing...	Splitdorf...	hand....
Brockway.....O	2,000	1,450	124*	pr-steel..	flexible .	solid....	34x3½	34x4	wood-sq.	3	4-3½x5	19.61	block	right...	thermo.	fin-cast. .	sing...	Bosch.....	fixed....
Brockway..... J-2	3,000	1,825	124*	pr-steel..	flexible..	solid....	36x3½	36x5	wood-sq.	3	4-3½x5	22 50	block	right ..	thermo.	fin-cast	sing...	Bosch	fixed....
Brockway K-2	4,000	2,125	140*	pr-steel..	flexible..	solid....	36x4	36x6*	wood-sq.	3	4-4½x5½	27.20	block	left ..	cent...	fin-cast	sing...	Bosch	fixed....
Brockway.....R	7,000	.....	164*	pr-steel..	semi-flx..	solid....	36x5	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	fin-cast.....	siug...	Bosch.....	hand....
Burford.....O-3	4,000	2,250	144*	pr-steel..	rigid....	solid....	36x3½	36x3½d	wood-sq.	3	4-3½x5½	22.50	block...	right	cent ..	fin-cast .	sing...	Eisemann..	fixed....
Burford D-3	7,000	3,600	175*	pr-steel..	rigid....	solid....	38x5	38x5d	wood-sq.	3	4-4½x6½	32.40	block...	left ..	cent...	fin-cast....	sing...	Eisemann..	fixed....
Couple Gear.....HC	7,000	5,000	144*	rolled-c..	semi-flx..	solid....	36x4d	36x4d	pr-steel-d	5	4-5½x6	53.00	sing.....	opp....	gear ...	cell-sheet	dual..	Eisemann.	2-pt.-fix.
Couple Gear .....AC	10,000	5,350	144*	rolled-c..	semi-flx..	solid....	36x5d	36x5d	pr-steel-d	5	4-5¾x6	53.00	sing.....	opp....	gear....	cell-sheet..	dual..	Eisemann..	2-pt.-fix.
Chase.....A	2,000	1,650	.....	pr-steel..	.....	solid	36x3½	36x5	wood-ov.	3	4-3½x5½	19 61	block...	.....	cent...	fin-sheet .	sing..	Bosch.....	fixed....
Chase..... C	3,000	1,950	138	pr-steel..	.....	solid....	36x3½	36x3½d	wood-ov.	3	4-3½x5¼	19 61	block...	.....	cent...	fin-cast ..	sing...	Bosch....	fixed ..
Chase..... B	5,000	2,475	160	pr-steel.	.....	solid....	36x4	36x4d	wood .	3	4-4¼x5½	27.20	block...	.....	cent...	fin-cast	sing...	Bosch.....	fixed....
Chase..... X	6,000	.....	160	pr-steel..	.....	solid	36x4	36x5d	wood ..	3	4-4¼x5½	27.20	block.	.....	cent...	fin-cast....	sing...	Bosch.....	fixed....
Chase.....O	7,000	3,300	175	pr-steel..	.....	solid	36x5	36x5d	wood-ov.	3	4-4¼x6	29.00	block...	.....	cent...	fin-cast....	sing...	Bosch.....	fixed....
Collier.....M	1,500	800	118	rolled-c.	semi-flx..	pneu....	33x4	33x4	wood-ov.	3	4-3¼x5	16.92	block...	right..	thermo.	z-z-t-sheet	sing...	Conn.....	hnnd....
Columbia..... E	4,000	1,750	144*	pr-steel..	.....	solid....	36x4	36x6	wood-sq.	3	4-4½x5½	27.20	block..	right .	cent...	z-z-t-cast..	sing...	Eisemann..	hand....
Commerce.....N	1,500	975	120	pr-steel.	flexible	pneu. ..	34x4	34x4	wood-sq	3	4-3½x5	19.61	block	left	thermo	fin-cast....	sing...	Eisemann.	fixed....
Commerce..... E	2,000	1,175	126	pr-steel..	flexible..	solid	34x3	34x4	wood-sq.	3	4-3½x5	19.61	block .	left....	thermo.	fin-cast....	sing...	Remy.....	hand....
Continental (C)..... FL	2,000	1,550	144	...	...	solid ..	34x3	36x4	.....	3	4-3⅞x5½	22.50	pairs	left	cent...	fin-cast ..	sing...	Bosch* ...	fixed....
Continental (C).... HL	3,000	1,750	144			solid .	34x3½	36x5	...	3	4-3⅞x5½	22 50	pairs	left	cent	fin-cast	sing...	Bosch*....	fixed....
Continental (C) .... J	4,000	2,100	146			solid	36x4	36x4d	...	3	4-4¼x5½	27.20	pairs	left	cent	cell-cast ..	sing...	Bosch*....	fixed....
Continental (C).....M	7,000	3,000	168*			solid .	36x5	36x5d	....	3	4-4½x5½	32.40	pairs..	left....	ceut...	cell-cast...	sing...	Bosch*....	fixed....
Corbitt .....D	3,000	2,150	138	pr-steel..	rigid ..	solid .	36x3½	36x5	wood-sq	3	4-3⅞x5½	22 50	block...	right	cent...	fin-cast....	sing...	Eisemann..	hand....
Corbitt..... C	4,000	2,400	148	pr-steel..	rigid	solid	36x3½	36x3½d	wood-sq	3	4-4 x5½	27 20	block..	right	cent	fin-cast	sing...	Eisemann..	hand....
Corbitt..... B	5,000	2,650	148	pr-steel..	rigid	solid ..	36x4	36x4d	wood-sq	3	4-4¼x5½	27.20	block...	right	cent...	fin-cast....	sing...	Eisemann..	hand....

ABBREVIATIONS: General, *, *with other options;* opt, *optional;* **Price,** -o, *complete with body.* **Frame, Material,** pr-steel, *pressed steel;* rolled-c, *rolled steel, channel section;* rolled-I, *rolled steel, I section;* **Frame Construction,** semi-flx, *semi flexible.* **Tires, kind,** Pneu, *pneumatic;* cush, *cushion,* p & s, *pneumatic front, solid, rear;* s & st, *solid rubber front, steel in rear.* **Tire Sizes,** -d, *dual.* **Wheels,** pr-steel, *pressed steel;* -ov, *oval spokes;* -sq, *square spokes;* -d, *disk or web type;* -hol, *hollow spokes;* -cr, *cruciform spokes;* -x, *cross-shaped solid spokes.* **Cylinders cast,** sing, *singly or individually.* **Location of valves,** opp, *opposite, T-head motor;* r & h, *one valve at right, the other in head, L-head motor;* l & h, *one valve at left the other in head, L-head motor.* **Water circulation,** cent, *centrifugal pump;* thermo-, *thermo-syphon or natural circulation;* gear, *gear pump.* **Radiator Type,** fin, *individually finned tubes;* sq-t, *square-tubular, resembling cellular, sometimes known as flat-tubular;* z-z-t, *zig-zag tubular, resembling cellular,* cell, *cellular or honeycomb type;* tube, *plain tubes without fins;* ring, *tubes arranged in ring about blower fan.* **Radiator Case,** -sheet, *sheet metal;* -cast, *cast metal, built up.* **Ignition Type,** sing, *single;* doub, *double,* dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Conn., *Connecticut;* storage, *storage battery;* Westghs, *Westinghouse;* G & D, *Gray & Davis;* At Kent, *Atwater Kent.* **Spark Advance,** auto, *automatic;* 2-pt-fix, *two-point fixed, battery circuit in retard, magneto in advance.* **Electric System Type,** s, l & i, *starting, lighting and ignition, combination unit;* s & l, *starting and lighting, combination unit;* s & l-2, *starting and lighting, two-unit;* l & i, *lighting and ignition, combination unit.* **Electric System, Make,** Splitdf, *Splitdorf;* Al-Chal,—**(Abbreviations Continued on Opposite Page.)**

line Commercial Vehicles for 1917

Produced by 137 American Manufacturers, with Full Particulars of —Two Steam Models of One Maker Included

MOTOR										TRANSMISSION							BRAKES		CONTROL		
ELECTRIC SYSTEM			GOVERNOR			SPEED		FUEL SYSTEM			GEARSET										
Type	Make	Extra Cost	Type	Drive	Make	Motor in r. p. m.	Truck in m. p. h.	Carbureter Make	Fuel Feed	Tank Location	Clutch Type	Type	Location	Sp'ds	Total Gear Reduction in High	Final Drive	Propulsion Taken By	Torque Taken By	Hand	Foot	Steer	Levers	Name and Model
.....	.....	.....	.....	.....	.....	.....	.....	Scheb..	grav.	seat..	none..	elec..	amid...	2	28.00–1	int-g-f..	rad-rd..	rad-rd..	ex-r-w..	ex-f-w..	right.	right.	A & B.....3T
.....	.....	.....	.....	.....	.....	.....	.....	Scheb..	grav.	seat..	none..	elec..	amid...	2	28.00–1	int-g-f..	rad-rd..	rad-rd..	ex-r-w..	ex-f-w..	right.	right.	A & B.....5T
.....	.....	.....	cent..	motor	Wauk'a..	1,100	17½	Scheb..	vac..	.....	dry-d..	selec.	unit-m.	4	.....	worm..	springs	springs	int-r-w.	int-r-w.	right.	cent..	Acason.....2
.....	.....	.....	cent..	motor..	Wauk'a..	1,100	13½	Scheb..	vac..	.....	dry-d..	selec.	unit-m.	4	.....	worm..	springs	springs	int-r-w.	int-r-w.	right.	cent.	Acason.....
.....	.....	.....	cent..	motor	Pierce...	1,700	22	Ray...	vac..	.....	dry-d..	selec.	unit-m.	3	7.75–1	worm..	springs	springs	int.....	int.....	left..	cent..	Acme.....B
lighting.	.....	opt..	cent..	motor	Pierce...	1,300	17	Ray...	vac..	.....	dry-d..	selec.	unit-m.	3	8.50–1	worm	springs	springs	int.....	int.....	.....	cent..	Acme.....A
lighting.	.....	opt..	cent..	motor..	Pierce...	1,200	14	Ray...	vac..	.....	dry-p..	selec.	amid...	3	10.25–1	worm..	rad-rd..	springs	int-r-w.	int-r-w.	left..	cent..	Acme.....C
lighting	.....	60.00	cent..	drive-s..	Pierce*..	1,200	16	Scheb..	grav.	seat..	wet-d.	selec.	unit-m.	3	8.50–1	worm..	rad-rd..	springs	int-r-w.	int-r-w.	left..	cent..	Armleder.....HW2
lighting.	.....	60.00	cent..	motor*.	Pierce...	1,100	14	Scheb..	grav.	seat..	wet-d.	selec.	unit-m.	3	8.75–1	worm..	rad-rd..	springs	int-r-w.	ext-sht.	left..	cent..	Armleder.....KW
.....	.....	.....	.....	.....	.....	.....	.....	Carter..	grav.	seat..	wet-d.	selec.	unit-m.	3	4.75–1	sp-bev..	springs	springs	ext-r-w.	int-r-w.	left..	cent..	Atlas.....17
.....	.....	.....	cent..	motor	Pierce..	1,200	16½	Zenith..	grav.	seat..	dry-d..	selec.	unit-m	4	7.75–1	worm..	springs	springs	int-r-w.	int-r-w.	right.	right.	Atterbury.....6B
.....	.....	.....	cent..	motor	Pierce...	1,200	15	Zenith..	grav.	seat..	dry-d..	selec.	unit-m	4	7.75–1	worm..	springs	springs	int-r-w.	int-r-w.	right.	right.	Atterbury.....6R
.....	.....	.....	cent..	motor..	Pierce...	1,200	15	Zenith..	grav.	seat..	dry-d..	selec.	unit-m	4	8.50–1	worm..	springs	springs	int-r-w.	int-r-w.	right.	right.	Atterbury.....6C
.....	.....	.....	cent..	motor..	Pierce...	1,125	13	Zenith..	grav.	seat..	dry-d..	selec.	unit-m.	4	10.33–1	worm..	springs	springs	int-r-w.	int-r-w.	right.	right.	Atterbury.....6D
.....	.....	.....	.....	.....	.....	.....	.....	Stmbg..	.....	seat..	dry-p..	prog.	amid...	3	7.14–1	db-red..	springs	springs	int-r-w.	ext-r-w.	right.	right.	Autocar.....21F
.....	.....	.....	none	.....	.....	.....	.....	Stmbg.	grav.	seat..	dry-d..	selec	unit-m	3	7.00–1	worm..	springs	springs	int.....	int.....	left..	cent..	Available.....1
.....	.....	.....	none	.....	.....	.....	.....	Stmbg	grav.	seat..	dry-d..	selec	unit-m	3	7.75–1	worm..	springs	springs	int.....	int.....	left..	cent..	Available.....2
.....	.....	.....	cent	motor..	Pieree...	1,300	15	.....	grav.	seat..	dry-d..	selec.	unit-m.	3	10.33–1	worm..	rad-rd..	springs	int.....	int.....	left..	cent..	Available.....3
.....	.....	.....	cent	motor..	Pierce...	1,175	12	Stmbg	grav.	seat..	dry-d..	selec.	unit-m.	3	11.75–1	worm..	rad-rd..	springs	int.....	int.....	left..	cent..	Available.....5
.....	.....	.....	cent	motor..	.....	1,200	15	Ray...	.....	.....	dry-d..	selec.	unit-m.	3	7.75–1	dbl chn.	.....	rad-rd..	.....	.....	left..	cent..	Avery.....C
.....	.....	.....	l-h..	motor..	.....	1,200	14½	Ray...	.....	.....	dry-d..	selec.	unit-j..	3	3.50–1	dbl chn.	.....	rad-rd..	.....	.....	right.	cent..	Avery.....B
.....	.....	.....	cent..	motor..	.....	1,200	13	Ray...	.....	.....	dry-p..	selec.	unit-j..	3	3 50–1	dbl chn.	.....	rad-rd..	.....	.....	right.	cent..	Avery.....B
.....	.....	.....	cent..	motor..	.....	1,200	12	Ray...	.....	.....	dry-d..	selec.	unit-j..	3	3.50–1	dbl chn.	.....	rad-rd..	.....	.....	right.	cent..	Avery.....A
.....	.....	.....	cent..	motor..	.....	1,000	10	Scheb..	.....	.....	wet-d.	selec.	unit-j..	3	12.50–1	dbl chn.	.....	rad-rd..	.....	.....	right.	cent..	Avery.....B
.....	.....	.....	cent..	motor	Wauk'a..	1,000	12	King...	vac..	seat..	dry-p..	selec.	amid...	6	8.03–1	bevel-4.	rad-rd..	springs	ext-r-w.	ext-sht.	rt*...	cent..	Beech Creek.....3A
.....	.....	.....	.....	.....	none....	.....	.....	Scheb..	grav.	seat..	dry-d.	selec.	unit-m.	3	7.00–1	int-g...	springs	springs	int-r-w.	ext-r-w.	left..	cent	Bessemer.....G
.....	.....	.....	cent..	motor	Pierce...	.....	.....	Ray...	grav.	seat..	cone..	selec.	amid...	3	7.75–1	worm..	springs	springs	int-r-w.	int-r-w.	left..	cent..	Bessemer.....D
.....	.....	.....	cent..	.....	Pierce...	.....	.....	Ray...	grav.	.....	cone..	selec.	amid...	3	10.33–1	worm..	rad-rd..	springs	int-r-w.	int-r-w.	left..	cent	Bessemer.....E
.....	.....	.....	cent..	motor..	Pierce...	.....	.....	.....	grav.	seat..	cone..	selec.	amid...	3	13.00–1	worm..	rad-rd..	t-arm..	int-r-w.	ext-sht.	left..	cent..	Bessemer.....H
.....	.....	.....	cent..	motor	Wauk'a..	1,060	14	Scheb..	grav.	seat..	cone..	ind-c.	amid...	3	7.67–1	worm..	sub-f...	sub-f	int-r-w.	ext-sht.	right.	right.	Blair.....C
.....	.....	.....	cent..	motor	Wauk'a..	970	12	Scheb	grav.	seat..	cone..	ind-c.	amid...	3	8.67–1	worm..	sub-f...	sub-f...	int-r-w.	ext-sht.	right.	right.	Blair.....D
.....	.....	.....	cent..	motor	Wauk'a..	870	10	Scheb..	grav.	seat..	cone..	ind-c.	amid...	3	9.33–1	worm..	sub-f...	sub-f...	int-r-w.	ext-sht.	right.	right.	Blair.....E
.....	.....	.....	cent..	motor..	Wauk'a..	870	10	Scheb..	grav.	seat..	cone..	ind-c.	amid...	3	9.33–1	worm..	sub-f...	sub-f...	int-r-w.	ext-sht.	right.	right.	Blair.....F
lighting.	.....	.....	cent..	motor..	.....	.....	.....	.....	grav.	seat.	dry-d..	selec.	unit-m.	3	.....	worm..	.....	springs	int.....	ext.....	.....	cent..	Brinton.....H
lighting.	.....	stock...	cent..	motor..	.....	.....	.....	.....	grav	seat.	dry-d..	selec.	unit-m.	3	.....	worm..	springs	springs	int.....	ext.....	.....	cent.	Brinton.....F
s, l & i...	Spitdf..	stock	.....	.....	.....	.....	.....	.....	grav.	dash	cone..	selec	unit-x..	3	4.23–1	bevel...	springs	t-arm..	int-r-w.	ext-r-w.	left..	cent	Briscoe.....4–24
.....	.....	.....	suct..	motor..	Mon'rch.	1,400	18	Scheb.	grav.	seat..	dry-d..	selec.	unit-m.	3	7.90–1	worm..	springs	springs	int-r-w.	int-r-w.	left..	cent..	Brockway.....O
.....	.....	.....	suct..	motor..	Mon'rch.	1,250	15	Scheb	grav.	seat.	cone..	selec.	amid...	3	8.66–1	worm..	springs	springs	int-r-w.	ext-r-w.	left..	cent..	Brockway.....J–2
.....	.....	.....	suct..	motor	Mon'rch.	1,250	15	Scheb..	grav.	seat.	cone	selec	amid	3	8.66–1	worm..	springs	springs	int-r-w.	int-r-w.	left..	cent..	Brockway.....K–2
lighting.	.....	.....	suct..	motor..	Mon'rch.	1,200	12	Scheb	grav.	seat..	dry-d..	selec.	amid...	3	10.33–1	worm..	rad-rd..	springs	int-r-w	int-r-w.	left..	cent..	Brockway.....R
lighting	.....	stock..	.....	.....	none....	1,200	15	Zenith..	grav.	dash	cone.	selec.	unit-m.	3	8.50–1	int-g...	springs.	springs	ext-sht.	ext-r-w.	right.	cent..	Burford.....O–3
lighting.	.....	stock...	cent..	motor..	Wauk'a..	1,000	13	Zenith..	vac..	seat..	dry-d..	selec.	amid...	4	13.10–1	worm..	rad-rd..	springs	..r-w..	int-r-w	right.	right.	Burford.....D–3
lighting*	.....	stock.	.....	.....	Her-Sp	1,500	.....	Stmbg..	grav.	seat.	.....	elec.	.....	1	25.00–1	bevel-4.	rad-rd..	rad-rd..	.....	ext-4-w.	right.	c & r.	Couple Gear.....HC
lighting*	.....	stock...	c't*	f-whl*..	Her-Sp*.	1,500	.....	Stmbg..	grav.	seat.	.....	elec	amid...	1	25.00–1	bevel-4.	rad-rd..	rad-rd..	.....	ext-4-w.	right.	cent..	Couple Gear.....AC
.....	.....	.....	suct.	motor	Mon'rch.	1,200	18	Stmbg..	grav.	seat..	dry-d..	selec.	unit-m.	3	.....	worm..	springs	springs	int-r-w	int-r-w	right.	cent..	Chase.....A
.....	.....	.....	suct.	motor	Mon'rch.	1,000	15	Stmbg..	grav.	.....	dry-d.	selec	unit-m	3	.....	worm..	springs	springs	int-r-w	int-r-w	right.	cent..	Chase.....C
.....	.....	.....	suct.	motor	Mon'rch.	1,000	15	Stmbg..	grav	seat..	dry-d..	selec	unit-m	3	....	worm..	springs	springs	int-r-w	int-r-w	right.	cent.	Chase.....B
.....	.....	.....	suct.	motor	Mon'rch.	1,000	10	Stmbg..	grav.	.....	wet-d.	selec	unit-m	3	.....	worm..	springs	springs	int-r-w	int-r-w	right.	cent..	Chase.....X
.....	.....	.....	suct..	motor..	Mon'rch.	1,000	10	Stmbg..	grav.	seat..	wet-d.	selec.	unit-m	4	.....	worm..	springs	t-arm..	int....	int.....	right.	cent..	Chase.....O
s, l & i...	Dyneto..	stock...	.....	.....	none....	.....	35	Carter*	grav.	.....	dry-p.	selec.	unit-m.	3	6.00–1	bevel..	springs	t-arm.	int-r-w.	ext-r-w.	left..	cent	Collier.....M
none....	.....	.....	suct..	motor..	Mon'rch.	1,200	14	Shkspr.	grav.	.....	cone..	selec.	amid	3	9.45–1	int-g...	springs	springs	int-r-w.	ext-r-w.	left..	cent..	Columbia.....E
s, l & i...	.....	100 00	.....	.....	none....	1,630	25	Zenith..	grav.	seat..	cone..	selec.	unit-m.	3	6 00–1	bevel.	springs	t-arm	int-r-w	ext-r-w.	left	cent..	Commerce.....N
s & l-2...	Remy...	stock...	cent..	d-shft..	Pierce...	1,383	20	Zenith..	vac..	seat..	cone.	selec.	unit-m.	3	7.00–1	int-g	springs	springs	int-r-w.	ext-r-w.	left..	cent..	Commerce.....E
.....	.....	.....	suct.	motor..	.....	.....	.....	Stmbg..	.....	.....	dry-d..	selec.	unit-m.	3	7.75–1	worm..	springs	springs	.....	.....	left*	cent..	Continental (C)..... FL
.....	.....	.....	suct.	motor	.....	.....	.....	Stmbg..	.....	.....	dry-d..	selec.	unit-m.	3	9 25–1	worm	springs	springs	.....	.....	left*	cent..	Continental (C)..... HL
.....	.....	.....	suct.	motor	.....	.....	.....	Stmbg..	.....	.....	dry-d..	selec.	unit-m.	3	9 25–1	worm..	springs	springs	.....	.....	left*	cent..	Continental (C)..... J
.....	.....	.....	suct..	motor..	.....	.....	18	Stmbg..	.....	.....	dry-d..	selec.	unit-m.	3	10.50–1	worm..	springs	springs	.....	.....	left*	cent..	Continental (C).....M
.....	.....	.....	cent..	motor..	Pierce...	1,500	14	Stmbg..	grav.	seat.	dry-d..	selec.	unit-m	3	8 66–1	worm.	springs	springs	int-r-w	ext-r-w.	left..	cent..	Corbitt ..... D
.....	.....	.....	cent..	motor	Pierce	1,500	14	Stmbg.	grav	seat..	dry-d..	selec	unit-m.	3	8 66–1	worm.	springs	springs	int-r-w	ext-r-w.	left..	cent.	Corbitt C
.....	.....	.....	cent..	motor	Pierce	1,500	14	Stmbg.	grav	seat..	dry-d..	selec	unit-m.	3	8 66–1	worm	springs	springs	int-r-w	ext-r-w.	left	cent.	Corbitt ..... B

ABBREVIATIONS: (continued).—*Allis-Chalmers*; G & D, *Gray & Davis*; Westghs, *Westinghouse*; N-East, *Northeast*; Huff-S, *Huff-Simms*; Spl-App, *Splitdorf-Apple*. **Governor Type** cent, c't, *centrifugal*; suct, *suction or gas velocity*; l-h, *loose-ball*; hydr, *hydraulic*. **Governor Drive** motor, *from motor*; d-shft, *from driveshaft*; duplex, *from both motor and driveshaft or front wheel*; f-wheel, f-whl, *from front wheel*. **Governor Make** Wauk'a, *Waukesha*; Mon'rch, Mon, *Monarch*; Her-Sp, *Herschell-Spillman*; Milwkee, *Milwaukee*. **Carbureter Make,** Scheb, *Schebler*; Ray, *Rayfield*; Stmbg, *Stromberg*; Shkspr, *Shakespeare*; Flech, *Flechter*; Zen, *Zenith*, Johns, *Johnson*. **Fuel Feed,** grav, *gravity*; vac, *vacuum*; pres, *pressure*. **Tank Location,** seat, *under seat*; dash, *in dash*; rear, *at rear*; r-bd, *on running-board*. **Clutch Type,** dry-d, *dry multiple disk*; dry-p, *dry plate*; wet-d, *multiple-disk in oil*; wet-p, *plate-in-oil*. **Gearset Type,** selec, *selective sliding gear*; prog, *progressive sliding gear*; ind-c, *individual clutch, constant-mesh*; plnn, *planetary*; fric, *friction*; elec, *electric*. **Gearset Location,** amid, *amidships*; unit-m, *unit with motor*; unit-j, *unit with jackshaft*; unit-x, *unit with axle*. **Final Drive,** int-g, *internal-gear*; worm, *top worm*; dbl chn, *double side chains*; sp-bevel, *spiral bevel*; db-red, *double-reduction, bevel and spur gears*; ext-g, *external-gear*; -f, *to front wheels*; -4, *on all four wheels*. **Propulsion Taken By,** rad-rd, *radius rods*; tor-t, *torsion-tube*; sub-f, *sub-frame*; spg's, *springs*. **Torque Taken By,** rad-rd, *radius rods*; tor-t, *torsion-tube*; t-arm, *torque-arm*; sub-f, *sub-frame*; sp'gs, *springs*. **Brakes, Type,** ext, cx, *external contracting*; int, *internal expanding*. **Brake Location,** -r-w, *rear wheel*; -sht, *shaft*; -f-w, *front wheel*; -j-s, *jackshaft*; -4-w, *on all four wheels*. **Control, Levers,** cent, *center*; c & r, *gearshift center, brake right*; c & l, *gearshift center, brake left*.

Technical Specifications of Gasoline

Name and Model	Capacity in Pounds	Price of Chassis	Wheel base in Inches	FRAME Material	FRAME Construction	TIRES Kind	TIRES SIZES IN INCHES Front	TIRES SIZES IN INCHES Rear	Wheels	MOTOR No. of Crankshaft Bearings	MOTOR Bore and Stroke	MOTOR N.A.C.C. Hp.	MOTOR Cylinders Cast	MOTOR Valves Placed	MOTOR COOLING Water Circulation	MOTOR COOLING Radiator Core and Case	MOTOR IGNITION Type	MOTOR IGNITION Make	MOTOR IGNITION Spark Advance
Corbitt....A	7,000	$3,200	168	pr-steel..	rigid....	solid....	36x5	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	right...	cent...	fin-cast....	sing...	Eisemann..	hand....
Corliss....A	1,000	800-c*	100	pr-steel..	rigid....	pneu....	31x4	31x4	wood-ov.	2	4-3½x4½	15.64	block...	left....	thermo.	fin-sheet...	sing...	Dixie.....	hand....
Croce....17	1,000	825	108	pr-steel..	.....	p. & a....	32x4	32x4	wood-sq	2	4-3½x5	16.92	block...	left....	cent...	sq-t-sheet..	sing...	Bosch.....	fixed....
Crowther-Duryea.....	1,200	600-c	110	pr-steel..	semi-fix..	pneu....	32x3½	32x3½	wood-ov.	4	4-3½x4½	22.50	sing.....	head...	thermo.	cell-sheet..	dual..	Dixie.....	hand....
Dart....B-B	1,500	1,200	124	pr-steel..	flexible..	solid....	34x3	34x3½	wood-eq.	3	4-3½x5½	19.61	block...	right...	thermo	cell-sheet..	sing...	Eisemann..	fixed....
Dart....E	3,000	1,800	130	pr-steel..	flexible..	solid....	34x3½	34x5	wood-eq.	3	4-3½x5½	22.50	block...	right...	thermo.	cell-sheet..	sing...	Eisemann..	fixed....
Dart....C-C	5,000	2,470	150	pr-steel..	flexible..	solid....	36x4	36x4d	wood-sq.	3	4-4½x5½	27.20	block...	right...	cent...	cell-sheet..	sing...	Eisemann..	fixed....
D-E....Junior	1,250	895	108	pr-steel..	rigid....	pneu....	33x4	33x4	wood-ov.	2	4-3½x4½	15.64	block...	right...	thermo.	fin-sheet...	sing...	Dixie.....	hand....
D-E....Senior	2,000	1,450	128*	pr-steel..	rigid....	solid....	34x3½	34x4	wood-sq.	3	4-3½x5	19.61	block...	right...	thermo.	fin-sheet...	sing...	Dixie.....	hand....
DeKalb....D-1½	4,000	2,100	134*	pr-steel..	flexible..	solid....	34x4	36x5	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	cell-sheet..	sing...	Eisemann..	hand....
DeKalb....D-2½	5,000	2,450	136*	pr-steel..	flexible..	solid....	36x4	36x6	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	cell-sheet..	sing...	Eisemann..	hand....
Denby....R	2,000	990	119	rolled-c..	semi-fix..	pneu*...	34x4½*	34x4½*	wood-sq	2	4-3½x4½	15.64	block...	right...	thermo.	cell-cast...	sing...	Dixie.....	fixed....
Denby....G	3,000	1,575	120*	pr-steel..	semi-fix..	solid	35x3½	35x5	wood-sq	3	4-3½x5	19.61	block...	right...	thermo.	cell-cast...	sing...	Eisemann..	fixed....
Denby....H	4,000	1,790	144*	pr-steel..	semi-fix..	solid....	36x3½	36x3½d*	wood-sq	3	4-3½x5	22.50	block...	right...	thermo.	cell-cast...	sing...	Eisemann..	fixed....
Denby....K	5,000	2,090	144*	pr-steel..	semi-fix..	solid....	36x4	36x4d*	wood-sq.	3	4-3½x5	22.50	block...	right...	thermo.	cell-cast...	sing...	Eisemann..	fixed....
Dispatch....G	1,200	1,150	120	wood....	flexible..	pneu....	36x3½	36x3½	wood-ov.	3	4-3½x5	22.50	block...	left....	thermo.	cell-sheet..	sing...	Bosch.....	hand....
Doane.....	5,000	3,000-c	150	rolled-c..	flexible..	solid....	36x4	36x7	wood-eq	3	4-4½x5½	29.00	pairs....	right...	cent...	fin-cast....	sing...	Bosch.....	auto....
Doane.....	12,000	4,500-c	178	rolled-I..	flexible..	solid....	36x6	38x6d	wood-sq	3	4-4½x6½	36.15	pairs....	left....	cent...	fin-cast....	sing...	Bosch.....	auto....
Dorris....I-B-4	1,500	1,900	132	pr-steel..	semi-fix..	pneu....	36x4	36x4½	wood-ov.	3	4-4½x5	30.65	pairs....	head...	cent...	z-z-t-sheet	dual..	Bosch.....	hand....
Dorris....I-B-W	4,000	1,990	132	pr-steel..	semi-fix..	pneu....	36x4	36x4d	wood-sq.	3	4-4½x5	30.65	pairs....	head...	cent...	z-z-t-sheet	sing...	Bosch.....	hand....
Ellsworth....25-A	1,000	695-c	108	pr-steel..	flexible..	pneu....	30x3½	30x3½	wood-ov.	2	4-3½x5	16.92	block...	right...	thermo.	sq-t-sheet..	sing...	storage....	hand....
Federal....S	2,000	.....	132	pr-steel..	semi-fix..	solid*...	34x3*	34x4*	wood-ov.	5	4-3½x5½	19.61	block...	right...	cent...	fin-sheet...	sing...	Eisemann..	fixed....
Federal....I-M	3,000	1,800	144*	pr-steel..	semi-fix..	solid...	36x3½	36x5	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	cell-cast...	sing...	Eisemann..	fixed....
Federal....O-P	4,000	2,100	144*	pr-steel..	semi-fix..	solid....	36x4	36x7*	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	cell-cast...	sing...	Eisemann..	fixed....
Federal....L	7,000	2,800*	146*	rolled-c..	semi-fix.	solid....	36x5	36x5d	wood-sq*	3	4-4½x5½	32.40	pairs....	left....	cent...	fin-cast....	sing...	Eisemann..	fixed....
Federal....W	10,000	.....	156*	rolled-c..	semi-fix	solid....	36x6	40x6d*	cast-hol.	5	4-4½x5½	29.00	block...	right...	cent...	fin-sheet*..	sing...	Eisemann..	fixed....
Ferschler.....	2,000	1,650	130	rolled-c..	flexible..	solid*...	36x3	36x4	wood-sq.	3	4-3½x5	19 61	block...	right...	cent...	sq-t-sheet..	sing...	Bosch.....	fixed....
Ferschler.....	4,000	2,250	140*	rolled-c..	flexible..	solid*...	34x3½	34x5	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	sq-t-sheet..	sing...	Bosch.....	fixed....
F. W. D....B	6,000	4,000	124	pr-steel..	.....	solid....	36x6	36x6	wood-ov.	3	4-4½x5½	36.15	pairs....	opp	cent...	sq-t-sheet.	sing...	Eisemann..	hand....
Garford....75	2,000	1,450	120	pr-steel..	semi-fix	p. & s...	34x4½	36x3½	wood-ov.	3	4-3½x5½	19. 61	block...	right ..	thermo	cell-sheet..	sing...	Dixie.....	hand....
Garford....66	3,000	1,800	142*	pr-steel..	semi-fix..	solid...	36x3½	36x5	wood-ov.	3	4-3½x5½	22.50	block...	right...	cent...	cell-sheet..	sing...	Dixie.....	hand....
Garford....70	4,000	2,300	142*	pr-steel..	semi-fix..	solid....	36x4	36x4d	wood-ov.	3	4-4½x5½	29.00	block...	right...	cent...	fin-cast....	sing...	Dixie.....	hand....
Garford....77-B	7,000	3,400	128*	pr-steel..	semi-fix..	solid....	36x5	40x5d	wood-ov.	3	4-4½x6	29.00	block...	right...	cent...	cell-sheet..	sing...	Bosch.....	hand....
Garford....68	10,000	4,300	128*	pr-steel..	semi-fix..	solid....	36x6	40x6d	wood-ov.	3	4-4½x5½	36.15	pairs ...	opp....	cent...	fin-cast....	sing...	Bosch.....	hand....
Garford....69	12,000	4,500	128*	pr-steel..	semi-fix..	solid....	36x6	40x7d	wood-ov.	3	4-5 1/16x5½	41.61	pairs....	opp....	cent...	fin-cast....	sing...	Bosch.....	hand....
G. A. Schacht.....	3,000	2,650	138*	rolled-c..	flexible .	solid....	38x3½	38x6	wood-sq.	3	4-4½x5½	29.00	block...	right...	cent...	cell-sheet	sing...	Bosch.....	hand....
G. A. Schacht	4,000	2,800	144*	rolled-c..	flexible .	solid....	38x4	38x4d	wood-sq.	3	4-4½x5½	29.00	block...	right...	cent...	z-z-t-cast.	sing...	Bosch.....	hand....
G. A. Schacht.....	6,000	3,200	168*	rolled-c..	flexible..	solid....	38x5	38x5d	wood-sq.	3	4-4½x5½	29.00	block...	right...	cent...	z-z-t-cast.	sing...	Bosch.....	hand....
G. V.-Mercedes....F.V.	12,000	.....	192¼	pr-steel..	rigid....	solid....	34x5	40x6d	cast-d...	3	4-4½x5 9/10*	29.00	pairs....	head...	cent...	sq-t-cast...	sing...	Bosch.....	fixed. ..
Geraix....C	5,000	2,500	150*	rolled-c..	rigid....	solid....	36x4	36x7	wood-ov.	4	6-3½x5½	33.75	block...	left....	cent...	cell-cast...	sing...	Westghs...	hand....
Globe.....	2,500	1,375	130*	rolled-c..	semi-fix..	solid....	34x3½	34x4	wood-sq.	3	6-3½x4½	25.39	block...	left....	cent...	fin-cast....	sing...	Dixie.....	fired. ..
G. M. C....15	1,500	1,090	122	pr-steel..	rigid....	pneu...	35x5	35x5	wood-ov.	3	4-3½x5	19.61	block...	right...	cent...	fin-sheet...	sing...	Eisemann.	hand....
G. M. C....21	2,000	.....	136	pr-steel..	semi-fix	solid ..	34x3½	34x5	wood-ov.	3	4-3½x5	22.50	block...	left....	cent...	fin-cast....	sing...	Eisemann.	hand....
G. M. C....31	3,000	1,900	144*	pr-steel..	rigid ..	solid	36x3½	36x5	wood-ov.	3	4-3½x5	22.50	block...	right ..	cent ..	fin-cast ..	sing...	Eisemann.	hand....
G. M. C....41	4,000	2,375	158*	pr-steel..	rigid....	solid...	36x4	36x4d	wood-ov	3	4-4½x5½	27.20	block...	right...	cent...	fin-cast ..	sing...	Eisemann.	hand....
G. M. C....71	7,000	3,300	163*	rolled-c..	rigid....	solid...	36x5	40x5d	wood-sq.	3	4-4½x5½	32 40	pairs ..	left....	cent...	fin-cast....	sing...	Eisemann.	hand....
G. M. C....101	10,000	3,850	163*	rolled-c..	rigid....	solid....	36x6	40x6d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	fin-cast....	sing...	Eisemann.	hand....
Gramm-Bernatein....	2,000	1,650	124*	pr-steel..	semi-fix	solid....	34x3½	34x4	wood-sq.	3	4-3½x5½	22.50	block...	right ..	thermo.	fin-cast....	sing...	Eisemann.	hand....
Gramm-Bernatein.....	3,000	2,000	130*	pr-steel..	semi-fix	solid ..	34x3½	36x4	wood-sq.	3	4-3½x5½	22 50	block...	right...	thermo.	fin-cast....	sing...	Eisemann.	hand....
Gramm-Bernatein.....	4,000	2,300	146	pr-steel..	semi-fix	solid ..	34x4	34x3½d	wood-sq.	3	4-3½x5½	22 50	block...	right...	thermo.	fin-cast....	sing...	Eisemann.	hand....
Gramm-Bernatein.....	5,000	2,700	156	pr-steel..	semi-fix	solid....	36x4	36x4d	wood-sq.	3	4-4½x5½	29 00	pairs ..	left....	cent...	fin-cast ..	dual..	Eisemann.	hand....
Gramm-Bernatein.....	7,000	3,400	158*	pr-steel..	semi-fix	solid....	30x5	40x5d	cast-hol.	3	4-4½x5½	29.00	pairs ..	left....	cent...	fin-cast....	dual..	Eisemann.	hand....
Gramm-Bernatein.....	10,000	4,300	168*	pr-steel..	semi-fix	solid ..	36x6	40x6d	cast-hol.	3	4-4½x6½	32.40	pairs ..	left....	cent...	fin-cast ..	dual..	Eisemann.	hand....
Gramm-Bernatein.....	12,000	4,500	168*	pr-steel..	semi-fix..	solid....	36x6	40x7d	cast-hol..	3	4-4½x6½	32.40	pairs ..	left....	cent...	fin-cast....	dual..	Eisemann.	hand....
Hahn....C	2,000	1,750	136*	pr-steel.	.....	solid ..	36x3½	30x5	wood-ov.	3	4-4½x5½	2 .20	block ..	left....	cent...	sq-t-sheet.	dual ..	Bosch ..	hand....
Hahn....E	4,000	2,250	144*	pr-steel..	.....	solid....	36x4	36x4d	wood-ov.	3	4-4½x5½	32.40	pairs ..	left....	cent...	sq-t-sheet..	dual ..	Bosch.....	hand....
Hall	4,000	2,000	132	rolled-c..	semi-fix..	solid ..	36x4	36x4d	wood-sq*	3	4-4½x5½	27.20	block	left....	cent...	fin-cast ..	sing...	Bosch*....	fixed....
Hall	7,500	2,800	144	rolled-c.	semi-fix..	solid	36x5	36x5d	wood-sq*	3	4-4½x5½	32.40	pairs	left ..	cent...	fin-cast ..	sing...	Bosch* ...	fixed....
Hall	10,000	3,400	144	rolled-c..	semi-fix..	solid....	36x5	40x6d	wood-sq*	3	4-4½x5½	32.40	pairs	left....	cent...	fin-cast....	sing...	Bosch*....	fixed....
Harriaen C	7,000	.....	.....	rolled-c.	rigid	solid....	37x5	37x4½d	wood-ov.	3	4-4½x5	32.40	pairs	right	cent	..sheet..	dual	Bosch ..	hand....
Harrisen.....F	7,000	.....	.....	rolled-c.	rigid....	solid ..	37x5	37x5d	wood-sq	3	4-4½x5	32.40	pairs....	right...	cent...	sq-t-sheet..	dual..	Bosch	hand....
Harvey.....W-F	4,000	2,250	150	rolled-c..	semi-fix..	solid .	36x4	36x6	wood-sq	3	4-4½x5½	29.00	block...	right .	cent...	sq-t-sheet..	sing...	Eisemann.	auto....
Harvey.....W-H	7,000	2,950	160*	rolled-c.	semi-fix..	solid ..	36x5	36x5d	wood-sq	3	4-4½x6	29.00	block...	right .	cent...	sq-t-sheet..	sing...	Eisemann.	auto....
Harvey.....W-K	10,000	3,600	160*	rolled-c.	semi-fix..	solid...	36x6	40x6d	wood-sq	3	4-4½x6	32.40	block...	right...	cent...	sq-t-sheet..	sing...	Eisemann.	auto....
Hawkeye.....H	2,500	1,300	136*	rolled-c.	.....	solid....	34x3½	34x5	wood-sq.	3	4-3½x5	22.50	block..	head...	gear...	fin-cast. .	sing...	Eisemann.	band....
Horner	3,000	2,250	145	pr-steel.	rigid ..	solid	36x4	36x4	wood-sq	3	4-4½x5½	27.20	block	.....	cent...	fin-cast....	dual..	.....	hand....
Horner.....	4,000	2,650	145	pr-steel..	rigid....	solid ..	36x4	36x3½d	wood-sq.	3	4-4½x5½	27.20	block	.....	cent...	fin-cast....	dual..	.....	hand....

ABBREVIATIONS: General, *, *with other options;* opt, *optional;* Price, -c, *complete with body.* **Frame, Material, pr-steel, *pressed steel;* rolled-c, *rolled steel, channel section;* rolled-I, *rolled steel, I section;* **Frame Construction,** semi-fix, *semi flexible.* **Tires, kind,** Pneu, *pneumatic;* cush, *cushion,* p & s, *pneumatic front, solid, rear;* s & st, *solid rubber front, steel in rear.* **Tire Sizes,** -d, *dual.* **Wheels,** pr-steel, *pressed steel;* -ov, *oval spokes;* -sq, *square spokes;* -d, *disk or web type;* -hol, *hollow spokes;* -cr, *cruciform spokes;* -x, *cross-shaped solid spokes.* **Cylinders cast,** sing, *singly or individually.* **Location of valves,** opp *opposite, T-head motor;* r & h, *one valve at right, the other in head, L-head motor;* l & h, *one valve at left the other in head, L-head motor.* **Water circulation,** cent, *centrifugal pump;* thermo-, *thermo-syphon or natural circulation;* gear, *gear pump.* **Radiator Type,** fin, *individually finned tubes;* sq-t, *square-tubular, resembling cellular, sometimes known as flat-tubular;* z-s-t, *zig-zag tubular, resembling cellular,* cell *cellular or honeycomb type;* tube, *plain tubes without fins;* ring, *tubes arranged in ring about blower fan.* **Radiator Case,** -sheet, *sheet metal;* -cast, *cast metal, built up.* **Ignition Type,** sing, *single;* doub *double,* dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Conn., *Connecticut;* storage, *storage battery;* Westghs, *Westinghouse;* G & D, *Gray & Davis;* At Kent, *Atwater Kent.* **Spark Advance,** auto, *automatic;* 2-pt-fix, *two-point fixed, battery circuit in retard, magneto in advance.* **Electric System Type,** s, l & i, *starting, lighting and ignition, combination unit;* s & l, *starting and lighting combination unit;* s & l-2, *starting and lighting, two-unit;* l & i, *lighting and ignition, combination unit.* **Electric System, Make,** Splitdf, *Splitdorf;* Al-Chal,—**(Abbreviations Continued on Opposite Page.)**

Commercial Vehicles for 1917—Continued

MOTOR										TRANSMISSION							BRAKES		CONTROL		
ELECTRIC SYSTEM			GOVERNOR			SPEED		FUEL SYSTEM			GEARSET			Total Gear Reduction in High	Final Drive	Propulsion Taken By	Torque Taken By					Name and Model
Type	Make	Extra Cost	Type	Drive	Make	Motor in r. p. m.	Truck in m. p. h.	Carbureter Make	Fuel Feed	Tank Location	Clutch Type	Type	Location	Sp'da				Hand	Foot	Steer	Levera	
.....	.....	.....	cent..	motor..	Pierce...	1,500	14	Stmbg..	grav.	seat..	wet-d.	ind-c.	amid...	3	8.75-1	worm..	springs.	springs.	int.....	int.....	left..	cent..	Corbitt.....A
.....	.....	.....	.....	.....	.....	.....	.....	Scheb..	grav.	dash.	dry-d..	selec.	unit-m.	3	4.50-1	bevel...	tor-t ..	tor-t...	int-r-w.	int-r-w.	left..	cent..	Corliss.....A
.....	.....	.....	.....	.....	none....	1,000	17½	Zenith..	grav.	seat..	dry-d..	selec.	unit-m.	3	5.00-1	bevel..	springs.	springs.	int.....	ext-r-w.	left..	cent..	Croce.....17
s, l & i...	Splitdf..	stock...	.....	.....	none....	2,500	40	Scheb..	grav.	dash.	.....	roller	unit-x..	.....	.....	roller...	sub-f...	sub-f...	ext-r-w.	.....	left..	c & l..	Crewther-Duryea.....
none...	.....	.....	.....	.....	none....	.....	.....	.....	vac..	seat..	dry-d..	selec.	unit-m.	3	7.75-1	worm..	springs.	springs	int-r-w.	int-r-w.	left..	cent..	Dart.....B-B
.....	.....	.....	.....	.....	none....	.....	.....	Stmbg..	vac..	seat..	dry-d..	selec.	unit-m	3	7.00-1	worm..	springs.	springs.	int-r-w.	int-r-w.	left..	cent..	Dart.....E
none...	.....	.....	cent..	duplex..	Duplex*.	.....	.....	Stmbg..	vac..	seat..	dry-d..	selec.	unit-m.	4	9.25-1	worm...	springs.	springs.	int-r-w.	int-r-w.	left..	cent..	Dart.....C-C
s & l....	Al-Chal..	85.00	.....	.....	.....	.....	.....	Scheb..	vac..	.....	dry-d..	selec.	unit-m.	3	6.20-1	worm..	springs.	springs.	int-r-w.	int-r-w.	left..	cent..	D-E.....Junior
.....	.....	.....	suct..	motor..	Mon'rch.	1,250	16	Zenith..	vac..	seat..	dry-d..	selec.	unit-m.	3	7.80-1	worm..	springs.	springs.	int-r-w.	int-r-w.	left..	cent..	D-E.....Senior
none...	.....	.....	cent..	motor..	Pierce...	1,800	15	Master.	grav.	seat..	cone..	selec.	unit-m.	3	6.83-1	worm..	springs.	springs.	int-r-w.	int-r-w.	left..	cent..	DeKalb.....D-1½
none...	.....	.....	cent..	motor..	Pierce...	1,800	13	Master.	grav.	seat..	dry-d..	selec.	unit-m.	3	8.25-1	worm..	springs.	springs.	int-r-w.	int-r-w.	left..	cent..	DeKalb.....D-2½
s & l....	Al-Chal..	85.00	cent..	motor..	Milwk...	1,800*	22*	Zenith..	grav.	dash.	dry-d..	selec.	unit-m.	3	8.20-1	int-g...	springs.	springs.	int-r-w.	ext-r-w.	left..	cent..	Denby.....R
a & l-2...	G & D...	135.00	cent..	motor..	Pierce...	1,440	17	Stmbg..	grav.	dash.	dry-d..	selec.	unit-m.	3	8.80-1	int-g...	springs.	springs.	int-r-w.	ext-r-w.	left..	cent..	Denby.....G
s & l-2...	G & D...	135.00	cent..	motor..	Pierce...	1,320	15	Stmbg..	grav.	.....	dry-d..	selec.	unit-m.	3	9.45-1	int-g...	springs.	springs.	int-r-w.	ext-r-w.	left..	cent..	Denby.....H
s & l-2...	G & D...	135.00	cent..	motor..	Pierce...	1,240	14	Stmbg..	grav.	.....	dry-d..	selec.	unit-m.	3	9.45-1	int-g...	springs.	springs.	int-r-w.	ext-r-w.	left..	c & l..	Donby.....K
s & l....	U.S.L..	stock...	.....	.....	.....	2,000	25	Ray...	vac..	rear..	none..	fric..	amid...	4	9.00-1	dbl chn.	rad-rd..	springs.	int-r-w.	int-r-w.	right.	cent..	Diapatch.....G
.....	.....	.....	.....	.....	Wauk'a..	1,000	14	Holley..	grav.	.....	dry-d..	selec.	unit-m.	3	8.00-1	dbl chn.	rad-rd..	.....	int.....	ext....	right.	cent..	Doano.....
.....	.....	.....	cent..	motor..	Wauk'a..	1,000	10	Holley..	grav.	seat..	dry-d..	selec.	unit-m.	3	10.50-1	dbl chn.	rad-rd..	.....	int.....	ext....	right.	cent..	Doano.....
lighting.	Westghs.	stock...	.....	.....	.....	.....	.....	Stmbg..	vac..	.....	dry-d..	prog.	unit-m.	3	4.08-1	sp-bev..	springs.	t-arm..	int-r-w.	ext-r-w.	left..	cent..	Dorria.....1-B-4
.....	.....	.....	cent..	motor..	Pierce...	1,085	15	Stmbg..	grav.	seat..	dry-d..	selec.	unit-m.	3	7.75-1	worm..	springs.	springs.	int-r-w.	int-r-w.	left..	cent.	Dorris.....1-B-W
s, l & i...	Apple...	stock...	.....	.....	.....	.....	.....	Carter..	grav.	seat..	cone..	selec.	unit-m.	3	4.46-1	bevel...	springs.	tor-t...	int-r-w.	int-r-w.	left..	cent..	Ellaworth.....25-A
s, l & i*..	.....	opt....	c't*..	motor*.	Simplex*	1,067*	18*	Zenith..	grav.	seat..	dry-p..	selec.	amid...	3	6.00-1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left*.	cent..	Federal.....S
s & l-2...	Westghs.	245.00	cent..	motor..	own.....	1,190	15	Stmbg..	grav.	seat..	cone..	selec.	amid...	3	8.50-1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left..	cent..	Federal.....J-M
a & l-2...	Westghs.	150.00	cent..	motor..	own.....	1,031	13	Stmbg..	grav.	seat..	cone..	selec.	amid...	3	8.50-1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left..	cent..	Federal.....O-P
lighting.	Westghs.	150.00	cent..	motor..	own.....	1,160	12	Stmbg..	grav.	seat..	dry-d..	selec.	unit-m.	3	10.33-1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	right.	cent..	Federal.....L
s, l & i*..	.....	opt....	cent..	motor..	Simplex.	1,000	10	Zenith..	grav.	seat..	dry-p..	selec.	amid...	4	11.60-1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left*.	cent..	Federal.....W
.....	.....	.....	suct..	motor..	Mon'rch.	1,200	16	Zenith..	grav.	seat..	dry-d..	selec.	unit-m.	3	7.75-1	worm..	springs.	springs.	int-r-w.	int-r-w.	left..	cent..	Forschler.....
.....	.....	.....	cent..	motor..	Pierce...	1,200	12	Zenith..	grav.	seat..	dry-d..	selec.	unit-m.	3	7.75-1	worm..	springs.	springs.	int-r-w.	int-r-w.	left..	cent..	Forschler.....
s & l....	N-East..	300.00	cent..	motor..	Pierce...	1,100	14	Stmbg..	grav.	seat..	wet-d.	ind-c.	amid...	3	8.90-1	bevel-4.	springs.	t-arm..	ext-r-w.	ext-sht.	right.	right.	F. W. D.....B
s & l....	Westghs.	175.00	suct..	motor..	Mon'rch.	1,238	17	Ray...	grav.	seat..	dry-d..	selec.	unit-m.	3	7.80-1	worm..	springs.	springs.	int-r-w.	int-r-w.	right.	cent..	Garford..... 75
s & l....	Westghs.	175.00	suct..	motor..	Mon rch.	1,111	14	Ray...	grav.	seat..	dry-d..	selec.	amid...	3	8.50-1	worm..	springs.	springs.	int-r-w.	ext-r-w.	right.	cent..	Garford.....66
s & l....	Westghs.	175.00	suct..	motor..	Mon'rch.	934	13	Ray....	grav.	seat..	dry-d..	selec.	amid ..	3	7.75-1	worm..	springs.	springs.	int-r-w.	ext-r-w.	right.	cent..	Garford.....70
s & l....	Westghs.	175.00	cent..	motor..	own.....	1,041	12	Ray...	grav.	seat..	dry-d..	selec.	amid...	4	10.33-1	worm..	rad-rd..	springs.	ext-sht.	int-r-w.	right.	cent..	Garford.....77-B
none...	.....	.....	suct..	motor..	own.....	1,005.	9	Ray...	grav.	seat..	dry-d..	selec.	unit-j..	4	13.31-1	dbl chn.	rad-rd..	.....	int-r-w.	ext-sht.	right.	right.	Garford.....68
none...	.....	.....	suct..	motor..	own.....	.920	8	Ray...	grav.	seat..	dry-d..	selec.	unit-j..	4	13.31-1	dbl chn.	rad-rd..	.....	int-r-w.	int-sht.	right.	right.	Garford.....69
.....	.....	.....	cent..	motor..	own.....	900	16	Scheb..	grav.	seat..	cone..	selec.	amid...	3	7.75-1	worm..	rad-rd..	t-arm..	int-r-w.	ext-r-w.	left..	cent..	G. A. Schacht.....
.....	.....	.....	cent..	motor..	own.....	900	15	Scheb..	grav.	seat..	cone..	selec.	amid...	3	8.67-1	worm..	rad-rd..	t-arm..	int-r-w.	ext-r-w.	left..	cent..	G. A. Schacht.....
.....	.....	.....	cent..	motor..	own.....	900	12	Scheb..	grav.	seat..	cone..	selec.	amid...	3	9.67-1	worm..	rad-rd..	t-arm..	int-r-w.	ext-r-w.	left..	cent..	G. A. Schacht.....
.....	.....	.....	cent..	motor..	own.....	850	10	own....	pres..	seat..	cone..	selec.	amid...	4	9.36-1	int-g...	rad-rd..	t-arm..	ext-r-w.	ext-sht.	right.	right.	G. V.-Mercedes....F.V.
s & l-2...	Westghs.	stock...	suct..	motor..	Mon'rch.	1,050	13	Ray...	vac..	seat..	dry-p..	ind-c.	unit-m.	3	8.66-1	worm..	springs.	springs.	int-r-w.	ext-r-w.	left..	cent..	Geraix.....C
.....	.....	.....	cent..	d-shft..	Pierce...	3,400	25	Master.	vac..	seat..	dry-d..	selec.	unit-m.	3	7.40-1	int-g...	springs.	springs.	int-r-w.	ext-r-w.	left..	cent.	Globe.....
none...	.....	.....	suct..	motor..	Mon'rch.	1,150	20	Marvel.	grav.	seat..	cone..	selec.	amid ..	3	0.00-1	bevel..	tor-t...	tor-t...	int-r-w	ext-r-w.	left..	cent..	G. M. C.....15
none...	.....	.....	suct..	motor..	Mon'rch.	1,380	18	Marvel.	grav.	seat..	dry-d..	selec.	unit-m.	3	7.75-1	worm..	springs.	springs.	int-r-w.	int-r-w.	left..	cent..	G. M. C..... 21
none...	.....	.....	suct..	motor..	Mon'rch.	1,150	15	Marvel.	grav.	seat..	dry-d..	selec.	unit-m.	4	9.25-1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left..	cent..	G. M. C.....31
none...	.....	.....	suct..	motor..	Mon'rch.	1,200	14	Marvel.	grav.	seat..	dry-d..	selec.	unit-m.	4	0.25-1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left..	cent..	G. M. C.....41
none...	.....	.....	suct..	motor..	Mon'rch.	1,250	12	Marvel.	grav.	seat..	dry-d..	selec.	amid...	4	12.00-1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left..	cent..	G. M. C..... 71
none...	.....	.....	suct..	motor..	Mon'rch.	1,250	10	Marvel.	grav.	seat..	dry-d..	selec.	amid...	4	13.67-1	worm..	rad-rd..	springs	int-r-w.	int-r-w.	left..	cent..	G. M. C.....101
s & l-2*..	Westghs.	200.00*	l-h...	motor..	Wauk'a..	1,200	19	Zenith..	grav.	seat..	dry-d..	ind-c.	amid...	3	6.50-1	worm..	springs.	springs.	int-r-w	int-r-w.	left..	cent..	Gramm-Bernstein.....
s & l-2*..	Westghs.	200.00*	l-b...	motor..	Wuak'a..	1,200	17	Zenith..	grav.	seat..	dry-d..	ind-c.	amid ...	3	7.75-1	worm..	springs.	springs.	int-r-w	ext-r-w.	left..	cent..	Gramm-Bernstein.....
s & l-2*..	Westghs.	200.00*	l-b...	motor..	Wauk'a..	1,200	14	Zenith..	grav.	seat..	dry-d..	ind-c.	amid...	3	8.60-1	worm..	springs.	springs.	int-r-w	ext-r-w.	left..	cent..	Gramm-Bernstein.....
s & l-2*..	Westghs.	200.00*	cent..	motor..	Wauk'a..	1,000	14	Zenith..	grav.	seat.	dry-d..	ind-c.	amid...	3	7.75-1	worm..	springs	springs	int-r-w	ext-r-w.	left..	cent..	Gramm-Bernstein.....
s & l-2*..	Westghs.	200.00*	cent..	motor..	Wauk'a..	1,000	14	Zenith..	grav.	seat.	dry-d..	ind-c.	amid ...	4	8 75-1	worm..	springs.	springs.	int-r-w	int-r-w.	left..	cent.	Gramm-Bernstein.....
a & l-2*..	Westghs.	200.00*	cent..	motor..	Wauk'a..	1,000	10	Zenith..	grav.	seat.	cone..	ind-c.	amid ...	4	11.75-1	worm..	springs	springs	int-r-w	int-r-w.	left..	cent..	Gramm-Bernstein.....
s & l-2*..	Westghs.	200.00*	cent..	motor..	Wauk'a..	1,000	10	Zenith..	grav.	seat..	cone..	ind-c.	amid...	4	11.75-1	worm..	springs.	springs.	int-r-w	int-r-w.	left..	cent..	Gramm-Bernstein.....
.....	.....	.....	cent..	motor..	Pierce...	1,175	18	Stmbg..	grav.	seat..	dry-d..	selec	unit-m.	3	7.00-1	worm.	springs	springs	int-r-w	ext-r-w.	.....	cent..	Hahn.....C
.....	.....	.....	cent..	motor..	Pierce...	080	15	Stmbg..	grav.	seat.	dry-d..	selec.	unit-m.	3	7.00-1	worm.	rad-rd..	t-arm..	.....	.....	left..	cent..	Hahn.....E
lighting.	Bosch...	50.00	suct..	motor..	Mon'rch.	1,250	20	Zenith..	grav.	seat..	dry-d..	selec.	unit-m.	3	9.25-1	worm..	springs	springs	int-r-w	int-r-w	left..	cent..	Hall.....
lighting.	Bosch...	50.00	suct*	motor.	Mon*...	1,200	15	Zenith..	grav.	seat..	dry-d..	selec.	unit-m.	3	10.51-1	worm*	sp'gs*	sp'gs*	int-r-w	int-r-w	left..	cent..	Hall.....
lighting.	Bosch...	50.00	suct*	motor..	Mon*...	1,200	12	Zenith..	grav.	.....	dry-d..	selec.	unit-m.	4	12.00-1	dbl chn.	rad-rd..	.....	iut-r-w	ext-j. s.	left..	cent..	Hall.....
.....	.....	.....	cent..	motor	own.....	1,025	12	Scheb..	grav.	seat.	cone..	selec.	unit-j..	3	9.43-1	dbl chn.	rad-rd..	.....	int-r-w	ext-r-w.	right.	right.	Harrison.....C
.....	.....	.....	cent..	motor..	own.....	1,000	12	Stmbg..	grav.	seat..	cone..	selec.	unit-j..	3	9.60-1	dbl chn.	rad-rd..	.....	int.....	ext....	right.	cent..	Harrison.....F
s & l-2...	Westghs.	125.00	cent..	duplex..	Duplex...	1,000	14	Holley..	grav.	seat.	dry-p..	selec.	amid...	4	7 75-1	worm..	springs.	springs	int-r-w	int-r-w	left	cent..	Harvey.....W-F
s & l-2...	Westghs.	150.00	cent..	duplex..	Duplex...	1,000	13	Stmbg..	grav.	seat..	dry-p..	selec	amid...	4	8.75-1	worm	springs	springs	int-r-w	int-r-w	left	cent.	Harvey.....W-H
a & l-2...	Westghs.	150.00	cent..	duplex..	Duplex..	000	11	Stmbg..	grav.	seat.	dry-p..	selec.	amid...	4	11.75-1	worm.	springs.	springs	int-r-w	int-r-w	left.	cent.	Harvey.....W-K
.....	.....	.....	.....	.....	.....	1,700	.....	Master.	vac..	.....	dry-p..	selec.	unit-m.	3	.....	int-g..	springs	springs	int-r-w	ext-r-w.	left..	cent..	Hawkeye.....H
.....	.....	.....	cent..	motor..	.....	.....	.....	.....	grav.	seat.	dry-d..	selec.	.....	3	.....	worm	rad-rd..	.....	int-r-w	int-r-w	left	cent..	Horner.....
.....	.....	.....	cent..	motor	.....	.....	.....	.....	grav.	seat.	dry-d..	selec.	.....	.....	.....	worm	rad-rd.	springs.	int-r-w	int-r-w	left.	cent..	Horner.....

ABBREVIATIONS (continued).—*Allis-Chalmers*; G & D, *Gray & Davis*; Westghs, *Westinghouse*; N-East, *Northeast*; Huff-S, *Huff-Simms*; Spl-App, *Splitdorf-Apple*. **Governor Type** cent, c't, *centrifugal*; suct, *suction or gas velocity*; l-h, *loose-ball*; hydr, *hydraulic*. **Governor Drive** motor, *from motor*; d-shft, *from driveshaft*; duplex, *from both motor and driveshaft or front wheel*; f-wheel, f-whl, *from front wheel*. **Governor Make** Wauk'a, *Waukesha*; Mon'rch, Mon, *Monarch*; Her-Sp, *Herschell-Spillman*; Milwkee, *Milwaukee*. **Carbureter Make**, Scheb, *Schebler*; Ray, *Rayfield*; Stmbg, *Stromberg*; Shkspr, *Shakespeare*; Flech, *Flechter*; Zen *Zenith*, Johns, *Johnson*. **Fuel Feed**, grav, *gravity*; vac, *vacuum*; pres, *pressure*. **Tank Location**, seat, *under seat*; dash, *in dash*; rear, *at rear*; r-bd, *on running-board*. **Clutch Type**, dry-d, *dry multiple disk*; dry-p, *dry plate*: wet-d, *multiple-disk in oil*; wet-p, *plate-in-oil*. **Gearset Type**, selec, *selective sliding gear*; prog, *progressive sliding gear*; ind-c, *individual clutch, constant-mesh*; plan, *planetary*; fric, *friction*; elec, *electric*. **Gearset Location**, amid, *amidships*; unit-m, *unit with motor*; unit-j, *unit with jackshaft*; unit-x, *unit with axle*. **Final Drive**, int-g, *internal-gear*; worm, *top worm*; dbl chn, *double side chains*; sp-bevel, *spiral bevel*; db-red, *double-reduction, bevel and spur gears*; ext-g, *external-gear*; -f, *to front wheels*; -4, *on all four wheels*. **Propulsion Taken By**, rad-rd, *radius rods*; tor-t, *torsion-tube*; sub-f, *sub-frame*; spg's, *springs*. **Torque Taken By**, rad-rd, *radius rods*; t-r-t, *torsion-tube*; t-arm, *torque-arm*; sub-f, *sub-frame*; sp'gs, *springs*. **Brakes**, Type, ext, ex, *external contracting*; int, *internal expanding*. **Brake Location**, -r-w, *rear wheel*: -sht, *shaft*; -f-w, *front wheel*; -j-s, *jackshaft*; -4-w, *on all four wheels*. **Control**, Levers, cent, *center*; o & r, *gearsh.ft center, brake right*; o & l, *gearshift center, brake left*.

Technical Specifications of Gasoline

Name and Model	Capacity in Pounds	Price of Chassis	Wheelbase in Inches	FRAME		TIRES			Wheels	MOTOR								
				Material	Construction	Kind	SIZES IN INCHES Front	SIZES IN INCHES Rear		No. of Crankshaft Bearings	Bore and Stroke	N.A.C.C. Hp.	Cylinders Cast	Valves Placed	COOLING Water Circulation	COOLING Radiator Core and Case	IGNITION Type	IGNITION Make	IGNITION Spark Advance
Horner	6,000	$3,200	145	rolled-c..	rigid....	sold....	36x5	40x4d	wood-sq.	3	4-4½x5½	32.40	pairs....	opp....	cent...	fin-cast...	dual..	.....	hand...
Horner	10,000	4,200	156	rolled-o..	rigid....	soid....	38x6	42x6d	wood-sq.	3	4-5½x5½	44.20	pairs....	opp....	cent...	fin-cast...	dual..	.....	hand...
Hurlburt	3,000	2,250	136*	pr-steel..	rigid....	solid....	34x4	34x5	wood-ov.	3	4-3½x5½	22.50	block...	right...	cent...	cell-sheet..	sing...	Eisemann..	fixed....
Hurlburt	4,000	3,000	148*	pr-steel..	rigid....	solid....	36x4	36x4d	wood-ov.	3	4-4½x5½	27.20	block...	right...	cent...	fin-cast....	dual..	Eisemann..	fixed....
Hurlburt	7,000	3,500	146*	pr-steel..	rigid....	solid....	36x5	36x5d	wood-ov.	3	4-4½x5½	29.00	block...	right...	cent...	fin-cast....	dual..	Eisemann..	fixed....
Hurlburt	10,000	4,250	156*	pr-steel..	.....	solid....	36x5	38x6d	wood-ov.	4	6-3½x5½	33.75	block...	right...	cent...	fin-cast....	dual..	Eisemann..	fixed....
Hurlburt	14,000	5,000	156*	pr-steel..	.....	solid....	36x6	40x7d	wood-ov.	4	6-3½x5½	33.75	block...	right...	cent...	fin-cast....	dual..	Eisemann..	fixed....
Independent.....F	2,000	1,385	128*	pr-steel..	.....	solid*...	36x3*	36x4*	wood-sq.	3	4-3½x5	19.61	block...	.....	cent...	s-s-t-sheet.	sing..	Eisemann..	fixed....
Independent.....G	4,000	1,850	144	pr-steel..	.....	solid....	36x3½	36x5	wood-sq.	3	4-4½x5½	27.20	block...	.....	cent....	s-s-t-cast..	sing..	Eisemann..	fixed....
I.H.C.....H	1,500	1,225	115	pr-steel..	semi-fix..	solid....	86x3	36x3½	wood-ov.	3	4-3½x5½	19.61	block...	right...	cent...	fin-sheet...	sing...	Bosch.....	hand....
I.H.C.....F	2,000	1,500	128*	pr-steel..	semi-fix..	solid....	36x3½	36x4	wood-ov.	3	4-3½x5½	19.61	block...	right...	cent...	fin-sheet...	sing...	Bosch.....	hand....
Jeffery.....1016	1,500	965	116	pr-steel..	flexible..	pneu....	35x4½	35x4½	wood-ov.	3	4-3½x5½	22.50	block...	right...	cent...	cell-sheet..	sing...	Dixie.....	hand....
Jaffery.....2016	3,000	1,465	130	pr-steel..	flexible..	p & s....	34x4½	34x5	w'd-sq*..	3	4-3½x5½	22.50	block...	right...	cent...	cell-sheet..	sing...	Dixie.....	hand....
Jaffery Quad.....4016	4,000	2,850	124*	pr-steel..	flexible..	solid....	36x5	36x5	cast-d....	3	4-4½x5½	29.00	block...	right...	cent...	cell-sheet..	sing...	Dixie.....	hand....
Kelly-Springfield...K-31	3,000	2,000	144*	pr-steel..	semi-fix..	solid*...	36x3½*	36x6*	wood-sq.	3	4-3½x5½	22.50	block...	right...	cent...	cell-sheet..	sing...	Eisemann..	auto....
Kelly-Springfield...K-32	3,000	2,000	144*	pr-steel..	semi-fix..	solid*...	36x3½*	36x6*	wood-sq.	3	4-3½x5½	22.50	block...	right...	cent...	cell-sheet..	sing...	Eisemann..	auto....
Kelly-Springfield...K-34	5,000	2,750	144*	pr-steel..	semi-fix..	solid*...	36x4*	36x4d*	wood-sq.	3	4-3½x5½	22.50	block...	right...	cent...	cell-sheet..	sing...	Eisemann..	auto....
Kelly-Springfield...K-35	5,000	2,750	144*	pr-steel..	semi-fix..	solid*...	36x4*	36x4d*	wood-sq.	3	4-3½x5½	22.50	block...	right...	cent...	cell-sheet..	sing...	Eisemann..	auto....
Kelly-Springfield...K-40	7,000	3,400	150*	pr-steel..	semi-fix..	solid*...	38x5*	38x5d*	wood-sq.	3	4-4½x6½	32.40	pairs....	opp....	cent...	cell-sheet..	sing...	Eisemann..	auto....
Kelly-Springfield...K-45	8,000	3,600	150*	pr-steel..	semi-fix..	solid*...	38x5*	40x6d*	wood-sq.	3	4-4½x6½	32.40	pairs....	opp....	cent...	cell-sheet..	sing...	Eisemann..	auto....
Kelly-Springfield...K-50	10,000	4,250	150*	pr-steel..	semi-fix..	solid*...	38x6*	40x6d*	wood-sq.	3	4-4½x6½	32.40	pairs....	opp....	cent...	cell-sheet..	sing...	Eisemann..	auto....
Kelly-Springfield...K-60	12,000	4,500	150*	pr-steel..	semi-fix.	solid*...	38x6*	40x7d*	w'd-sq*	3	4-4½x6½	32.40	pairs....	opp....	cent...	cell-sheet..	sing...	Eisemann..	auto....
King	7,000	2,600	120	rolled-o..	flexible..	solid....	36x5	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	s-s-t-sheet.	dual-d	Bosch.....	2 pt-fix..
Kisselkar	1,500	950	124	pr-steel..	rigid....	pneu....	32x4	32x4	wood-sq.	3	4-3½x5½	24.22	block...	right...	cent...	sq-t-sheet..	sing...	Eisemann.	hand....
Kisselkar	2,000	1,250	132	pr-steel..	rigid....	solid*...	34x3*	34x4*	wood-sq.	3	4-3½x5½	24.22	block...	right...	cent...	sq-t-sheet..	sing...	Eisemann.	hand....
Kisselkar	4,000	1,875	144*	pr-steel..	rigid....	solid....	34x3½	36x6	wood-sq.	3	4-4½x5½	29.00	block...	right...	cent...	sq-t-sheet..	sing...	Eisemann.	hand....
Kisselkar	5,000	2,250	166	pr-steel..	rigid....	solid....	34x4	36x4d	wood-sq.	3	4-4½x5½	29.00	block...	right...	cent...	sq-t-sheet..	sing...	Eisemann.	hand....
Kisselkar	8,000	2,850	168	pr-steel..	rigid....	solid....	36x5	36x5d.	wood-sq.	3	4-4½x5½	29.00	block...	right...	cent...	sq-t-sheet..	sing...	Eisemann.	band....
Kisselkar	10,000	3,350	180	pr-steel..	rigid....	solid....	36x6	36x6d	wood-sq.	3	4-4½x5½	29.00	block...	right...	cent...	sq-t-sheet..	sing...	Eisemann.	band....
Klaiber.....AA	1,750	1,600	130*	rolled-o..	semi-fix	solid*...	34x3*	34x5*	wood-ov.	3	4-3½x5	22.50	block...	right...	thermo.	s-s-t-sheet.	dual..	Bosch.....	hand....
Klaiber.....A1	3,000	2,250	140*	rolled-c..	semi-fix..	solid....	36x3½	36x5*	wood-ov.	3	4-4½x5½	27.20	block...	left....	cent...	s-s-t-sheet.	dual..	Bosch.....	hand....
Kleiber.....A2	4,000	2,400	145*	rolled-c..	semi-fix..	solid....	36x3½*	36x6*	wood-sq.	.....	4-4½x5½	27.20	block...	left....	cent...	s-s-t-sheet.	dual..	Bosch.....	hand....
Klaiber.....B	5,000	2,750	150*	rolled-c..	semi-fix..	solid....	36x4	36x4d	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	s-s-t-sheet.	dual..	Bosch.....	hand....
Klaiber.....C	7,000	3,500	160*	rolled-c..	semi-fix..	solid....	36x5	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	s-s-t-sheet.	dual..	Bosch.....	hand....
Klaiber.....D	10,000	4,500	170*	rolled-c..	semi-fix..	solid....	36x6	40x6d	wood-sq.	3	4-5½x5½	44.20	pairs....	opp....	cent...	s-s-t-sheet.	dual..	Bosch.....	hand....
Knickerbocker.....A	7,000	3,500	128	rolled-o..	rigid....	solid....	35x5	35x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	sq-t-sheet..	dual..	Bosch.....	hand....
Knickerbocker.....C	10,000	4,500	148*	rolled-c..	rigid....	solid....	36x6	36x6d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	sq-t-sheet..	dual..	Bosch.....	hand....
Knox Tractor.....35	.....	4,500	108½	rolled-c..	rigid....	solid....	36x5	38x6d	cast-hol.	3	4-5x5½	40.00	pairs....	head....	cent...	cell-sheet..	sing...	Eisemann..	hand....
Knox Tractor.....36	6,000	5,000	108½	rolled-c..	rigid....	solid*...	36x4	38x6d*	cast-hol..	3	4-5x5½	40.00	pairs....	head....	cent...	cell-sheet..	sing...	Eisemann..	hand....
Koehler.....K	2,000	895	129	rolled-c..	rigid....	solid....	34x3	34x3½	wood-sq.	3	4-3½x5	19.61	block...	head....	thermo.	fin-cast....	sing...	Heinze....	fixed....
Krebs.....40	3,000	2,050	146	pr-steel..	.....	solid....	36x3½	36x5	wood-sq	3	4-3½x5½	22.50	block...	left....	cent...	tube-cast..	sing...	Bosch.....	hand....
Krebs.....60	4,000	2,375	162	pr-steel..	semi-fix..	solid....	36x4	36x4d*	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	tube-cast..	sing...	Bosch.....	hand....
Kreba.....90	7,000	3,250	180	pr-steel..	semi-fix..	solid....	36x5	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	tube-cast..	sing...	Bosch.....	hand....
Lambert.....V2	2,000	1,700	144	rolled-o..	semi-fix..	solid....	36x3½	36x4	wood-sq	5	4-4½x5½	29.00	sing.....	left....	cent...	fin-sheet...	sing*.	Remy*....	hand....
Lane.....A	1,500	1,075	120	rolled-c..	.....	solid*...	34x3*	34x4*	wood-sq.	2	4-3½x5	16.92	block...	left....	thermo.	fin-cast....	sing...	G & D....	hand....
Langa.....C	3,000	1,850	130*	rolled-c..	rigid....	solid....	36x3½	38x4	wood-ov.	3	4-3½x5½	22.50	block...	right...	thermo.	sq-t-sheet..	sing...	Bosch.....	hand....
Langa.....B	5,000	2,450	136*	rolled-c..	rigid....	solid....	36x4	38x6	wood-ov.	3	4-4½x5½	27.20	block...	right...	thermo.	sq-t-sheet..	sing...	Bosch.....	hand....
Larrabee	2,000	1,550	130	pr-steel..	semi-fix..	solid*...	34x3*	34x4*	wood-sq.	3	4-3½x5	22.50	block...	right...	thermo.	sq-t-sheet..	sing...	G & D*....	hand....
Larrabee	3,000	2,000	140*	pr-steel..	flexible..	solid....	36x3½	36x5	wood-sq.	3	4-4½x5½	27.20	block...	right...	cent...	sq-t-cast..	sing...	G & D*....	hand....
Larrabee	5,000	2,300	152*	pr-steel..	flexible..	solid....	36x4	36x6	wood-sq.	3	4-4½x5½	27.20	block...	right...	cent...	sq-t-cast..	sing...	G & D*....	hand....
Lawson.....35	1,000	.....	112	pr-steel..	.....	pneu....	31x4	31x4	wood-ov.	3	4-3½x4½	22.50	block...	right...	thermo.	cell-sheet..	sing...	Dixie.....	hand....
Lincoln.....L	2,000	975	122*	pr-steel..	semi-fix..	pneu....	33x5	33x5	wood-ov.	3	4-3½x5	19.61	block...	right...	thermo.	tube-cast..	sing...	Dixie.....	fixed....
Lippard-Stewart....MW	1,000	1,000	106	pr-steel..	semi-fix..	pneu....	33x4	33x4	wood-ov.	2	4-3½x5	16.92	block...	left....	thermo.	sq-t-sheet..	sing...	Berling...	fixed....
Lippard-Stewart.....W	1,500	1,600	125*	pr-steel..	semi-fix..	pneu....	35x4½	35x4½	wood-ov.	3	4-3½x5½	22.50	block...	left....	cent...	sq-t-sheet..	sing...	Eisemann.	fixed....
Lippard-Stewart.....H	2,000	2,000	145	pr-steel.	semi-fix..	solid....	36x3	36x5	wood-ov.	3	4-3½x5½	22.50	block...	left....	cent...	sq-t-cast..	sing...	Eisemann.	fixed....
Lippard-Stewart.....F	3,000	2,300	145*	pr-steel..	flexible.	solid....	36x3½	36x3d	wood-ov.	3	4-4½x5½	27.20	block...	left....	cent...	sq-t-cast..	sing...	Eisemann.	fixed....
Lippard-Stewart.....G	4,000	2,600	158*	pr-steel..	flexible..	solid....	36x4	36x4d	wood-ov.	3	4-4½x5½	27.20	block...	left....	cent...	sq-t-cast..	sing...	Eisemann.	fixed....
Little Giant.....15	1,500	1,500	138	pr-steel..	semi-fix..	p. & s....	34x4	34x3½	wood-sq.	3	4-3½x5	19.61	block...	right...	thermo.	cell-sheet..	sing...	Eisemann.	hand....
Little Giant.....H	2,000	1,400	110	rolled-I..	semi-fix..	solid....	36x3	36x3½	wood-sq	3	4-3½x5½	19.61	block...	right...	thermo.	s-s-t-sheet.	sing...	Eisemann.	hand....
Little Giant.....H	3,000	1,500	110	rolled-o..	semi-fix..	solid....	36x3½	36x4	wood-sq.	3	4-3½x5½	19.61	block...	right...	thermo.	s-s-t-sheet.	sing...	Eisemann.	band....
Little Giant.....16	4,000	2,500	144	pr-steel..	semi-fix..	solid....	36x4	36x6	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	cell-sheet..	sing...	Eisemann.	hand....
Maccar.....L	3,000	2,100	150	pr-steel..	rigid....	solid....	36x4	36x5	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	fin-sheet...	sing...	Bosch.....	hand....
Maccar.....H	5,000	2,600	162	pr-steel..	rigid....	solid....	36x4	36x4d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	cell-sheet..	sing...	Bosch.....	hand....
Maccar.....M	7,000	3,250	174	pr-steel..	rigid....	solid....	37x5	37x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	cell-sheet..	sing...	Bosch.....	hand....
Maccar.....U	11,000	.....	186	pr-steel..	rigid....	solid....	37x5	40x6d	wood-sq.	.....	4-4½x5½	32.40	pairs....	left....	cent...	cell-sheet..	sing...	Bosch.....	hand....
Mack.....AB	2,000	2,000	144*	pr-steel..	semi-fix..	solid....	36x4	36x3½d*	wood-sq.	3	4-4x5	25.60	pairs....	right...	cent...	cell-sheet..	sing...	Splitdorf...	hand....
Mack.....AB	2,000	2,000	144*	pr-steel..	semi-fix..	solid....	36x4	36x3½d*	wood-sq.	3	4-4x5	25.60	pairs....	right...	cent...	cell-sheet..	sing...	Splitdorf...	hand....
Mack.....AB	3,000	2,350	162*	pr-steel..	semi-fix..	solid....	36x4	36x3½d*	wood-sq.	3	4-4x5	25.60	pairs....	right...	cent...	cell-sheet..	sing...	Splitdorf...	hand....
Mack.....AB	3,000	2,350	162*	pr-steel..	semi-fix..	solid....	36x4	36x3½d*	wood-sq.	3	4-4x5	25.60	pairs....	right...	cent...	cell-sheet..	sing...	Splitdorf...	hand....
Mack.....AB	4,000	2,700	162*	pr-steel..	semi-fix..	solid....	36x4	36x4d	wood-sq.	3	4-4x5	25.60	pairs....	right...	cent...	cell-sheet..	sing...	Splitdorf...	hand....
Mack.....AB	4,000	2,700	162*	pr-steel..	semi-fix..	solid....	36x4	36x4d	wood-sq.	3	4-4x5	25.60	pairs....	right...	cent...	cell-sheet..	sing...	Splitdorf...	hand....
Mack.....AC	7,000	3,400	156*	pr-steel..	semi-fix..	solid....	36x5	40x5d	wood-sq.	3	4-5x6	40.00	pairs....	right...	cent...	ring-cast..	dual..	Bosch.....	hand....

ABBREVIATIONS: General, *, *with other options;* opt, *optional;* **Price, -c, *complete with body.* **Frame, Material,** pr-steel, *pressed steel;* rolled-c, *rolled steel, channel section;* rolled-I, *rolled steel, I section;* **Frame Construction,** semi-fix, *semi flexible.* **Tires, kind,** Pneu, *pneumatic;* cush, *cushion,* p & s, *pneumatic front, solid, rear;* s & st, *solid rubber front, steel in rear.* **Tire Sizes,** -d, *dual.* **Wheels,** pr-steel, *pressed steel;* -ov, *oval spokes;* -sq, *square spokes;* -d, *disk or web type;* -hol, *hollow spokes;* -cr, *cruciform spokes;* -x, *cross-shaped solid spokes.* **Cylinders cast,** sing, *singly or individually.* **Location of valves,** opp, *opposite, T-head motor;* r & h, *one valve at right, the other in head, L-head motor;* l & h, *one valve at left the other in head, L-head motor.* **Water circulation,** cent, *centrifugal pump;* thermo-, *thermo-syphon or natural circulation;* gear, *gear pump.* **Radiator Type,** fin, *individually finned tubes;* sq-t, *square-tubular, resembling cellular, sometimes known as flat-tubular;* z-z-t, *zig-zag tubular, resembling cellular,* cell, *cellular or honeycomb type;* tube, *plain tubes without fins;* ring, *tubes arranged in ring about blower fan.* **Radiator Case,** -sheet, *sheet metal;* -cast, *cast metal, built up.* **Ignition Type,** sing, *single;* doub, *double,* dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Conn., *Connecticut;* storage, *storage battery;* Westghs, *Westinghouse;* G & D, *Gray & Davis;* At Kent, *Atwater Kent.* **Spark Advance,** auto, *automatic;* 2-pt-fix, *two-point fixed, battery circuit in retard, magneto in advance.* **Electric System Type,** s, l & i, *starting, lighting and ignition, combination unit;* s & l, *starting and lighting, combination unit;* s & l-2, *starting and lighting, two-unit;* l & i, *lighting and ignition, combination unit.* **Electric System, Make,** Splitdf, *Splitdorf;* Al-Chal,—**(Abbreviations Continued on Opposite Page.)**

Commercial Vehicles for 1917—Continued

MOTOR											TRANSMISSION								BRAKES		CONTROL		
ELECTRIC SYSTEM			GOVERNOR			SPEED		FUEL SYSTEM				GEARSET			Total Gear Reduction in High	Final Drive	Propulsion Taken By	Torque Taken By					Name and Model
Type	Make	Extra Cost	Type	Drive	Make	Motor in r. p. m.	Truck in m. p. h.	Carbureter Make	Fuel Feed	Tank Location	Clutch Type	Type	Location	Sp'ds					Hand	Foot	Steer	Levers	
.....	.....	.....	cent..	motor	.....	.....	.....	.....	grav.	.....	dry-d..	selec.	.....	3	9.40–1	worm..	rad-rd..	springs	int-r-w.	int-r-w.	left..	cent..	Horner.....
.....	.....	.....	cent.	motor	.....	.....	.....	.....	grav.	seat..	dry-d..	selec.	amid...	3	13.42–1	worm..	rad-rd..	springs	int-r-w.	int-r-w.	left..	cent..	Horner.....
lighting.	Vesta...	stock...	cent..	motor.	Pierce...	1,200	18	Flech..	grav.	seat..	dry-d..	selec.	unit-m.	3	7.75–1	worm..	springs.	springs	int-r-w.	int-r-w.	left..	cent..	Hurlburt.....
lighting.	Vesta...	stock...	cent..	motor.	Pierce...	1,200	16	Flech..	grav.	seat..	cone..	selec.	amid...	3	8.67–1	worm..	rad-rd..	t-arm.	int-r-w.	ext-r-w.	left..	cent..	Hurlburt.....
lighting.	Vesta.	stock.	cent..	motor.	Pierce...	1,200	13	Flech..	grav.	seat..	conc.	selec.	amid...	3	8.67–1	worm..	rad-rd..	t-arm.	int.....	ext.....	left..	cent..	Hurlburt.....
lighting.	Westghs.	stock...	cent..	motor.	Pierce...	1,200	12	Flech..	grav.	seat..	dry-d..	selec.	amid...	3	10.33–1	worm..	rad-rd..	t-arm.	int-r-w.	int-r-w.	left..	cent..	Hurlburt.....
lighting.	Westghs.	stock...	cent..	motor.	Pierce...	1,200	12	Flech..	grav.	seat..	dry-d..	selec.	amid...	4	11.33–1	worm..	rad-rd..	t-arm.	int-r-w.	ext-sbt.	left..	cent..	Hurlburt.....
s, l &i...	Jesco....	100.00	suct.	motor	Mon'rch.	1,350	.....	Marvel.	grav.	seat..	dry-d..	selec.	unit-m.	3	.....	worm..	springs.	springs	int-r-w.	int-r-w.	left..	cent..	Independent.....F
.....	.....	.....	suct..	motor.	Mon'rch.	.....	.....	Marvel.	grav.	seat..	dry-d.	selec.	unit-m.	3	.....	worm..	springs.	springs	int-r-w.	int-r-w.	left..	cent..	Independent.....G
s &l*...	N-East*.	125.00	cent..	motor	own.....	1,275*	18*	Holley..	grav.	sent..	cone..	selec.	amid...	3	7.00–1	int-g...	springs	springs	int-r-w.	int-r-w.	left..	cent.	I.H.C.....H
s &l*...	N-East*.	125.00	cent..	motor.	own.....	1,300	17	Holley..	grav.	sent..	cone..	selec.	amid...	3	8.00–1	int-g...	springs	springs	int-r-w.	int-r-w.	left..	cent..	I.H.C.....F
s &l-2...	Bijur....	stock..	.....	.....	.....	1,750	40	Stmbg..	.....	.....	dry-p..	selec.	unit-m.	3	4.50–1	sp-bev..	springs	springs	ext-sht.	ext-r-w.	left..	cent..	Jeffery.....1016
s &l-2...	Bijur....	stock...	cent..	duplex..	Duplex..	1,500	16	Stmbg..	grav.	dash.	dry-p..	selec.	unit-m.	3	8.10–1	int-g...	springs.	springs.	ext-sht..	ext-r-w.	left..	cent.	Jeffery.....2016
s &l-2...	Bijur....	125.00	cent..	duplex..	Duplex..	1,500	14	Stmbg..	grav.	seat..	dry-p..	ind-c.	amid...	4	8.50–1	int-g-4.	springs.	springs	ext-sbt.	int-4-w.	left..	cent..	Jeffery Quad.....4016
s &l-2...	R & M*	175.00	l-b...	motor	own.....	1,200	15	Ray...	grav.	seat..	cone..	selec.	amid...	3	.....	dbl cbn.	rad-rd..	.....	int-r-w.	int-r-w.	left..	cent..	Kelly–Springfield...K–31
s &l-2...	R & M*	175.00	l-b...	motor	own.....	1,200	15	Ray...	grav.	seat..	cone..	selec.	amid...	3	.....	worm..	rad-rd..	springs	int-r-w.	int-r-w.	left..	cent..	Kelly–Springfield...K–32
s &l-2...	R & M*	175 00	l-b...	motor	own.....	1,200	11	Ray...	grav.	seat..	cone..	selec.	amid...	3	.....	worm..	rad-rd..	springs	int-r-w	int-r-w	left..	cent..	Kelly–Springfield...K–36
s &l-2...	R & M*	175.00	l-b...	motor	own.....	1,200	11½	Ray...	grav.	seat..	cone..	selec.	amid...	3	.....	dbl cbn	rad-rd..	.....	int-r-w	int-r-w.	left..	cent..	Kelly–Springfield...K–35
s &l-2...	R & M*	175 00	l-b...	motor	own.....	1,100	12	Ray...	grav.	seat..	cone..	selec.	amid...	3	.....	dbl cbn	rad-rd..	.....	int-r-w	int-r-w.	left..	cent..	Kelly–Springfield...K–40
s &l-2...	R & M*	175 00	l-b...	motor	own.....	1,100	12	Ray...	grav.	seat..	cone..	selec.	amid...	3	.....	dbl cbn	rad-rd..	.....	int-r-w	int-r-w.	left..	cent..	Kelly–Springfield...K–45
s &l-2...	R & M*	175 00	l-b...	motor	own.....	1,100	10¾	Ray...	grav.	seat..	cone..	selec.	amid...	3	.....	dbl chn.	rad-rd..	.....	int-r-w.	int-r-w.	left..	cent.	Kelly–Springfield...K–50
s &l-2...	R & M*	175.00	l-b....	motor..	own.....	1,100	10¾	Ray...	grav.	seat..	cone..	selec.	amid...	3	.....	dbl cbn.	rad-rd.	.....	.....	.....	left..	cent..	Kelly–Springfield...K–60
.....	.....	.....	cent..	motor.	Pierce...	1,000	12	Scheb..	grav.	seat..	dry-d..	ind-c.	unit-j..	3	8.67–1	dbl chn.	rad-rd.	.....	int-r-w.	ext-j...	right.	right.	King.....
s &l-2*	Remy ..	150.00*	cent..	motor	Pierce...	1,200	25	Stmbg..	vac..	seat..	cone..	selec.	unit-m.	3	4.58–1	sp-bev..	springs	springs	ext-r-w.	ext-r-w.	left..	cent..	Kisselkar.....
s &l-2*..	Remy...	150.00	cent..	motor	Pierce...	1,280	20	Stmbg..	vac..	seat..	cone..	selec.	unit-m.	3	6.50–1	worm..	springs.	springs	int-r-w.	int-r-w.	left..	cent..	Kisselkar.....
s &l-2*..	Remy...	150.00	cent..	motor	Pierce...	1,295	15	Stmbg..	vac..	seat..	dry-p..	selec.	unit-m.	4	9.25–1	worm..	springs.	springs	int-r-w.	int-r-w.	left..	cent..	Kisselkar.....
s &l-2*..	Remy...	150 00	cent.	motor	Pierce...	1,060	13	Stmbg..	vac..	seat..	dry-p..	selec.	unit-m.	4	8 70–1	worm..	springs.	springs	int-r-w.	int-r-w.	left..	cent..	Kisselkar.....
s &l-2*	Remy...	150 00	cent.	motor	Pierce...	1,425	13	Stmbg..	vac..	seat..	dry-p..	selec.	amid...	4	11.75–1	worm..	springs.	springs	int-r-w.	int-r-w.	left..	cent..	Kisselkar.....
.....	.....	.....	cent	motor	Pierce...	1,456	12	Stmbg..	vac..	seat..	dry-p.	selec.	amid...	4	13.00–1	worm..	springs.	springs	int-r-w.	int-r-w.	left..	cent..	Kisselkar.....
lighting.	.....	opt....	cent..	motor	Pierce...	1,300	20	Scheb..	grav.	sent..	dry-p.	selec.	unit-m.	3	6.75–1	worm..	springs.	springs.	int	int.....	rigbt.	cent .	Kleiber.....AA
lighting.	.....	opt	cent..	motor	Pierce...	1,250	18	Scheb..	grav.	sent..	wet-d	selec.	amid ..	3	6.50–1	worm..	springs.	springs.	int	ext.....	right.	cent..	Kleiber.....A1
lighting.	.....	opt.....	cent..	motor	Pierce...	1,225	17	Scheb..	grav.	seat..	wet-d	selec.	amid...	3	7.75–1	worm..	rad-rd .	springs	int	ext.....	right.	cent..	Kleiber.....A2
lighting.	.....	opt.....	cent..	motor	Pierce...	1,200	16	Scheb..	grav.	.....	wet-d..	selec.	amid...	3	8.67–1	worm..	springs.	springs	int	ext.....	rigbt.	cent..	Kleiber.....B
lighting.	.....	opt.....	cent..	motor	Pierce...	1,150	14	Scheb..	grav.	seat..	wet-d.	selec.	amid...	3	8.75–1	worm..	springs.	springs.	int	int.....	rigbt.	cent.	Kleiber.....C
lighting.	.....	opt.....	cent..	motor	Pierce...	1,100	12	Scbeb..	grav.	seat..	wet-d.	selec.	amid...	4	8.75–1	worm..	springs.	springs	int	int.....	rigbt.	cent.	Kleiber.....D
lighting.	.....	stock...	cent..	motor	Pierce .	1,500	12	Stmbg..	grav.	seat.	cone.	selec	unit-m.	3	3.50–1	dbl chn.	rad-rd..	.....	int-r-w.	ext-f-w	left .	left..	Knickerbocker.....A
ligbting.	.....	stock...	cent..	motor	Pierce...	1,500	10	Stmbg..	grav.	seat..	cone..	selec.	unit-m.	3	3.50–1	dbl chn.	rad-rd..	.....	int-r-w.	ext-f-w.	left..	left..	Knickerbocker.....C
s &l-2...	Bijur....	stock...	.....	.....	none.....	.....	.....	Zenith..	vac..	r-bd..	dry-p..	selec.	unit-j..	3	9.60–1	dbl chn.	rad-rd..	.....	int-r-w	ext-j-s..	left..	cent..	Knox Tractor.....35
s &l-2...	Bijur....	stock...	.....	.....	nonc.....	.....	.....	Zenith	vac..	r-bd..	dry-p..	selec.	unit-j..	3	12.05–1	dbl cbn.	rad-rd..	.....	int-r-w.	ext-j-s..	left..	cent..	Knox Tractor.....36
none....	.....	.....	opt..	opt....	opt.....	2,050	30	Zephyr.	grav.	seat..	dry-d..	selec.	unit-m.	3	7.00–1	int-g...	springs.	springs.	int-r-w.	ext-r-w.	rigbt.	cent..	Koehler.....K
.....	.....	.....	cent.	motor	own.....	1,100	15	Zenith..	grav.	seat..	dry-d..	selec.	unit-m.	4	7.75–1	worm..	springs.	springs.	int-r-w.	int-r-w.	rigbt.	cent..	Kreba.....40
.....	.....	.....	cent..	motor	own.....	1,110	14	Zenith..	grav.	seat..	dry-d..	selec.	amid...	4	8.50–1	worm..	springs.	springs	int-r-w.	int-r-w.	rigbt.	right.	Krebs.....60
.....	.....	.....	cent..	motor	own.....	1,160	12	Zenith..	grav.	seat..	dry-d..	selec.	amid...	4	10.33–1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	right.	right.	Krebs.....90
s, l &i...	.....	100.00	cent..	motor..	Pierce...	1,500	.....	Scbeb..	grav.	seat..	nonc..	fric..	amid...	inf...	.....	dbl chn.	rad-rd..	.....	int.....	ext.....	left*.	.....	Lambert.....V2
.....	G & D...	stock...	.....	.....	.....	.....	.....	Sbkspr.	grav.	dasb.	wet-d.	selec.	unit-m.	3	6.20–1	worm..	springs.	springs.	int-r-w.	int-r-w.	left..	cent..	Lane.....A
none....	.....	.....	cent..	motor	Pierce...	1,250	18	Stmbg..	grav.	seat..	wet-d	ind-c.	unit-j..	3	8.05–1	dbl cbn.	rad-rd..	.....	int-r-w.	ext-sht.	left..	cent..	Lange.....C
none....	.....	.....	cent..	motor..	Pierce...	1,250	15	Stmbg..	grav.	seat.	wet-d.	ind-c.	unit-j..	3	9.21–1	dbl cbn.	rad-rd..	.....	int-r-w.	ext-sbt.	left..	cent..	Lange.....B
s, l &i...	G & D...	stock...	cent..	motor	Pierce	1,200	18¾	Scheb .	grav	seat.	dry-d..	selec.	unit-m.	3	6.50–1	worm..	springs.	springs.	int-r-w	int-r-w.	left..	cent..	Larrabee.....
s, l &i-2.	G & D...	stock...	cent..	motor	Pierce .	1,200	15	Scheb .	grav.	seat..	dry-d..	selec	unit-m.	3	7.75–1	worm..	springs.	springs	int-r-w.	ext-r-w.	left..	cent..	Larrabee.....
s, l &i-2.	G & D.	stock...	cent..	motor	Pierce...	1,200	14	Scheb .	grav.	seat..	dry-d..	selec	unit-m.	3	8.66–1	worm..	springs.	springs	int-r-w.	ext-r-w.	left..	cent..	Larrabee.....
s &l-2 .	Splitdf..	opt....	.....	.....	.....	.....	.....	Scheb..	grav.	seat..	wet-p.	selec	unit-m.	3	4.30–1	bevel...	springs.	tor-t...	int.....	ext.....	left..	cent..	Lawson.....35
s, l &i...	Delco...	100 00	suct.	motor..	Mon'rch.	1,500	20	Zenith..	vac..	.....	cone..	selec	unit-m.	3	6.50–1	bevel...	.....	t-arm.	int-r-w.	ext-r-w.	left..	c &l..	Lincoln.....L
s &l-2 .	Remy	stock..	.....	.....	nonc ...	1,525	25	Zenith..	grav	seat..	cone..	selec	amid..	3	5 80–1	worm..	springs.	springs	int-r-w.	iut-r-w.	left..	cent..	Lippard–Stewart....MW
s &l....	Dyneto.	135 00	.....	.....	none ...	1,182	20	Zen*	grav.	.....	cone..	selec	amid...	3	6 00–1	worm..	springs.	springs	int-r-w.	int-r-w.	left..	cent..	Lippard–Stewart....W
s &l....	Dyneto.	135 00	cent..	motor	Pierce	1,134	18	Zenith..	grav.	seat..	conc..	selec	amid...	3	6.75–1	worm..	springs.	springs	int.....	ext.....	left..	cent..	Lippard–Stewart.....H
s &l....	Dyneto..	135 00	cent..	motor.	Pierce...	1,300	18	Zen*	grav	seat.	cone..	selec	amid...	3	7 75–1	worm..	springs.	springs	int.....	int.....	left..	cent..	Lippard–Stewart.....F
s &l....	Dyneto.	135 00	cent..	motor	Pierce...	1,295	15	Zen*	grav.	seat..	cone..	selec	amid...	3	9.25–1	worm..	springs.	springs	int.....	int.....	left..	cent..	Lippard–Stewart.....G
lighting.	.....	stock...	.....	.....	.....	.....	.....	Scheb .	grav	seat..	dry-d..	selec.	unit-m.	3	6 00–1	worm..	springs	springs	int-r-w.	int-r-w.	right.	cent.	Little Giant 15
.....	.....	..	.....	.....	.....	.....	.....	Scheb	grav	.....	wet-d..	.....	unit-j	3	6 88–1	dbl chn.	rad-rd..	.....	ext..	ext....	right.	cent..	Little Giant.....H
.....	.....	.....	.....	.....	.....	.....	.....	Scheb	grav	seat..	wet-d.	selec.	unit-j..	3	6 88–1	dbl cbn.	rad-rd..	.....	ext-r-w.	ext-j-s..	right.	cent..	Little Giant.....H
.....	.....	.....	.....	.....	.....	.....	.....	Scbeb..	grav.	seat..	dry-d..	selec	unit-m	3	7.75–1	worm..	springs	springs	int-r-w.	int-r-w.	right.	cent..	Little Giant.....16
none....	.....	.....	cent..	motor	Pierce ..	1,000	16	Stmbg..	grav.	seat..	dry-d..	selec	unit-m.	3	6.75–1	worm..	rad-rd..	springs	ext-r-w.	..r-w..	left..	cent..	Maccar.....L
none....	.....	.....	cent..	motor	Pierce ..	1,000	13¾	Stmbg..	grav.	seat.	dry-d..	selec	unit-m.	3	7.75–1	worm .	rad-rd..	springs	int-r-w	int-r-w.	left..	cent..	Maccar.....H
none....	.....	.....	cent..	motor	Pierce	1,000	10½	Stmbg..	grav.	seat..	dry-d..	selec	unit-m	3	10.20–1	worm..	rad-rd..	springs	int-r-w	int-r-w.	left..	cent..	Maccar.....M
none....	.....	.....	cent..	motor.	Pierce...	1,000	8¾	Stmbg..	grav.	seat..	dry-d..	selec.	amid...	4	13.66–1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left..	cent..	Maccar.....U
s &l-2...	Bosch ..	250 00	cent..	motor	own.....	1,160	19¾	Stmbg..	grav	seat..	dry-d .	selec	unit-m.	3	6.29–1*	dbl chn	rad-rd..	.....	int-r-w	ext-sbt	left..	cent..	Mack.....AB
s &l-2...	Bosch..	250 00	cent..	motor	own.....	1,160	17¾	Stmbg..	grav.	seat..	dry-d..	selec.	unit-m.	3	7.00–1*	worm..	springs	springs	int-r-w	int-r-w.	left.	cent..	Mack.....AB
s &l-2...	Bosch	250.00	cent..	motor	own.....	1,160	16	Stmbg..	grav.	sent..	dry-d..	selec.	unit-m.	3	7.75–1*	worm.	springs	springs	int-r-w	int-r-w.	left.	cent..	Mack.....AB
s &l-2...	Bosch	250 00	cent..	motor	own.....	1,160	17¾	Stmbg..	grav.	sent..	dry-d..	selec.	unit-m.	3	6.99–1*	dbl chn.	rad-rd.	.....	int-r-w.	ext-sht	left.	cent..	Mack.....AB
s &l-2...	Bosch	250.00	cent..	motor	own.....	1,160	16	Stmbg..	grav.	seat..	dry-d..	selec.	unit-m.	3	7.75–1*	worm..	springs	springs	int-r-w.	int-r-w	left.	cent..	Mack.....AB
s &l-2...	Bosch	250 00	cent..	motor	own ..	1,160	17¾	Stmbg..	grav.	seat..	dry-d..	selec.	unit-m.	3	6.99–1*	dbl chn.	rad-rd.	.....	int-r-w	ext-sht	left	cent..	Mack.....AB
s &l-2...	Bosch	250 00	cent.	motor	own.....	1,000	15¾	Stmbg..	grav.	seat.	dry-p..	selec.	unit-j..	3	7.54–1*	dbl chn.	rad-rd.	.....	int-r-w	ext-j-s.	left	cent..	Mack.....AC

ABBREVIATIONS: (continued).—*Allis-Chalmers*; G & D, *Gray & Davis*; Westghs, *Westinghouse*; N-East, *Northeast*; Huff-S, *Huff-Simms*; Spl-App, *Splitdorf-Apple*. **Governor Type** cent, c't, *centrifugal*; suct, *suction or gas velocity*; l-b, *loose-ball*; hydr, *hydraulic*. **Governor Drive** motor, *from motor*; d-shft, *from driveshaft*; duplex, *from both motor and driveshaft or front wheel*; f-wheel, f-whl, *from front wheel*. **Governor Make** Wauk'a, *Waukesha*; Mon'rch, Mon, *Monarch*; Her-Sp, *Herschell-Spillman*; Milwkee, *Milwaukee*. **Carburater Make,** Scheb, *Schebler*; Ray, *Rayfield*; Stmbg, *Stromberg*; Shkspr, *Shakespeare*; Flech, *Flechter*; Zen, *Zenith*, Johns, *Johnson*. **Fuel Feed,** grav, *gravity*; vac, *vacuum*; pres, *pressure*. **Tank Location,** seat, *under seat*; dash, *in dash*; rear, *at rear*; r-bd, *on running-board*. **Clutch Type,** dry-d, *dry multiple disk*; dry-p, *dry plate*: wet-d, *multiple-disk in oil*; wet-p, *plate-in-oil*. **Gearset Type,** selec, *selective sliding gear*; prog, *progressive sliding gear*; ind-c, *individual clutch, constant-mesh*; plan, *planetary*; fric, *friction*; elec, *electric*. **Gearset Location,** amid, *amidships*; unit-m, *unit with motor*; unit-j, *unit with jackshaft*; unit-x, *unit with axle*. **Final Drive,** int-g, *internal-gear*: worm, *top worm*; dbl chn, *double side chains*; sp-bevel, *spiral bevel*; db-red, *double-reduction, bevel and spur gears*; ext-g, *external-gear*; -f, *to front wheels*; -4, *on all four wheels*. **Propulsion Taken By,** rad-rd, *radius rods*; tor-t, *torsion-tube*; sub-f, *sub-frame*; spg's, *springs*. **Torque Taken By,** rad-rd, *radius rods*; tor-t, *torsion-tube*; t-arm, *torque-arm*; sub-f, *sub-frame*; sp'gs, *springs*. **Brakes, Type,** ext, ex, *external contracting*; int, *internal expanding*.* **Brake Location,** -r-w, *rear wheel*: -sht, *shaft*; -f-w, *front wheel*; -j-s, *jackshaft*; -4-w, *on all four wheels*. **Control, Levers,** cent, *center*; c & r, *gearshift center, brake right*; c & l, *gearshift center, brake left*.

Technical Specifications of Gasoline

Name and Model	Capacity in Pounds	Price of Chassis	Wheelbase in Inches	FRAME		TIRES			Wheels	MOTOR										
				Material	Construction	Kind	SIZES IN INCHES			No. of Crankshaft Bearings	Bore and Stroke	N.A.C.C. Hp.	Cylinders Cast	Valves Placed	COOLING		IGNITION		
							Front	Rear							Water Circulation	Radiator Core and Case	Type	Make	Spark Advance
Mack.....AC	11,000	$4,000	156*	pr-steel	semi-fix	solid	36x6-	40x6d	wood-sq.	3	4-5x6	40.00	pairs	right	cent	ring-cast	dual	Bosch	hand
Mack.....AC	15,000	4,500	156*	pr-steel	semi-fix	solid	36x7	40x7d	wood-sq	3	4-5x6	40.00	pairs	right	cent	ring-cast	dual	Bosch	hand
Mack Tractor.....AC	14,000	3,400	119	pr-steel	semi-fix	solid	36x5	40x5d	wood-sq.	3	4-5x6	40.00	pairs	right	cent	ring-cast	dunl	Bosch	hnnd
Mack Tractor.....AC	22,000	4,000	119	pr-steel	semi-fix	solid	36x6	40x6d	wood-sq	3	4-5x6	40.00	pairs	right	cent	ring-cast	dunl	Bosch	hand
Mack Tractor.....AC	30,000	4,500	119	pr-steel	semi-fix	solid	36x7	40x7d.	wood-sq	3	4-5x6	40.00	pairs	right	cent	ring-cast	dual	Bosch	hand
Maxwell.....25	500	535	103	pr-steel	flexible	pneu	30x3½	30x3½	wood-ov.	2	4-3½x4½	21.08	block	right	thermo.	fin-sheet	dual	Simms	hand
Menominee.....EW	1,500	1,295	124	rolled-c	semi-fix	cush	36x4	37x5½	wood-ov.	3	4-3½x5	22.50	block	right	thermo.	cell-sheet	sing	Bosch	hand
Menominee.....FW	2,000	1,575	130*	rolled-c	semi-fix	solid	36x3½	36x5	wood-sq	3	4-3½x5½	22.50	block	left	cent	cell-sheet	sing	Bosch	hand
Menominee.....H	3,000	1,775	130*	rolled-c	semi-fix	solid	36x3½	36x5	wood-sq.	3	4-3½x5½	22.50	block	left	cent	cell-sheet	sing	Bosch	hand
Menominee.....D	4,000	2,240	144*	rolled-c	semi-fix	solid	36x4	36x6*	wood-sq.	3	4-4 x5½	27.20	block	left	cent	cell-sheet	sing	Bosch	hand
Menominee.....G	7,000	2,775	160*	rolled-c	semi-fix	solid	36x5	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs	left	cent	fin-cast	sing	Bosch	hand
Mercury Bulley Trac..A		3,400	71	rolled-c	rigid	solid	34x4	38x4d	wood-sq	3	4-4¼x5	29.00	pairs	opp	cent	cell-sheet	dual	Bosch	hand
Moreland.....15-D	2,000	1,650	126	pr-steel	semi-fix	solid	34x3½	34x4	wood-sq.	3	4-3¾x5	22.50	block	right	thermo.	cell-cast	sing	Dixie	hand
Moreland.....15-B	3,000	1,950	126*	pr-steel	semi-fix	solid	34x3½	34x5	wood-sq.	3	4-4 x5½	27.20	block	right	cent	cell-sheet	sing	Dixie	hand
Moreland.....15-C	5,000	2,550	144*	pr-steel	semi-fix	solid	34x4	34x4d	wood-sq.	3	4-4½x5½	32.40	pairs	right	cent	cell-sheet	sing	Dixie	hand
Moreland.....15-G	8,000	3,400	162*	pr-steel	semi-fix	solid	36x5	38x5d	wood-sq.	3	4-4¾x6½	36.15	pairs	right	cent	cell-sheet	dual	Dixie	hand
Moreland.....16-J	10,000	3,800	180*	pr-steel	semi-fix	solid	36x6	40x6d	wood-sq.	3	4-4¾x6½	36.15	pairs	rigbt	cent	cell-sheet	dual	Dixie	hand
Moon.....B	3,000	1,600	140*	pr-steel	rigid	solid	36x3½	36x4*	wood-ov.	3	4-3¼x5¼	22.50	block	head	gear	z-s-t-sheet	dual	Remy*	
Nelson & LeMoon...E1	2,000	1,700	opt			solid	36x3	36x4		3	4-3½x5½	22.50	block	left	cent	sq-t-sheet	sing	Bosch	
Nelson & LeMoon...E2	4,000	2,250	opt			solid	36x4	36x7		3	4-4 x5½	27.20	block	left	cent	sq-t-sheet	dual	Bosch	
Nelson & LeMoon...E3	6,000	2,950	opt			solid	36x5	38x5d		3	4-4½x5½	32.40	pairs	left	cent	sq-t-sheet	dual	Bosch	auto
Netco.....D	4,000	2,350	144*	pr-steel	rigid	solid	36x4	36x6	wood-sq	3	4-4¼x5½	27.20	block	left	cent	fin-t-cast	sing	Eisemann	fixed
Netco.....E	4,000	2,600	144*	pr-steel	semi-fix	solid	36x4	36x6	wood-sq.	3	6-3½x5½	33.75	threes	right	cent	fin-t-cast	dual	G & D	hand
New York.....M	3,000	2,200	144*	rolled-c	semi-fix	solid	36x3½	36x5	wood-sq.	3	4-4¼x5½	27.20	block	left	cent	sq-t-sheet	sing	Bosch	fixed
Niles.....B	2,000	1,175	124	pr-steel	flexible	pneu	35x5	35x5	wood-ov.	3	4-3½x5	19.61	block	left	thermo.	sq-t-sheet	sing	Eisemann	hand
Niles.....E	4,000	1,875	140*	pr-steel	flexible	solid	36x4	36x7	wood-ov.	3	4-4 x5½	27.20	block	left	cent	z-s-t-sheet	sing	Eisemann	hand
Old Hickory.....	1,250	825	112	rolled-c	semi-fix	pneu	33x4	33x4	wood-ov		4-3¼x5	16.92	block	right	thermo.	cell-sheet	sing	Conn	hand
Old Reliable.....	3,000	1,950	150*	pr-steel	semi-fix	solid	34x3	36x6	wood-sq.	3	4-3¾x5	22.50	block	left	cent	sq-t-sheet	sing	Bosch	hand
Old Reliable.....	4,000	2,450	150	rolled-c	semi-fix	solid	34x4	36x4d	wood-sq.	4	4-4x6	25.60	block	left	cent	sq-t-sheet	sing	Bosch	hand
Old Reliable.....	5,000	2,750		rolled-c	rigid	solid	34x4	36x4d	wood-sq.	3	4-4¼x5	29.00	pairs	opp	cent	sq-t-sheet	sing	Bosch	hnnd
Old Reliable.....	6,000	3,250	150	rolled-c	semi-fix	solid	34x5	36x5d.	wood-sq.	4	4-4¼x6	29.00	block	left	cent	sq-t-sheet	sing	Bosch	hand
Old Reliable.....	8,000	3,750		rolled-c	semi-fix	solid	36x5	40x5d	wood-sq.	3	4-4¾x5½	36.15	pairs	opp	cent	sq-t-sheet	sing	Bosch	hand
Old Reliable.....	8,000	3,750		rolled-c		solid	36x6	36x6d	wood-sq.	3	4-4¾x5½	36.15	pairs	opp	cent	sq-t-sheet	sing	Bosch	hand
Old Reliable.....	10,000	4,500	150*	rolled-c	rigid	solid	36x6	36x6d	wood-sq.	3	4-4¾x5½	36.15	pairs	opp	cent	sq-t-sheet	sing	Bosch	hand
Old Reliable.....	14,000	5,000	150	rolled-c	rigid	solid	36x6	40x7d	wood-sq.	3	4-5 1/16x5¾	41.62	pairs	opp	cent	sq-t-sheet	sing	Bosch	hand
Overland.....75-B	800	625-c	104	pr-steel		pneu	31x4	31x4	wood-ov.	2	4-3¼x5	18.21	block	right	thermo.	cell-sheet		storage	hand
Overland.....	1,200	725	106	pr-steel		pneu	33x4½	33x4½	wood-ov.	5	4-4 x4½	27.20	block	right	thermo.	cell-sheet		Dixie	hand
Packard.....1-D	2,000	2,200	126*	rolled-c		solid	34x3½	34x6	wood-sq.	3	4-4x5½	25.60	block	right	cent	cell-sheet	dual	Dixie	hand
Packard.....1½-D	3,000	2,500	126*	rolled-c		solid	34x3½	34x3½d	wood-sq.	3	4-4x5½	25.60	block	right	cent	cell-sheet	dual	Dixie	hand
Packard.....2-D	4,000	2,800	144*	rolled-c		solid	34x4	34x4d	wood-sq.	3	4-4x5½	25 60	block	right	cent	cell-sheet	dual	Dixie	hand
Packard.....3-D	6,000	3,400	156*	rolled-c		solid	36x5	36x5d	wood-sq.	3	4-4½x5½	32.40	block	right	cent	cell-sheet	dual	Dixie	hand
Packard.....4-D	8,000	3,800	156*	rolled-c		solid	36x5	40x5d	wood-sq.	3	4-4½x5½	32 40	block	right	cent	cell-sheet	dual	Dixie	hand
Packet.....	600	350	100	pr-steel	rigid	pneu	28x3	28x3	wood-ov.	2	4-2¾x4	12.08	block	right	thermo.	fin-sheet	sing	At Kent	auto
Palmer.....	2,000	1,350	132½	pr-steel	rigid	solid	34x3½	34x4	wood-sq.	3	4-3¾x5	22.50	block	right	thermo	sq-t-cast	sing	Bosch	fixed
Palmer.....	4,000	1,975	144	pr-steel	rigid	solid	36x3½	36x3½d	wood-sq.	3	4-4 x5¼	27.20	block	left	cent	sq-t-cast	sing	Bosch	fixed
Palmer-Moore.....K	1,500	1,150	106	pr-steel	rigid	solid	36x3	36x3½	wood-ov.	3	4-3¼x5¼	19.61	block	right	thermo	fin-cast	sing	Bosch	nuto
Palmer-Moore.....M	2,000	1,350	126	pr-steel	rigid	solid	36x3½	36x4	wood-sq.	3	4-3¾x5¼	22.50	block	right	thermo	fin-cast	sing	Bosch	auto
Peerless.....TC2	4,000		145			solid	36x4	36x4d		3	4-4½x6½	32.40	pairs	opp	gear	fin-sheet	dunl	Remy	hand
Peerless.....TC3	6,000		151*			solid	36x4	40x4d		3	4-4¼x6½	32 40	pairs	opp	gear	fin-sheet	dual	Remy	hand
Peerless.....TC4	8,000		151*			solid	36x5	40x5d		3	4-4¼x6½	32.40	pnirs	opp	gear	fin-sheet	dual	Remy	hand
Peerless.....TC5	10,000		151*			solid	38x6	42x6d		3	4-4¼x6½	32.40	pairs	opp	gear	fin-sheet	dual	Remy	hand
Peerless.....TC6	12,000		151*			solid	38x7	42x7d		3	4-4¼x6½	32 40	pairs	opp	gear	fin-sheet	dunl	Remy	hand
Pennay.....15	1,000	660	98	pr-steel		pneu	30x3½	31x4	wood-ov.	2	4-4¾x4½	27.20	block	right	thermo.	fin-sheet	sing	Dixie	fixed
Pierce-Arrow.....	4,000	3,000	150*	pr-steel	flexible	solid	36x4	36x4d	wood-ov.	3	4-4x5½	25 60	pairs	opp	cent	fin-cast	sing	Eisemann*	hand
Pierce-Arrow.....	10,000	4,500	168*	pr-steel	flexible	solid	36x5	40x6d	wood-ov.	3	4-4¼x6	38.25	pnirs	opp	cent	fin-cast	dual	Bosch*	hand
Pullman.....4-24	1,000		114	pr-steel	semi-fix	pneu	31x4	31x4	wood-ov.	3	4-3¾x4½	22.50	block	left	thermo.	cell-sheet	sing	Dixie	hand
Rainier.....	1,000	850	115	pr-steel	rigid	pneu	33x4	33x4	wood-sq.	2	4-3¼x4½	16.92	block	left	thermo.	fin-sheet	sing	Dixie	hand
Reo.....F	1,500	1,000	120	pr-steel	rigid	pneu	34x4½	34x4½	wood-ov.	3	4-4¼x4½	27.20	pairs	r&h	cent	fin-sheet	sing	Remy	hand
Reo.....J	4,000	1,650	146	pr-steel	rigid	solid	36x4	36x3½d	wood-sq	3	4-4¼x4½	27.20	pairs	r&h	cent	fin-cast	dual	Nntional	hand
Republic.....9	1,500	750	120	pr-steel	flexible	cush	32x3	32x3½	wood-sq.	2	4-3½x5	16.92	block	left	thermo.	sq-t-cast	sing	Bosch	fixed
Republic.....10	2,000		124	pr-steel	semi-fix	solid	34x3	34x4	wood-sq.	3	4-3½x5	19.61	block	left	thermo.	cell-cast	sing	Bosch	fixed
Republic.....11	3,000		144	pr-steel	semi-fix	solid	34x3	34x5	wood-sq.	3	4-3½x5	22.50	block	left	thermo.	cell cast	sing	Bosch	fixed
Republic.....12	4,000		144*	pr-steel	semi-fix	solid	34x4	34x6	wood-sq.	3	4-4¼x5½	27 20	block	left	cent	cell-cast	sing	Bosch	fixed
Republic.....T	6,000		165*	pr-steel	semi-fix	solid	36x5	36x5d	cast-d	3	4-4¼x5½	29 00	block	left	cent	cell-cast	sing	Bosch	hand
Riker.....	6,000	3,500	150*	pr-steel	rigid	solid	36x5	36x5d	wood-sq	5	4-4¼x6	29.00	pairs	opp	cent	fin-cast	dual	Bosch	hand
Riker.....	8,000	3,650	150*	pr-steel	rigid	solid	36x5	36x6d	wood-sq	5	4-4¼x6	29.00	pairs	opp	cent	fin-cast	dual	Bosch	hand
Royal.....	2,000		124*	rolled-c		solid	34x4	34x5	wood-sq	3	4-3¼x5	16 92	block	left	cent	cell-cast	sing	Bosch	fixed
Royal.....	5,000		132*	rolled-c		solid	36x4½	36x6	wood-sq	3	4-4x6	25.60	block	left	cent	cell-cast	sing	Bosch	fixed
Royal.....	7,000		158*	rolled-c		solid	36x5	38x5d	wood-ov.	3	4-4¼x6	29 00	block	left	cent	cell-cast	sing	Bosch	fixed

ABBREVIATIONS: General, *, *with other options;* opt, *optional;* **Price, -c, *complete with body.* **Frame, Material,** pr-steel, *pressed steel;* rolled-c, *rolled steel, channel section;* rolled-I, *rolled steel, I section;* **Frame Construction,** semi-fix, *semi flexible.* **Tires, kind,** Pneu, *pneumatic;* cush, *cushion,* p & s, *pneumatic front, solid, rear;* s & st, *solid rubber front, steel in rear.* **Tire Sizes,** -d, *dual.* **Wheels,** pr-steel, *pressed steel;* -ov, *oval spokes;* -sq, *square spokes;* -d, *disk or web type;* -hol, *hollow spokes;* -cr, *cruciform spokes;* -x, *cross-shaped solid spokes.* **Cylinders cast,** sing, *singly or individually.* **Location of valves,** opp, *opposite, T-head motor;* r & h, *one valve at right, the other in head, L-head motor;* l & h, *one valve at left the other in head, L-head motor.* **Water circulation,** cent, *centrifugal pump;* thermo-, *thermo-syphon or natural circulation;* gear, *gear pump.* **Radiator Type,** fin, *individually finned tubes;* sq-t, *square-tubular, resembling cellular, sometimes known as flat-tubular;* z-s-t, *zig-zag tubular, resembling cellular,* cell, *cellular or honeycomb type;* tube, *plain tubes without fins;* ring, *tubes arranged in ring about blower fan.* **Radiator Case,** -sheet, *sheet metal;* -cast, *cast metal, built up.* **Ignition Type,** sing, *single;* doub, *double,* dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Conn., *Connecticut;* storage, *storage battery;* Westghs, *Westinghouse;* G & D, *Gray & Davis;* At Kent, *Atwater Kent.* **Spark Advance,** auto, *automatic;* 2-pt-fix, *two-point fixed, battery circuit in retard, magneto in advance.* **Electric System Type,** s, l & i, *starting, lighting and ignition, combination unit;* s & l, *starting and lighting, combination unit;* s & l-2, *starting and lighting, two-unit;* l & i, *lighting and ignition, combination unit.* **Electric System, Make,** Splitdf, *Splitdorf;* Al-Chal,—(Abbreviations Continued on Opposite Page.)

Commercial Vehicles for 1917—Continued

MOTOR										TRANSMISSION							BRAKES		CONTROL		
ELECTRIC SYSTEM			GOVERNOR			SPEED	FUEL SYSTEM				GEARSET			Total Gear Reduction in High	Final Drive	Propulsion Taken By	Torque Taken By					Name and Model
Type	Make	Extra Cost	Type	Drive	Make	Motor in r.p.m.	Truck in m.p.h.	Carburetor Make	Fuel Feed	Tank Location	Clutch Type	Type	Location	Sp'ds				Hand	Foot	Steer	Levers	
s&l-2...	Bosch ..	250.00	cent..	motor..	own....	1,000	14½	Stmbg..	grav.	seat..	dry-p..	selec.	unit-j..	3	8.40–1*	dbl chn.	rad-rd..	.....	int-r-w.	ext-j-s..	left..	cent..	Mack.....AC
s&l-2...	Bosch ..	250.00	cent	motor.	own....	1,000	10½	Stmbg	grav.	seat..	dry-p..	selec.	unit-j..	3	11.58–1*	dbl chn.	rad-rd..	.....	int-r-w.	ext-j-s	left ..	cent..	Mack.....AC
s&l-2 .	Bosch...	250.00	cent..	motor.	own....	1,000	9	Stmbg..	grav.	seat..	dry-p .	selec.	unit-j..	3	12.42-1*	dbl chn.	rad-rd..	.....	int-r-w.	ext-j-s..	left..	cent..	Mack Tractor.....AC
s&l-2...	Bosch...	250.00	cent..	motor.	own....	1,000	10½	Stmbg..	grav.	seat..	dry-p..	selec.	unit-j..	3	11.58–1*	dbl chn.	rad-rd..	.....	int-r-w.	ext-j-s..	left..	cent..	Mack Tractor.....AC
s&l-2...	Bosch...	250.00	cent	motor..	own....	1,000	8½	Stmbg	grav.	seat..	dry-p..	selec.	unit-j..	3	14.10–1*	dbl chn.	rad-rd..	.....	int-r-w.	ext-j-s..	left..	cent..	Mack Tractor.....AC
s&l....	Huff-S..	stock...	none.	.....	.....	.....	.....	K. D ..	grav.	dash.	cone..	selec.	unit-m.	3	3.59–1	bevel...	springs.	tor-t...	int-r-w.	ext-r-w.	left..	cent..	Maxwell.....25
none....	.....	.....	cent	d-shaft	own....	900	25	Stmbg	grav.	seat..	dry-d..	selec.	unit-m.	3	.....	worm..	rad-r...	springs.	int-r-w.	int-r-w.	left..	cent..	Menominee.....EW
none....	.....	.....	cent	d-shaft	own....	850	16	Stmbg	grav.	seat..	dry-d..	selec.	unit-m.	3	.....	worm..	rad-r...	springs.	int-r-w.	int-r-w.	left..	cent..	Menominee.....FW
none....	.....	.....	cent .	d-shaft	own....	800	15	Stmbg..	grav.	seat..	dry-d..	selec.	unit-m.	3	.....	worm..	rad-r...	springs.	int-r-w.	int-r-w.	left..	cent..	Menominee.....H
none....	.....	.....	cent..	d-shaft	own....	750	14	Stmbg..	grav.	seat..	dry-d..	selec.	unit-m.	3	.....	worm..	rad-r...	springs.	int-r-w.	int-r-w.	left..	cent..	Menominee.....D
none....	.....	.....	.....	.....	own....	750	12	Stmbg..	grav.	seat..	.....	.....	amid...	3	.....	worm..	rad-rd..	springs.	int-r-w	int-r-w.	left..	cent..	Menominee.....G
lighting.	Bosch...	stock...	cent..	motor..	Pierce...	800	12	Stmbg..	grav.	seat..	dry-p..	ind-c.	unit-j..	3	14.00–1	dbl chn.	rad-rd..	.....	ext-j-s..	int-r-w.	right.	right.	Mercury-Bulley Trac..A
lighting.	Westghs.	75.00	cent..	motor..	Pierce...	1,075	18	Ensign.	grav.	seat..	dry-d..	selec.	unit-m.	3	6.00–1	worm..	springs	springs	int-r-w.	ext-r-w.	right.	cent..	Moreland.....15–D
lighting.	Westghs.	75.00	cent..	motor..	Pierce...	1,200	18	Ensign.	grav.	seat..	dry-d..	selec.	unit-m.	3	6.75–1	worm..	rad-rd..	springs	int-r-w.	int-r-w.	right.	cent..	Moreland.....15–B
lighting.	Westghs.	75.00	cent..	motor..	Pierce...	1,100	15	Ensign.	grav.	seat..	dry-d..	selec.	unit-m.	4	7.00–1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	right.	cent.	Moreland.....15–C
lighting.	Westghs.	75.00	cent..	motor..	Pierce...	890	12½	Ensign.	grav.	seat..	dry-d.	selec.	amid...	4	7.80–1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	right.	cent	Moreland.....15–G
lighting.	Westghs.	75.00	cent..	motor..	Pierce...	890	9	Ensign.	.....	.....	dry-d.	selec.	amid...	4	11.67–1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	right.	cent	Moreland.....16–J
none....	.....	.....	.....	.....	none....	1,800	18	Stmbg..	grav.	seat .	cone..	selec.	unit-j..	3	.....	dbl chn.	rad-rd..	.....	int-r-w.	int-r-w.	left..	l & c..	Moon.....B
.....	.....	.....	suct.	motor .	Mon'rch.	1,000	16	Ray...	.....	.....	dry-d..	selec.	unit-m.	3	6.75–1	worm..	.....	.....	.....	.....	right.	cent..	Nelson & LeMoon...E1
.....	.....	.....	suct..	motor.	Mon'rch.	1,000	14	Ray...	.....	.....	dry d..	selec.	unit-m.	3	8.75–1	worm..	.....	.....	.....	.....	right.	cent..	Nelson & LeMoon...E2
.....	.....	.....	suct..	motor..	Mon'rch.	1,000	12	Ray...	.....	.....	dry-d..	selec.	unit-m.	3	8.75–1	worm..	.....	.....	.....	.....	right.	cent..	Nelson & LeMoon...E3
s,l&i...	G & D...	200.00	.....	.....	none....	1,800	15	Zenith..	grav.	seat..	dry-d..	selec.	unit-m.	3	8.50–1	worm..	springs.	springs.	int-r-w.	int-r-w.	left..	cent..	Netco.....D
s,l&i...	G & D...	200.00	.....	.....	none....	.....	.....	Zenith..	grav.	seat..	dry-d..	prog.	unit-m.	3	8.50–1	worm..	springs.	springs.	int-r-w.	int-r-w.	left..	cent..	Netco.....E
.....	.....	.....	.....	cent.	motor.	Pierce..	1,400	18	Stmbg..	grav.	seat.	dry-p..	ind-c.	unit-m.	3	7.75–1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left..	cent..	New York.....M
opt.....	.....	.....	cent..	motor	Pierce ..	1,573	25	Stmbg..	grav.	seat..	dry-d..	selec	unit-m	3	6.50–1	worm..	springs.	springs.	int-r-w.	int-r-w.	left..	cent..	Nilea.....B
opt.....	.....	.....	cent..	motor..	Pierce...	1,173	15	Stmbg..	grav.	seat..	dry-p..	selec.	amid...	3	8.50–1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left..	cent..	Nilea.....E
s&l-2...	Dyneto..	stock...	.....	.....	.....	960	16	Carter..	grav.	seat..	cone..	selec.	unit-m.	3	6.00–1	bevel...	tor-t...	tor-t...	int-r-w.	ext-r-w.	left..	cent..	Old Hickory.....
lighting.	.....	stock...	.....	.....	.....	.....	.....	Stmbg..	grav.	dash	dry-d..	selec.	unit-m.	3	7.75–1	worm..	springs.	springs	int-r-w.	int-r-w.	right.	r & c.	Old Reliable.....
lighting.	.....	stock...	cent..	duplex..	Duplex..	.....	.....	Stmbg..	grav.	dash	dry-d..	selec.	unit-m.	3	7.75–1	worm..	springs.	springs	int-r-w.	int-r-w.	right.	cent..	Old Reliable.....
.....	.....	.....	.....	.....	.....	.....	.....	Stmbg..	grav.	seat..	wet-d.	selec.	unit-j..	3	.....	dbl chn.	rad-rd..	.....	int-r-w.	ext-j-s..	right.	right.	Old Reliable.....
lighting.	.....	stock..	cent..	duplex..	Duplex..	.....	.....	Stmbg..	vac..	.....	dry-d..	selec.	unit-m.	3	8.75–1	worm..	springs.	springs	int-r-w.	int-r-w.	right.	cent..	Old Reliable.....
lighting.	.....	stock...	cent..	duplex..	Duplex..	.....	.....	Stmbg..	vac..	.....	dry-d..	selec.	amid...	4	8.75–1	worm..	springs.	springs	int-r-w.	int-r-w.	right.	cent..	Old Reliable.....
lighting.	.....	stock...	.....	.....	.....	.....	.....	Stmbg..	grav.	seat..	wet-d.	selec.	amid...	3	.....	dbl chn.	rad-rd..	.....	ext....	int.....	right.	right.	Old Reliable.....
lighting.	.....	stock...	cent..	duplex..	Duplex..	.....	.....	Stmbg..	grav.	seat..	wet-d.	selec.	amid...	3	.....	dbl chn.	rad-rd..	.....	ext-r-w.	int-j-s..	right.	right.	Old Reliable.....
lighting.	.. ..	stock...	cent..	duplex..	Duplex..	.....	.....	Stmbg..	grav.	.....	wet-d.	selec.	unit-j..	4	.....	dbl chn.	rad-rd..	.....	int-r-w.	ext-j-s..	right.	right.	Old Reliable.....
s,l&i-2.	.....	stock...	.....	.....	none....	.....	.....	.....	grav.	dash	cone..	selec.	unit-x..	3	.....	bevel...	tor-t...	tor-t...	ext-r-w.	ext-r-w.	left..	cent..	Overland.....75–B
s,l&i-2.	.....	stock...	.....	.....	none....	.....	.....	.....	grav.	seat..	cone..	selec.	unit-x..	3	.....	bevel...	tor-t...	tor-t...	ext-r-w.	ext-r-w.	left..	cent..	Overland.....
s&l-2...	Bijur....	180.00	cent..	motor..	own....	1,000	16	own....	pres..	seat..	dry-d..	prog.	amid...	3	6.25–1	worm..	rad-rd..	t-arm..	int-r-w.	ext-sht.	left..	left..	Packard.....1–D
s&l-2...	Bijur....	180.00	cent..	motor	own....	1,000	16	own....	pres.	seat..	dry-d..	prog.	amid...	3	6.25–1	worm..	rad-rd..	t-arm..	int-r-w.	ext-sht.	left..	left..	Packard.....1½–D
s&l-2...	Bijur....	180.00	cent..	motor.	own....	1,000	14	own....	pres.	seat..	dry-d..	prog.	amid...	3	7.25–1	worm..	rad-rd..	t-arm..	int-r-w.	ext-sht.	left..	left..	Packard.....2–D
s&l-2...	Bijur....	180.00	hydr	motor.	own....	1,000	12	own....	pres.	seat..	dry-d..	prog	amid...	3	9.00–1	worm..	rad-rd..	t-arm..	int-r-w.	ext-sht.	left..	left..	Packard.....3–D
s&l-2. .	Bijur....	180.00	hydr	motor.	own....	1,000	12	own....	pres.	seat..	dry-d..	prog.	amid...	3	10.00–1	worm..	rad-rd..	t-arm..	int-r-w.	ext-sht.	left..	left..	Packard.....4–D
none....	.....	.....	.....	.....	none....	1,500	29	Carter..	grav.	dash.	none..	frict	unit-j..	3	4.25–1	dbl chn	rad-rd..	.....	int-r-w.	int-r-w.	left..	left..	Packet.....
none....	.....	.....	.....	.....	none....	.....	18	Stmbg..	grav.	seat..	dry-d.	selec.	unit-m.	3	.....	int-g...	springs	springs	int-r-w.	ext-r-w.	left..	cent	Palmer.....
none....	.....	.....	cent..	motor..	Pierce...	1,000	15	Stmbg.	grav.	seat..	dry-d..	selec.	unit-m.	3	7.75–1	worm..	rad-rd..	springs.	int-r-w.	int-r-w.	left..	cent..	Palmer.....
s&l*...	opt.....	.....	suct.	motor..	Mon'rch.	1,275	20	Zenith..	grav.	seat.	dry-d..	selec.	amid...	3	6.83–1	int-g...	springs	t-arm..	int-r-w.	ext-r-w.	left..	cent..	Palmer-Moore.....K
s&l*...	opt.....	.....	suct.	motor	Mon'rch.	1,150	18	Zenith..	grav.	seat.	dry-d..	selec.	amid...	3	6.83–1	int-g...	springs	t-arm..	int-r-w.	ext-r-w.	left..	cent..	Palmer-Moore.....M
.....	.....	.....	cent.	motor	.....	.....	.....	Stmbg..	.....	.....	cone..	selec.	amid...	3	6.00–1	worm..	springs.	springs.	.....	.....	right.	right.	Peerless.....TC2
.....	.....	.....	cent..	motor	.....	925	14½	Stmbg..	.....	.....	cone..	selec.	unit-j..	4	7.45–1	dbl chn.	rad-rd.	.....	.....	.....	right.	right.	Peerless.....TC3
.....	.....	.....	cent..	motor	.....	.....	.....	Stmbg..	.....	.....	cone..	selec.	unit-j..	4	8.70–1	dbl chn.	rad-rd.	.....	.....	.....	right.	right.	Peerless.....TC4
.....	.....	.....	cent..	motor.	.....	.....	.....	Stmbg..	.....	.....	cone..	selec.	unit-j..	4	10.50–1	dbl chn.	rad-rd.	.....	.....	.....	right.	right.	Peerless.....TC5
.....	.....	.....	cent..	motor.	.....	.....	.....	Stmbg..	.....	.....	cone..	selec.	unit-j..	4	10.50–1	dbl chn.	rad-rd.	.....	.....	.....	right.	right.	Peerless.....TC6
.....	Dyneto..	75.00	.....	.....	none....	2,200	42½	Zenith..	grav.	seat..	dry-d..	selec.	unit-m.	3	4.75–1	bevel...	springs	springs.	int.....	ext.....	left..	cent..	Pennay.....15
.....	.....	.....	cent..	motor	own....	1,050	16	own....	grav.	seat..	cone.	selec	amid...	3	7.00–1*	worm..	rad-rd..	t-arm..	int-r-w.	ext-sht.	right.	right.	Pierce-Arrow.....
.....	.....	.....	cent..	motor	own....	950	14	own....	grav.	seat..	cone..	selec.	amid...	3	7.80–1*	worm..	rad-rd..	t-arm..	int-r-w.	ext-sht.	right.	right.	Pierce-Arrow.....
s&l-2...	Apple...	stock...	.....	.....	none....	2,800	35	Stmbg..	grav.	dash.	wet-d.	selec.	unit-m.	3	4.25-1	bevel...	springs.	t-arm..	int-r-w.	ext-r-w.	left..	cent..	Pullman.....4–24
s&l....	Spltdrf..	85.00	.....	.....	none....	2,500	42	Carter..	grav.	seat..	dry-p..	selec.	unit-m.	3	5.80–1	worm..	springs	springs	int-r-w.	int-r-w.	left..	cent..	Rainier.....
s&l-2...	Remy...	stock...	.....	.....	none	.....	.....	Johns..	grav.	dash.	dry-d..	selec.	amid ..	3	4.30–1	sp-bev..	springs.	t-arm..	none...	2 s-r-w.	left .	cent	Reo.....F
.....	.....	.....	hydr	motor..	own....	1,250	14	Johns..	grav.	seat.	dry-d..	selec.	amid...	3	8.70–1	dbl chn.	rad-rd..	.....	ext-r-w	ext-j-s.	left..	cent	Reo.....J
lighting.	Bosch...	stock...	suct.	motor..	Ruggles	1,050	20	.....	grav.	dash	dry-d..	selec.	unit-m.	3	5.36–1	int-g...	springs	springs	ext-sht	int-r-w.	left..	cent..	Republic.....9
s&l-2...	Bosch ...	.....	suct.	motor	Ruggles	1,050	15	Stmbg.	grav.	seat..	dry-d..	selec.	unit-m	3	7.00–1	int-g...	springs	springs	int-r-w	ext-r-w.	left..	cent.	Republic.....10
s&l-2...	Bosch...	.....	suct.	motor	Ruggles	1,200	15	Stmbg.	grav.	seat..	dry-d..	selec.	unit-m.	3	8.00–1	int-g...	springs	springs	int-r-w	ext-r-w.	left..	cent..	Republic.....11
s&l-2...	Bosch ...	.....	suct.	motor	Ruggles	950	12	Stmbg	grav.	seat.	dry-d..	selec.	unit-m.	3	8.00–1	int-g...	springs	springs	int-r-w	ext-r-w.	left..	cent..	Republic.....12
s&l-2...	Bosch...	.....	suct..	motor..	Ruggles	1,025	10	Stmbg	grav.	seat..	dry-d..	selec.	unit-m.	4	11.00–1	int-g...	springs	springs	int-r-w.	ext-r-w.	left..	cent..	Republic.....T
s&l-2...	Westghs.	225.00	l-h..	motor	own....	1,180*	14½	own....	grav.	seat..	cone	selec.	amid...	4	10.00–1	worm..	rad-rd..	t-arm..	int-r-w.	ext-sht	right.	right.	Riker.....
s&l-2...	Westghs.	225.00	l-b..	motor..	own....	1,350*	14½	own....	grav.	seat.	cone.	selec.	amid...	4	10.00–1	worm.	rad-rd.	t-arm.	int-r-w.	ext-sht	right.	right.	Riker.....
starting.	.....	stock...	suct.	motor.	Mon'rch.	1,600*	25*	Master.	grav	seat..	dry-p..	ind-c.	amid ..	3	.....	worm..	springs	springs	int-r-w	int-r-w	right.	right.	Royal.....
starting.	.....	stock..	suct.	motor.	Mon'rch.	1,600	18	Master.	grav.	seat'.	dry-p..	ind-c.	amid ..	3	.....	worm..	springs	springs	int-r-w	int-r-w	right.	right.	Royal.....
starting	.....	stock.	suct..	motor	Mon'rch.	1,600	15	Master.	grav.	seat.	dry-p..	ind-c.	amid	3	.....	worm.	springs	springs	int-r-w.	int-r-w.	right.	right.	Royal.....

ABBREVIATIONS: (continued).—*Allis-Chalmers*; G & D, *Gray & Davis*; Westghs, *Westinghouse*; N-East, *Northeast*; Huff-S, *Huff-Simms*; Spl-App, *Splitdorf-Apple*. **Governor Type** cent, o't, *centrifugal*; suct, *suction or gas velocity*; l-b, *loose-ball*; hydr, *hydraulic*. **Governor Drive** motor, *from motor*; d-shft, *from driveshaft*; duplex, *from both motor and driveshaft or front wheel*; f-wheel, f-whl, *from front wheel*. **Governor Make** Wauk'a, *Waukesha*; Mon'rch, Mon, *Monarch*; Her-Sp, *Herschell-Spillman*; Milwkee, *Milwaukee*. **Carbureter Make,** Scheb, *Schebler*; Ray, *Rayfield*; Stmbg, *Stromberg*; Shkspr, *Shakespeare*; Flech, *Flechter*; Zen, *Zenith*, Johns, *Johnson*. **Fuel Feed,** grav, *gravity*; vac, *vacuum*; pres, *pressure*. **Tank Location, seat,** *under seat*; dash, *in dash*; rear, *at rear*; r-bd, *on running-board*. **Clutch Type,** dry-d, *dry multiple disk*; dry-p, *dry plate*: wet-d, *multiple-disk in oil*; wet-p, *plate-in-oil*. **Gearset Type,** selec, *selective sliding gear*; prog, *progressive sliding gear*; ind-c, *individual clutch, constant-mesh*; plan, *planetary*; fric, *friction*; elec, *electric*. **Gearset Location,** amid, *amidships*; unit-m, *unit with motor*; unit-j, *unit with jackshaft*; unit-x, *unit with axle*. **Final Drive,** int-g, *internal-gear*; worm, *top worm*; dbl chn, *double side chains*; sp-bevel, *spiral bevel*; db-red, *double-reduction, bevel and spur gears*; ext-g, *external-gear*; -f, *to front wheels*; -4, *on all four wheels*. **Propulsion Taken By,** rad-rd, *radius rods*; tor-t, *torsion-tube*; sub-f, *sub-frame*; sp'gs, *springs*. **Torque Taken By,** rad-rd, *radius rods*; tor-t, *torsion-tube*; t-arm, *torque-arm*; sub-f, *sub-frame*; sp'gs, *springs*. **Brakes, Type,** ext, ex, *external contracting*; int, *internal expanding*. **Brake Location,** -r-w, *rear wheel*: -sht, *shaft*; -f-w, *front wheel*; -j-s, *jackshaft*; -4-w, *on all four wheels*. **Control, Levers,** cent, *center*; c & r, *gearshift center, brake right*; c & l, *gearshift center, brake left*.

Technical Specifications of Gasoline

Name and Model	Capacity in Pounds	Price of Chassis	Wheelbase in Inches	FRAME		TIRES			WHEELS	MOTOR									
				Material	Construction	Kind	SIZES IN INCHES Front	SIZES IN INCHES Rear		No. of Crankshaft Bearings	Bore and Stroke	N.A.C.C. Hp.	Cylinders Cast	Valves Placed	COOLING Water Circulation	COOLING Radiator Core and Case	IGNITION Typ	IGNITION Make	IGNITION Spark Advance
Royal	10,000	.....	168*	rolled-c..	.....	solid....	36x6	40x6d	wood-ov.	3	4-4½x5½	36.15	pairs....	opp....	cent...	cell-cast...	sing..	Bosch.....	fixed....
Royal	12,000	.....	158*	rolled-c..	.....	solid....	36x6	40x6d	wood-ov.	3	4-5½*x6*	42.20*	pairs....	opp....	cent...	cell-cast...	sing..	Bosch.....	fixed....
Royal	14,000	.....	158*	rolled-c..	.....	solid....	36x7	40x7d	wood-ov.	3	4-5½x7	44.20	pairs....	opp....	cent...	cell-cast...	sing..	Bosch.....	fixed....
Rush.....D	1,000	$ 695	105	pr-steel..	flexible..	pneu....	31x4	31x4	wood-ov.	2	4-3½x5	16.92	block...	right...	thermo.	fin-cast....	sing..	Conn.....	hand....
Sanford.....O	2,000	1,290	120	pr-steel..	flexible..	pneu*...	34x4½*	35x5*	wood-sq.	3	4-3½x5½	19.61	block...	right...	thermo.	fin-cast....	sing..	Dixie.....	fixed....
Sanford.....R	3,000	1,370	138	pr-steel..	semi-flx..	solid*...	36x3½*	36x4*	wood-sq.	3	4-3½x5½	19.61	block...	right...	thermo.	fin-cast....	sing..	Dixie.....	fixed....
Sanford.....S	4,000	2,100	150*	rolled-c..	flexible..	solid....	36x4	36x7	wood-sq.	3	4-4½x5½	29.00	block...	right...	cent...	fin-cast....	sing..	Dixie.....	fixed....
Sauer.....L	10,000	4,800	153½	pr-steel..	semi-flx..	solid....	36x5	42x5d	wood-sq.	3	4-4½x5½	34.28	pairs....	opp....	cent...	cell-sheet..	sing..	Bosch.....	hand....
Sauer.....M	13,000	5,800	156½	pr-steel..	semi-flx..	solid....	36x5	42x6d	wood-sq.	3	4-4½x5½	34.28	pairs....	opp....	cent...	cell-sheet..	sing..	Bosch.....	hand....
Schleicher	6,000	3,500	150*	rolled-c..	rigid....	solid....	34x4½	34x3½d	wood-ov.	3	4-4½x5½	29.00	pairs....	right...	cent...	sq-t-sheet..	dual-d	Bosch.....	hand....
Schleicher	10,000	4,500	150*	rolled-c..	rigid....	solid....	34x5	34x4d	wood-ov.	3	4-5x6	40.00	pairs....	right...	cent...	sq-t-sheet..	dual-d	Bosch.....	hand....
Selden.....G	1,500	985	110	pr-steel..	semi-flx..	pneu....	32x3½	33x4	wood-sq.	2	4-3½x4½	15.64	block...	right...	thermo.	sq-t-sheet..	sing..	Dixie.....	fixed....
Selden.....TL	2,000	1,700	126½	pr-steel..	semi-flx..	solid....	34x3	34x4	wood-sq.	3	4-3½x5	19.61	block...	right...	thermo.	sq-t-sheet..	sing..	Bosch.....	fixed....
Selden.....JC	4,000	2,000	150	pr-steel..	semi-flx..	solid....	36x4	36x6	wood-sq.	3	4-3½x5½	22.50	block...	left....	cent...	sq-t-sheet..	sing..	Bosch.....	fixed....
Selden.....JWW	4,000	2,250	150	pr-steel..	semi-flx..	solid....	36x4	36x6	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	sq-t-sheet..	sing..	Bosch.....	fixed....
Selden.....N	7,000	2,950	164	pr-steel..	semi-flx..	solid....	36x5	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	sq-t-sheet..	sing..	Eisemann..	hand....
Service.....120	2,000	1,375	135	pr-steel..	flexible..	solid*...	34x3*	34x4*	wood-sq	3	4-3½x5½	19 61	block...	right...	thermo.	fin-cast....	sing..	Bosch.....	hand....
Service.....130	3,000	1,950	150	pr-steel..	.....	solid....	36x3½	35x5	wood-sq	3	4-4'x5½	27.20	block...	right...	cent...	fin-cast....	sing..	Eisemann..	hand....
Service.....140	4,000	2,250	160*	pr-steel..	rigid....	solid....	36x4	36x7	wood-sq.	3	4-4½x5½	27.20	block...	right...	cent...	fin-cast....	sing..	Eisemann..	hand....
Service.....170	7,000	3,000	170*	pr-steel..	rigid....	solid....	36x5	36x5d	wood-sq.	3	4-4½x5½	29.00	block...	right...	cent...	fin-cast....	sing..	Eisemann..	hand....
Service.....175	7,000	3,250	170*	pr-steel..	rigid....	solid....	36x5	36x5d	wood-sq.	3	4-4½x6	32.40	block...	right...	cent...	fin-cast....	sing..	Eisemann..	hand....
Service.....200	10,000	4,000	170*	pr-steel..	rigid....	solid....	36x6	40x6d	wood-sq.	3	4-4½x6	32.40	block...	right...	cent...	fin-cast....	sing..	Eisemann..	hand....
Signal.....F	2,000	1,550	144*	pr-steel..	semi-flx..	solid....	34x3	36x4	wood-sq.	3	4-3½x5½	22.50	block...	left....	cent...	fin-cast....	sing..	Eisemann..	fixed....
Signal.....H	3,000	1,800	144*	pr-steel..	semi-flx..	solid....	34x3½	36x5	wood-sq.	3	4-4'x5½	27.20	block...	left....	cent...	fin-cast....	sing..	Eisemann..	fixed....
Signal.....J	4,000	2,100	150*	pr-steel..	semi-flx..	solid....	34x4	36x4d	wood-sq.	3	4-4'x5½	27.20	block...	left....	cent...	fin-cast....	sing..	Eisemann..	fixed....
Signal.....M	7,000	3,000	168	pr-steel..	semi-flx..	solid....	36x5	40x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	fin-cast....	sing..	Eisemann..	fixed....
Signal.....R	10,000	4,000	180	pr-steel..	semi-flx..	solid....	36x6	40x6d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	fin-cast....	sing..	Eisemann..	fixed....
Standard.....70	4,000	2,000	140	.....	.....	solid....	36x4	36x6	.....	3	4-4½x5½	27.20	block...	left....	cent...	fin-sheet...	sing..	Eisemann..	auto....
Standard.....60	7,000	2,850	144*	.....	.....	solid....	36x5	36x5d	.....	3	4-4½x5½	32.40	pairs....	left....	cent...	fin-sheet...	sing..	Eisemann..	auto....
Standard.....40	8,000	3,025	144*	.....	.....	solid....	36x5	36x5d	.....	3	4-4½x5½	32.40.	pairs....	left....	cent...	fin-sheet...	sing..	Eisemann..	auto....
Standard.....50	10,000	3,400	144*	.....	.....	solid....	36x5	40x6d	.....	3	4-4½x5½	29.00	pairs....	left....	cent...	fin-sheet...	sing..	Eisemann..	auto....
Steele.....C	4,000	2,250	115*	rolled-c..	semi-flx..	solid....	38x5	40x4d	cast-cr..	3	4-4½x5½	27.20	block...	right...	cent...	cell-sheet..	sing..	At Kent...	auto....
Steele.....B	6,000	3,000	127*	rolled-c..	semi-flx	solid....	38x6	40x5d	cast-cr..	3	4-5x5	40.00	pairs....	head....	cent...	cell-sheet..	sing..	At Kent...	auto....
Steele.....BA	8,000	3,500	127*	rolled-c..	semi-flx..	solid....	38x6	40x5d	cast-cr.	3	4-5x5	40.00	pairs....	head....	cent...	cell-sheet..	sing..	At Kent...	auto....
Steele.....A	10,000	4,000	127*	rolled-c..	semi-flx..	solid....	38x7	40x6d	cast-cr..	3	4-5x5	40.00	pairs....	head....	cent...	cell-sheet..	sing..	At Kent...	auto....
Sterling	5,000	2,800	156*	pr-steel..	rigid....	solid....	36x4	36x4d*	wood-sq	3	4-4½x5½	29.00	pairs....	right...	cent...	fin-cast....	sing..	Eisemann..	auto....
Sterling	7,000	3,400	158*	pr-steel..	rigid....	solid....	36x5	36x5d	wood-sq	3	4-4½x5½	29.00	pairs....	right...	cent...	fin-cast....	sing..	Eisemann..	auto....
Sterling	10,000	4,500	168	pr-steel..	.....	solid....	36x5	40x6d	wood-sq.	3	4-4½x6½	36.15	pairs....	right...	cent...	fin-cast....	dual..	Eisemann..	auto....
Sterling	14,000	4,750	168	pr-steel..	.....	solid....	36x6	40x7d	wood-sq.	3	4-4½x6½	36.15	pairs....	opp....	cent...	fin-cast....	dual..	Eisemann..	auto....
Stewart.....5	1,000	695	106	pr-steel..	semi-flx..	pneu....	32x4	32x4	wood-ov.	2	4-3x4½	14.40	block...	l & h...	thermo.	fin-sheet...	sing..	Dixie.....	fixed....
Stewart.....3	1,500	1,290	118	pr-steel..	semi-flx.	pneu....	34x4½	34x4½	wood-ov.	3	4-3½x5½	19.61	block...	right...	thermo.	fin-sheet...	sing..	Dixie.....	fixed....
Stewart.....4	2,500	1,390	128	pr-steel..	semi-flx..	solid....	35x3	35x4	wood-sq.	3	4-3½x5½	19.61	block...	right...	thermo.	fin-sheet...	sing..	Dixie.....	fixed....
Studebaker.....SF	1,000	785	112	pr-steel..	rigid....	pneu....	34x4	34x4	wood-ov	3	4-3½x5	24.22	block...	left....	cent...	fin-sheet...	sing..	Remy.....	hand....
Studebaker.....7	2,000	1,100	125	pr-steel..	rigid....	pneu....	35x5	35x5	wood-ov.	3	4-3½x5	24.22	block...	left....	cent...	fin-sheet...	sing..	Remy.....	hand....
Sullivan.....G	3,000	1,650	129	rolled-c..	semi-flx	solid....	36x3	36x4	wood-sq.	2	4-3½x4½	22.50	block...	right...	thermo.	fin-sheet...	sing..	Bosch.....	fixed....
Sullivan.....E	4,000	2,250	150	pr-steel..	semi-flx	solid....	36x4	36x6	wood-sq.	3	4-4½x5½	27.20	block...	right...	cent...	fin-sheet...	sing..	Bosch.....	fixed....
Superior.....A	2,000	1,350	124*	pr-steel..	.....	solid....	34x3½	34x4	wood-sq.	3	4-3½x5	19.61	block...	head....	thermo.	sq-t-sheet..	sing..	Eisemann..	fixed....
Superior.....C	4,000	1,800	144	pr-steel..	.....	solid....	36x4	36x6	wood-sq.	3	4-3½x5	22.50	block...	head....	gear....	sq-t-sheet..	sing..	Eisemann..	fixed ....
Thomas.....40	5,000	2,700	150*	pr-steel..	semi-flx..	solid....	34x4	34x4d	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	cell-sheet..	sing..	Bosch.....	fixed....
Tiffin.....A	1,500	1,190	110	pr-steel..	flexible..	pneu*...	35x4½*	35x4½*	wood-ov.	2	4-3½x5	19.61	block...	right...	thermo.	fin-sheet...	sing..	Bosch.....	hand....
Tiffin.....AW	2,000	1,450	112	pr-steel..	flexible..	solid....	34x3	34x4	wood-sq	2	4-3½x5	19.61	block...	right...	thermo.	fin-sheet...	sing..	Bosch.....	hand....
Tiffin.....GW	3,000	1,790	135	pr-steel..	flexible..	solid....	36x3½	36x5	wood-sq	3	4-3½x5½	22.50	block...	left....	cent...	fin-sheet...	sing..	Bosch.....	hand....
Tiffin.....MC	5,000	2,360	140	pr-steel..	semi-flx..	solid....	36x4	36x3½d	wood-sq	3	4-4½x5½	27.20	block...	left....	cent...	fin-sheet...	sing..	Bosch.....	hand....
Tiffin.....MW	5,000	2,500	140	pr-steel..	semi-flx..	solid....	36x4	36x3½d	wood-sq	3	4-4½x5½	27.20	block...	left....	cent...	fin-sheet...	sing..	Bosch.....	hand....
Tiffin.....RW	10,000	4,250	168	rolled-I..	semi-flx..	solid....	36x5	40x5d	wood-sq	3	6-3½x5½	33.75	threes...	right...	cent...	fin-sheet...	sing..	Bosch.....	hand....
Tiffin.....SW	12,000	4,550	168	rolled-I..	semi-flx..	solid....	36x6	40x6d	wood-sq	3	6-3½x5½	33.75	threes...	right...	cent...	fin-sheet...	sing..	Bosch.....	hand....
Transport Tractor.....T	10,000	2,500	80	rolled-c..	rigid....	solid....	34x3½	34x4d	wood-ov.	3	4-3½x5½	19.61	block...	right...	thermo.	cell-sheet..	sing..	Bosch.....	fixed....
Union.....B	5,000	1,875	150	pr-steel..	flexible..	solid....	30x4	39x6	wood-sq.	4	4-4x6	25.60	block...	left....	cent...	fin-cast....	sing..	Eisemann.	hand....
United.....BSW	4,000	2,250	144*	rolled-c..	rigid....	solid....	36x4	36x4d	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	cell-cast...	sing..	Eisemann.	hand....
United.....CSW	7,000	2,900	144*	rolled-c..	rigid....	solid....	36x5	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	cell-cast...	sing..	Eisemann..	hand....
United.....DSW	8,000	3,300	144*	rolled-c..	rigid....	solid....	36x5	36x6d	wood-sq.	3	4-4½x5½	36.15	pairs....	opp....	cent...	cell-cast...	sing..	Eisemann..	hand....
United.....ESW	10,000	3,900	144*	rolled-c..	rigid....	solid....	36x6	40x6d	cast-cr..	3	4-5 7/16x5½	41.62	pairs....	opp....	cent...	fin-cast....	sing..	Eisemann..	hand....
U. S.....E	4,000	2,200	132*	rolled-c..	semi-flx..	solid....	34x3½	36x3½d	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	sq-t-sheet..	dual..	Bosch.....	hand....
U. S.....H	4,000	2,500	144*	rolled-c..	semi-flx..	solid....	34x4	36x4d	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	sq-t-sheet..	dual..	Bosch.....	hand....
U. S.....D	6,000	2,700	144*	rolled-c..	semi-flx..	solid....	34x5	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	sq-t-sheet..	dual..	Bosch.....	hand....
U. S.....J	7,000	3,150	156*	rolled-c..	semi-flx..	solid....	36x5	40x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	sq-t-sheet..	dual..	Bosch.....	hand....
U. S.....K	10,000	4,000	168*	rolled-c..	semi-flx..	solid....	36x6	40x6d	wood-sq.	3	4-4½x6½	36.15	pairs....	left....	cent...	sq-t-sheet..	dual..	Bosch.....	hand....
Universal.....G	3,000	1,950	133*	rolled-c..	rigid....	solid....	34x3½	34x5	wood-ov.	2	4-3½x5½	22.50	block...	right...	thermo.	fin-cast....	dual..	Eisemann..	.....
Universal.....D	4,000	2,800	132*	rolled-c..	rigid....	solid....	36x4	36x4d	wood-ov.	3	4-4x5½	25.60	pairs....	opp....	cent...	cell-sheet..	dual..	Eisemann.	.....
Universal.....A	6,000	3,400	132*	rolled-I..	rigid....	solid....	36x5	36x5d	wood-ov.	3	4-4x5½	25.60	pairs....	opp....	cent...	cell-sheet..	dual..	Eisemann.	hand....
Velie.....25	4,000	2,250	150*	pr-steel..	flexible..	solid....	36x4	36x3½d	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	fin-cast....	sing..	Bosch.....	hand....
Velie.....26	7,000	3,350	172*	pr-steel..	flexible..	solid....	36x5	40x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	fin-cast....	sing..	Bosch.....	hand....

ABBREVIATIONS: General, *, *with other options;* opt, *optional;* **Price, -o, *complete with body.* **Frame, Material,** pr-steel, *pressed steel;* rolled-c, *rolled steel, channel section;* rolled-I, *rolled steel, I section;* **Frame Construction,** semi-flx, *semi flexible.* **Tires, kind,** Pneu, *pneumatic;* cush, *cushion,* p & s, *pneumatic front, solid, rear;* s & st, *solid rubber front, steel in rear.* **Tire Sizes,** -d, *dual.* **Wheels,** pr-steel, *pressed steel;* -ov, *oval spokes;* -sq, *square spokes;* -d, *disk or web type;* -hol, *hollow spokes;* -cr, *cruciform spokes;* -x, *cross-shaped solid spokes.* **Cylinders cast,** sing, *singly or individually.* **Location of valves,** opp, *opposite, T-head motor;* r & h, *one valve at right, the other in head, L-head motor;* l & h, *one valve at left the other in head, L-head motor.* **Water circulation,** cent, *centrifugal pump;* thermo-, *thermo-syphon or natural circulation;* gear, *gear pump.* **Radiator Type,** fin, *individually finned tubes;* sq-t, *square-tubular, resembling cellular, sometimes known as flat-tubular;* s-z-t, *zig-zag tubular, resembling cellular,* cell, *cellular or honeycomb type;* tube, *plain tubes without fins;* ring, *tubes arranged in ring about blower fan.* **Radiator Case,** -sheet, *sheet metal;* -cast, *cast metal, built up.* **Ignition Type,** sing, *single;* doub, *double,* dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Conn., *Connecticut;* storage, *storage battery;* Westghs, *Westinghouse;* G & D, *Gray & Davis;* At Kent, *Atwater Kent.* **Spark Advance,** auto, *automatic;* 2-pt-fix, *two-point fixed, battery circuit in retard, magneto in advance.* **Electric System Type,** a, l & i, *starting, lighting and ignition, combination unit;* s & l, *starting and lighting, combination unit;* s & l-2, *starting and lighting, two-unit;* l & i, *lighting and ignition, combination unit.* **Electric System, Make,** Splitdf, *Splitdorf;* Al-Chal,—**(Abbreviations Continued on Opposite Page.)**

Commercial Vehicles for 1917—Continued

MOTOR										TRANSMISSION							BRAKES		CONTROL		
ELECTRIC SYSTEM			GOVERNOR			SPEED		FUEL SYSTEM			GEARSET			Total Gear Reduction in High	Final Drive	Propulsion Taken By	Torque Taken By					Name and Model
Type	Make	Extra Cost	Type	Drive	Make	Motor in r. p. m.	Truck in m. p. h.	Carburetor Make	Fuel Feed	Tank Location	Clutch Type	Type	Location	Sp'ds				Hand	Foot	Steer	Levers	
starting	.....	stock.	suct.	motor	Mon'rch.	900*	10*	Master	grav.	seat	wet-d.	ind-c.	amid	3	.....	worm	springs	springs	int-r-w.	int-r-w.	right.	right.	Royal
.....	.....	.....	suct.	motor.	Mon'rch.	900*	10*	Master.	grav.	seat	wet-d.	ind-c.	amid.	3	.....	worm*	sp'gs*	sp'gs*	int-r-w.	int-r-w.	right.	right.	Royal
.....	.....	.....	suct.	motor	Mon'rch.	900*	10*	Master	grav.	seat	wet-d.	ind-c.	amid	3	.....	dbl chn.	rad-rd.	.....	int-r-w.	int-r-w.	right.	right.	Royal
s & l-2	Spltdorf	stock	.....	.....	.....	1,600	29	Carter	grav.	seat	dry-d.	selec.	unit-m.	3	4.42-1	bevel	springs	springs	int-r-w.	ext-r-w.	left	cent	Rush D
.....	.....	.....	.....	.....	.....	1,100	16	Scheb.	grav.	seat	dry-d.	selec.	unit-m.	3	7.00-1	int-g	springs	springs	int-r-w.	int-r-w.	left	cent	Sanford O
.....	.....	.....	cent.	motor	Pierce	1,150	14	.....	grav.	seat	dry-d.	selec.	unit-m.	3	8.99-1	dbl chn.	rad-rd.	.....	int-r-w.	ext-r-w.	left	cent.	Sanford R
.....	.....	.....	.....	.....	.....	1,175	14	Scheb.	grav.	.....	dry-d.	selec.	unit-m.	3	9.00-1	int-g	springs	springs	int-r-w.	ext-r-w.	left	cent.	Sanford S
none	.....	.....	cent.	motor	own	1,000	8*	own	pres.	rear	cone	selec.	unit-j	4	15.85-1*	dbl chn.	rad-rd.	.....	int-r-w.	ext-sht.	right.	right.	Saurer L
none	.....	.....	cent.	motor	own	1,000	9½*	own	pres.	rear	cone	selec.	unit-j	4	14.80-1*	dbl chn.	rad-rd.	.....	int-r-w.	.....	right.	right.	Saurer M
none	.....	.....	.....	.....	opt	1,200	25	Stmbg.	grav	seat	.....	.....	.....	.....	.....	dbl chn.	rad-rd.	.....	ext-r-w.	ext-sht	right.	right.	Schleicher
none	.....	.....	.....	.....	.....	1,200	20	Stmbg.	grav.	seat	cone	selec.	amid	4	5.00-1	dbl chn.	rad-rd.	.....	ext-r-w.	ext-sht.	right.	right.	Schleicher
s & l	N-East.	80 00	cent.	motor	Milwkee.	1,200	20	Scheb.	grav.	seat	dry-d.	selec.	unit-m.	3	6.20-1	worm	springs	springs	int-r-w.	int-r-w.	right.	cent.	Selden G
s & l-2*	N-East.	175 00	cent.	motor	Pierce	1,135	17	Stmbg.	grav.	seat	dry-d.	selec.	unit-m.	3	6.75-1	worm	springs	springs	int-r-w.	int-r-w.	right.	cent.	Selden TL
s & l-2*	N-East.	150 00	cent.	motor	Pierce	1,295	14½	Stmbg.	grav.	seat	dry-d.	selec.	unit-m.	3	9.45-1	int-g	springs	springs	int-r-w.	ext-r-w.	left*	cent	Selden JC
s & l*	N-East.	.....	cent.	motor	Pierce	1,295	15	Stmbg.	grav.	seat	dry-d.	selec.	unit-m.	3	9.25-1	worm	springs	springs	int-r-w.	ext-r-w.	left*	cent	Selden JWW
s & l-2*	N-East.	175.00	cent.	motor	Pierce	1,250	13	Stmbg.	grav.	seat	dry-d.	selec.	unit-m.	4	10.33-1	worm	rad-rd.	springs	int-r-w.	int-r-w.	right.	cent.	Selden N
s & l-2*	Westghs.	160.00*	cent.	d-shaft	Pierce	1,200	18	Stmbg.	vac.	seat	dry-d.	selec.	unit-m.	3	7.00-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	Service 120
s & l-2*	Westghs.	200.00*	cent.	d-shaft	Pierce	1,090	14	Stmbg.	vac.	.....	dry-p.	selec.	unit-m.	3	7.75-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	Service 130
s & l-2*	Westghs.	200.00*	cent.	d-shaft	Pierce	1,090	14	Stmbg.	vac.	.....	dry-p.	selec.	unit-m.	3	7.75-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	Service 140
s & l-2*	Westghs	200.00*	cent	d-shaft	Pierce	1,090	12	Stmbg.	vac.	seat	dry-p.	selec.	unit-m.	4	8.75-1	worm	rad-rd.	springs	int-r-w.	int-r-w.	left	cent.	Service 170
s & l-2*	Westghs.	200.00*	cent.	d-shaft	Pierce	1,000	14	Stmbg.	vac.	seat	dry-p.	selec.	unit-m.	4	8.75-1	worm	rad-rd.	springs	int-r-w.	int-r-w.	left	cent.	Service 175
s & l-2*	Westghs.	200.00*	cent.	d-shaft	Pierce	1,000	10	Stmbg.	vac.	seat	dry-p.	selec.	unit-m.	4	8.75-1	worm	rad-rd.	springs	int-r-w.	int-r-w.	left	cent	Service 200
.....	.....	.....	suct.	motor	Mon'rch.	1,100	15	Stmbg.	grav.	seat	dry-d.	selec.	unit-m.	3	7.75-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	Signal F
.....	.....	.....	suct.	motor	Mon'rch.	1,200	15	Stmbg.	grav.	seat	dry-d.	selec.	unit-m.	3	8.50-1	worm	rad-rd.	springs	int-r-w.	int-r-w.	left	cent.	Signal H
.....	.....	.....	suct.	motor	Mon'rch.	1,300	15	Stmbg.	grav.	seat	dry-d.	selec.	unit-m.	3	9.25-1	worm	rad-rd.	springs	int-r-w.	int-r-w.	left	cent.	Signal J
.....	.....	.....	suct.	motor	Mon'rch.	1,300	15	Stmbg.	grav.	seat	dry-d.	selec.	unit-m.	3	10.33-1	worm	rad-rd.	springs	int-r-w.	int-r-w.	left	cent.	Signal M
.....	.....	.....	suct.	motor	Mon'rch.	1,700	15	Stmbg.	grav.	seat	dry-d.	selec.	amid	4	13.66-1	worm	rad-rd.	springs	int-r-w.	int-r-w.	left	cent.	Signal R
.....	.....	.....	suct.	motor	Mon'rch.	1,100	15	Scheb.	.....	.....	cone	selec.	amid	3	7.75-1	worm	rad-rd.	.....	.....	.....	left	cent.	Standard 70
.....	.....	.....	suct.	motor	Mon'rch.	1,050	12	Stmbg.	.....	.....	dry-d.	selec.	unit-m	3	10.33-1	worm	rad-rd.	.....	.....	.....	left	cent.	Standard 60
.....	.....	.....	suct.	motor	Mon'rch.	1,050	12	Stmbg.	.....	.....	dry-d.	selec.	unit-m	3	9.50-1	dbl chn.	rad-rd.	.....	.....	.....	left	cent	Standard 40
.....	.....	.....	suct.	motor	Mon'rch.	1,050	9	Stmbg.	.....	.....	dry-d.	selec.	unit-m	3	13.00-1	worm	rad-rd.	.....	.....	.....	left	cent	Standard 50
lighting	Carlton	stock	cent.	motor	own	1,150	14½	Stmbg.	.....	seat	wet-d.	ind-c	unit-j	3	9.52-1	dbl chn	rad-rd.	.....	int.	ext.	right.	right.	Steele C
lighting	Carlton.	stock	cent.	motor	own	950	11	Stmbg.	grav.	seat	wet-d.	ind-c	unit-j	3	9.21-1	dbl chn	rad-rd.	.....	int.	ext	right.	right.	Steele B
lighting	Carlton..	stock.	cent.	motor	own	950	11	Stmbg	grav	seat	wet-d.	ind-c	unit-j	3	9.21-1	dbl chn	rad-rd.	.....	int-r-w.	ext-j-s.	right.	right.	Steele BA
lighting	Carlton	stock	cent	motor	own	950	9	Stmbg.	grav.	seat	wet-d.	ind-c	unit-j	3	9.58-1	dbl chn	rad-rd.	.....	int-r-w.	ext-j-s.	right.	right	Steele A
lighting	.....	35 00	cent.	motor	Wauk's.	1,040	14½	Holley	grav.	seat	dry-d.	selec.	unit-m.	3	7.70-1	worm	springs	springs	int-r-w.	int.	left	cent	Sterling
lighting	.....	35 00	cent.	motor	Wauk'a.	1,040	13	.....	grav	.....	dry-d.	selec.	unit-m	3	8.75-1	worm	springs	springs	int-r-w.	int-r-w	left	cent	Sterling
lighting	.....	35.00	cent.	motor	Wauk'a.	950	12½	Holley	grav	.....	dry-d.	selec.	amid	4	8.75-1	worm	springs	.....	int.	int.	left	cent.	Sterling
lighting	.....	35.00	cent.	motor	Wauk'a.	950	10	.....	grav.	.....	dry-d.	selec.	amid	4	11.67-1	dbl chn.	rad-rd.	.....	ext-sht.	int-r-w.	left	cent.	Sterling
none	.....	.....	.....	.....	none	2,200	35	Zenith	grav.	seat	dry-p.	selec.	unit-m.	3	6.00-1	int-g	springs	springs	ext-r-w.	ext-r-w.	left	cent	Stewart 5
s & l-2	Westghs.	125 00	.....	.....	none	2,100	35	Zenith	grav.	seat	dry-p.	selec	unit-m	3	6.00-1	int-g	springs	springs	int-r-w.	ext-r-w.	left	cent.	Stawart 3
s & l-2	Westghs	125.00	.....	.....	none	2,100	30	Zenith	grav.	seat	dry-p.	selec.	unit-m	3	7.00-1	int-g	springs	springs	int-r-w.	ext-r-w.	left	cent.	Stewart 4
s & l-2	Wagner	stock	cent.	f-wheel	Pierce	925	20	Scheb.	vac.	rear	cone	selec	unit-x	3	4.60-1	bevel	rad-rd.	t-arm	int-r-w.	ext-r-w.	left	cent.	Studebaker SP
s & l-2	Wagner	stock	cent.	f-wheel	Pierce	975	20	Scheb.	vac.	rear	cone	selec.	unit-x	3	5.00-1	bevel	rad-rd.	t-arm	int-r-w.	ext-r-w.	left	cent	Studebaker 7
.....	.....	.....	.....	.....	.....	.....	.....	Holley	grav.	seat	cone	selec	unit-j	3	8.50-1	dbl chn.	rad-rd.	.....	int-r-w.	ext	left	cent.	Sullivan G
.....	.....	.....	.....	.....	.....	.....	.....	Holley	vac.	seat	dry-d.	selec.	unit-m.	3	9.25-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	Sullivan E
none	.....	.....	suct.	motor	Mon'rch.	1,300	15	Stmbg.	vac.	seat	dry-d.	selec.	unit-m.	3	7.00-1	int-g	springs	springs	int-r-w.	ext-r-w.	left	cent.	Superior A
none	.....	.....	suct.	motor	Mon'rch.	1,275	15	Stmbg.	vac.	seat	dry-d.	selec.	unit-m	3	9.00-1	int-g	rad-rd.	springs	int-r-w.	ext-r-w.	left	cent	Superior C
lighting	Bosch	stock	cent.	duplex	Duplex	1,100	14	Bergen	grav.	seat	dry-d.	selec.	unit-m.	3	8.50-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	Thomas 40
none	.....	.....	.....	.....	none	1,000	15	Scheb.	grav.	seat	cone	selec	unit-m	3	6.80-1	int-g	springs	springs	int-r-w.	ext-r-w.	left	cent.	Tiffin A
.....	.....	.....	cent.	motor	Pierce	1,000	15	Scheb.	grav.	seat	dry-d.	selec.	unit-m.	3	6.50-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	Tiffin AW
.....	.....	.....	cent.	motor	Pierce	1,000	13½	Scheb.	grav.	seat	dry-d.	selec.	unit-m.	3	8.60-1	worm	springs	springs	int-r-w.	ext-r-w.	left	cent.	Tiffin GW
.....	.....	.....	cent.	motor	Pierce	1,000	12	Scheb.	grav.	seat	cone	selec.	amid	3	8.80-1	dbl chn.	rad-rd.	.....	int-r-w.	ext-r-w.	left	cent.	Tiffin MC
.....	.....	.....	cent.	motor	Pierce	1,000	12	Scheb.	grav	seat	cone	selec	amid	3	7.75-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	Tiffin MW
s & l-2	Bosch	stock	cent.	motor	Pierce	1,000	10½	Scheb.	grav.	seat	dry-p.	selec	amid	3	11.70-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	Tiffin RW
s & l-2	Bosch	stock	cent.	motor	Pierce	1,000	10½	Scheb.	grav	seat	dry-p.	selec.	amid	3	11.70-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	Tiffin SW
.....	.....	.....	.....	.....	.....	.....	12	Zenith	grav.	.....	dry-d.	selec.	unit-m.	4	.....	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	Transport Tractor T
none	.....	.....	.....	.....	none	.....	.....	Scheb.	grav	dash	wet-d.	selec.	unit-m.	3	7.75-1	int-g	springs	springs	int-r-w.	ext-r-w.	right.	cent	Union B
s & l	opt	.....	suct.	motor	Mon'rch.	1,125	14	Stmbg.	grav.	seat	dry-d.	selec.	unit-m.	3	8.66-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	United BSW
s & l	opt	.....	suct.	motor	Mon'rch.	980	12	Stmbg.	grav.	seat	dry-d.	selec.	unit-m.	3	8.75-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	United CSW
s & l	opt	.....	suct.	motor	Mon'rch.	980	12	Stmbg.	grav.	seat	dry-d.	selec.	unit-m.	3	8.75-1	worm	springs	springs	int-r-w.	int-r-w.	.....	cent.	United DSW
s & l-2*	opt	200.00*	cent.	d-shaft	Pierce	987	10	Stmbg*	grav.	seat	dry-d.	selec.	amid	4	11.75-1	worm	springs	springs	int-r-w.	int-r-w.	right.	right.	United ESW
.....	.....	.....	cent.	motor	Pierce	1,170	15	Stmbg.	grav.	seat	cone	ind-c.	amid	3	8.16-1	dbl chn.	rad-rd.	.....	int-r-w.	ext-r-w.	left	cent.	U. S. E
.....	.....	.....	cent.	motor	Pierce	1,190	15	Stmbg.	grav.	seat	cone	ind-c.	amid	3	8.66-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	U. S. H
.....	.....	.....	cent.	motor	Pierce	1,092	14	Stmbg.	grav.	seat	cone	ind-c.	amid	3	8.01-1	dbl chn.	rad-rd.	.....	int-r-w.	ext-r-w.	left	cent.	U. S. D
.....	.....	.....	cent.	motor	Pierce	1,092	13	Stmbg.	grav.	seat	cone	ind-c.	amid	3	11.70-1	worm	springs	springs	int-r-w.	int-r-w.	left	cent.	U. S. J
.....	.....	.....	cent.	motor	Wauk'a.	900	12½	Stmbg.	grav.	seat	cone	ind-c.	amid	3	8.75-1	worm	springs	springs	int-r-w.	int-r-w.	right.	cent.	U. S. K
lighting	.....	stock	l-h.	motor	own	1,160	15	Zenith	grav.	seat	dry-p.	selec	unit-m	3	7.25-1	worm	rad-rd.	.....	int.	int.	left	cent.	Universal G
lighting	.....	stock	l-h	motor	own	1,057	12	Heath	grav.	seat	dry-d.	selec.	amid	3	9.16-1	dbl chn.	rad-rd.	.....	ext.	int.	right.	right.	Universal D
lighting	.....	stock	l-h.	motor	own	1,057	12	Heath	grav.	seat	dry-d.	selec.	amid	3	10.29-1	dbl chn.	rad-rd.	.....	ext-sht.	int-r-w.	right.	right.	Universal A
starting	Remy	120.00	cent.	motor	Pierce	1,008	18	Stmbg.	vac.	seat	dry-p.	selec.	amid	4	6.00-1	worm	springs	springs	int-r-w.	int-r-w.	right.	right.	Velie 25
none	.....	.....	cent.	motor	Pierce	1,215	14	Stmbg.	vac.	seat	dry-p.	selec.	amid	4	10.30-1	worm	rad-rd.	springs	int.	int.	right.	right.	Velie 26

ABBREVIATIONS: (continued).—*Allis-Chalmers*; G & D, *Gray & Davis*; Westghs, *Westinghouse*; N-East, *Northeast*; Huff-S, *Huff-Simms*; Spl-App, *Splitdorf-Apple*. **Governor Type** cent, c't, *centrifugal*; suct, *suction or gas velocity*; l-b, *loose-ball*; hydr, *hydraulic*. **Governor Drive** motor, *from motor*; d-shft, *from driveshaft*; duplex, *from both motor and driveshaft or front wheel*; f-wheel, f-whl, *from front wheel*. **Governor Make** Wauk'a, *Waukesha*; Mon'rch, Mon, *Monarch*; Her-Sp, *Herschell-Spillman*; Milwkee, *Milwaukee*. **Carburator Make**, Scheb, *Schebler*; Ray, *Rayfield*; Stmbg, *Stromberg*; Shkspr, *Shakespeare*; Flech, *Flechter*; Zen, *Zenith*, Johns, *Johnson*. **Fuel Feed**, grav, *gravity*; vac, *vacuum*; pres, *pressure*.* **Tank Location**, seat, *under seat*; dash, *in dash*; rear, *at rear*; r-bd, *on running-board*. **Clutch Type**, dry-d, *dry multiple disk*; dry-p, *dry plate*: wet-d, *multiple-disk in oil*; wet-p, *plate-in-oil*. **Gearset Type**, selec, *selective sliding gear*; prog, *progressive sliding gear*; ind-c, *individual clutch, constant-mesh*; plan, *planetary*; frio, *friction*; elec, *electric*. **Gearset Location**, amid, *amidships*; unit-m, *unit with motor*; unit-j, *unit with jackshaft*; unit-x, *unit with axle*. **Final Drive**, int-g, *internal-gear*; worm, *top worm*; dbl chn, *double side chains*; sp-bevel, *spiral bevel*; db-red, *double-reduction, bevel and spur gears*; ext-g, *external-gear*; -f, *to front wheels*; -4, *on all four wheels*. **Propulsion Taken By**, rad-rd, *radius rods*; tor-t, *torsion-tube*; sub-f, *sub-frame*; sp'gs, *springs*. **Torque Taken By**, rad-rd, *radius rods*; tor-t, *torsion-tube*; t-arm, *torque-arm*; sub-f, *sub-frame*; sp'gs, *springs*. **Brakes, Type**, ext, ex, *external contracting*; int, *internal expanding*. **Brake Location**, -r-w, *rear wheel*: -sht, *shaft*; -f-w, *front wheel*; -j-s, *jackshaft*; -4-w, *on all four wheels*. **Control, Levers**, cent, *center*; c & r, *gearshift center, brake right*; c & l, *gearshift center, brake left*.

Technical Specifications of Gasoline

Name and Model	Capacity in Pounds	Price of Chassis	Wheelbase in Inches	FRAME Material	FRAME Construction	TIRES Kind	TIRES SIZES IN INCHES Front	TIRES SIZES IN INCHES Rear	Wheels	MOTOR No. of Crankshaft Bearings	MOTOR Bore and Stroke	MOTOR N.A.C.C. Hp.	MOTOR Cylinders Cast	MOTOR Valves Placed	MOTOR COOLING Water Circulation	MOTOR COOLING Radiator Core and Case	MOTOR IGNITION Type	MOTOR IGNITION Make	MOTOR IGNITION Spark Advance
Walter.....C	7,000	$4,200	132*	pr-steel..	flexible..	solid....	40x6	40x6	cast-d...	3	4-4½x6	30.65	block...	left....	cent...	fin-cast....	sing...	Eisemann*.	auto....
Walter.....B	15,000	4,750	162*	pr-steel..	flexible..	solid....	36x6	40x6	cast-hol..	3	4-4½x6	30.65	block...	left....	cent...	fin-t-cast..	sing...	Eisemann*.	fixed....
Watson.....Tractor	10,000	3,600	80	rolled-c.	flexible..	solid....	34x4	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	cell-sheet..	dual..	Bosch.....	hand....
White.....GBBE	1,500	2,100	133½	pr-steel..	.....	pneu....	34x4½	34x4½	wood-ov.	2	4-3½x5½	22.50	block...	right...	cent...	cell-sheet..	sing...	Bosch*....	hand....
White.....TBC	3,000	3,000	145½	pr-steel..	.....	pneu....	36x4½	36x4½d	wood-ov.	2	4-3½x5½	22.50	block...	right...	cent...	cell-sheet..	sing...	Bosch*....	hand....
White.....TAD	6,000	3,700	163	rolled-I..	rigid....	solid....	36x5	40x5d	cast-x...	2	4-3½x5½	22.50	block...	right...	cent...	cell-sheet..	sing...	Bosch*....	hand....
White.....TCD	10,000	4,500	169	rolled-I..	.....	solid....	36x5	40x6d.	cast-x...	3	4-4½x6½	29.00	block...	right...	cent...	cell-sheet..	sing...	Bosch*....	hand....
Wichita.....A	2,000	1,350	110*	pr-steel..	semi-flx..	solid....	34x3	34x4	wood-sq.	2	4-3½x5	16.92	block...	left....	thermo.	cell-cast...	sing...	Bosch.....	hand....
Wichita.....K	2,000	1,650	118*	pr-steel..	semi-flx..	solid....	36x3	36x4	wood-sq.	2	4-3½x5	19.61	block...	left....	thermo.	cell-cast...	sing...	Bosch.....	hand....
Wichita.....L	3,000	1,800	118*	pr-steel..	semi-flx..	solid....	36x3	36x5	wood-sq.	2	4-3½x5	19.61	block...	left....	thermo.	cell-cast...	sing...	Bosch.....	hand....
Wichita.....B	4,000	2,100	118*	pr-steel..	semi-flx.	solid....	34x3½	34x6	wood-sq.	2	4-3½x5	19.61	block...	left....	thermo.	cell-cast...	sing...	Bosch.....	hand....
Wichita.....R	5,000	2,350	144*	pr-steel..	semi-flx..	solid....	36x4	36x7	wood-sq.	3	4-3½x5½	22.50	block...	right...	cent...	cell-cast...	sing...	Bosch.....	hand....
Wichita.....O	7,000	3,250	165*	pr-steel..	semi-flx..	solid....	36x5	36x5d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	cell-cast...	sing...	Bosch.....	hand....
Wichita.....Q	10,000	3,850	165*	pr-steel..	semi-flx..	solid....	38x6	38x6d	wood-sq.	3	4-4½x5½	32.40	pairs....	left....	cent...	cell-cast...	sing...	Bosch.....	hand....
Wilcox.....S	2,000	1,600	128	pr-steel..	rigid....	pneu*...	35x5*	35x5*	wood-ov.	3	4-3½x5	22.50	block...	right...	thermo.	cell-sheet .	sing...	Bosch.....	hand....
Wilcox.....R	3,000	1,800	134	pr-steel..	rigid....	solid....	36x4	36x5	wood-ov.	3	4-4½x5	29.00	pairs....	right...	cent...	cell-sheet..	sing...	Bosch.....	hand....
Wilcox.....Q	4,000	2,000	150*	pr-steel..	rigid....	solid....	36x4	36x3½d	wood-ov.	3	4-4½x5	29.00	pairs....	right...	cent...	cell-cast...	sing...	Bosch.....	hand....
Wilcox.....P	7,000	2,900	154*	pr-steel..	rigid....	solid....	36x5	36x5d	wood-ov.	3	4-4½x5	29.00	pairs....	right...	cent...	cell-cast...	sing...	Bosch.....	hand....
Wilson.....E	4,000	2,350	144	rolled-c..	semi-flx..	solid....	36x4	36x4d	wood-ov.	3	4-4½x5½	27.20	block...	left....	cent...	fin-cast....	sing...	Eisemann..	fixed....
Witt Will.....WD16	2,000	2,000	120	pr-steel..	flexible..	solid*...	36x3*	36x4*	wood-sq.	3	4-3½x5½	22.50	block...	left....	cent...	sq-t-sheet..	sing...	Eisemann..	auto....
Witt Will.....WD16	4,000	2,500	144	pr-steel..	flexible..	solid....	36x3½	36x7	wood-sq.	3	4-4½x5½	27.20	block...	left....	cent...	sq-t-sheet..	sing...	Eisemann..	auto....
Wisconsin.....B	2,500	1,650	136	pr-steel..	semi-flx..	solid....	34x3½	34x4	wood-ov.	3	4-3½x4	19.61	block...	right...	cent...	cell-sheet.	sing...	Eisemann..	hand....
Wisconsin.....C	5,000	2,500	156*	pr-steel..	semi-flx..	solid....	36x4	36x6*	wood-ov.	3	4-4x5½	25.60	pairs....	right...	cent...	cell-sheet..	sing...	Eisemann..	hand....
W. S.....4	5,000	2,975	154	rolled-c..	flexible..	solid....	36x6	36x6	wood-sq.	3	4-4½x5½	32.40	pairs....	.....	cent...	fin-cast....	dual..	Nat'l.....	hand....
Zeitler & Lamson.....	3,000	1,850	150*	pr-steel..	semi-flx..	solid....	36x3½	36x5	wood-sq.	3	4-4x5	25.60	block...	left....	cent...	cell-cast...	doub..	Bosch*....	hand....
Zeitler & Lamson.....	5,000	2,450	160*	pr-steel..	semi-flx..	solid....	36x4	36x7	wood-sq.	4	4-4x6	25 60	block...	left....	cent...	cell-cast...	doub..	Bosch*....	hand....
Zeitler & Lamson.....	7,000	3,150	170*	rolled-c..	semi-flx..	solid....	36x5	40x5d	cast-d...	3	4-4½x5½	36.15	pairs....	opp....	cent...	cell-cast...	doub..	Bosch*....	hand....
Zeitler & Lamson.....	10,000	4,150	180*	rolled-c..	semi-flx..	solid....	36x6	40x6d	cast-d...	3	4-5⅛x5½	41.62	pairs....	opp....	cent...	cell-cast...	doub..	Bosch*....	hand....

Received Too Late to Classify

Clyde.....C	3,000	1,000	134	pr-steel..	.....	solid*...	34x3½*	34x2½d*	wood-sq.	3	4-3½x4½	22.50	block...	left....	thermo.	fin-cast....	sing..	Eisemann.	fixed...
Dayton.....H	4,000	2,650	.....	rolled-c..	.....	solid....	36x4	36x3½d	wood-ov.	3	4-4½x5	29.00	pairs....	opp....	gear...	sq-t-cast...	dual..	Bosch.....	hand....
Dayton.....	7,000	3,400	.....	rolled-c..	.....	solid....	36x5	36x4d	wood-ov.	4	4-4½x6	29.00	block...	left....	cent...	fin-cast....	dual..	Bosch.....	hand....
Dayton.....K	7,000	3,400	.....	rolled-c..	.....	solid....	36x5	36x4d	wood-ov.	3	4-4½x5½	36.15	pairs....	opp....	gear...	sq-t-cast...	dual..	Bosch.....	hand....
Dayton.....M	10,000	4,500	.....	rolled-c..	.....	solid....	36x6	42x5d	wood-ov.	3	4-5½x7	44.20	pairs....	opp....	cent...	sq-t-cast...	dual..	Bosch.....	hand....
Dayton.....E	15,000	4,950	.....	rolled-c..	.....	solid....	36x7	42x6d	wood-ov.	3	4-5½x7	44.20	pairs....	opp....	cent...	sq-t-cast...	dual..	Bosch.....	hand....
Denmo.....19	2,500	1,385	124	pr-steel..	rigid....	p & s*...	34x4½*	34x4	wood-sq.	3	4-3½x5	22.50	block...	.....	thermo.	cell-sheet..	sing...	Dixie.....	.....
Diamond-T.....J5	2,000	1,485	132	pr-steel..	.....	solid....	36x3	36x4	wood-ov.	.....	4-3½x5	19.61	block...	right...	thermo.	z-s-t-sheet.	sing...	Bosch.....	fixed....
Diamond-T.....J4	3,000	2,050	154*	pr-steel..	.....	solid....	36x3½	36x5	wood-ov.	.....	4-3½x5	22.50	block...	right...	cent...	z-z-t-sheet.	sing...	Bosch.....	fixed....
Diamond-T.....J3	4,000	2,200	154*	pr-steel..	.....	solid....	36x4	36x6	wood-ov.	3	4-4½x5½	27.20	block...	right...	cent...	z-z-t-sheet.	sing...	Bosch.....	fixed....
Diamond-T.....L	7,000	3,300	170*	pr-steel..	.....	solid....	36x5	38x5d	wood-ov.	.....	4-4½x5½	32.40	pairs....	opp	cent...	z-z-t-sheet.	sing...	Bosch.....	hand....
Diamond-T.....R	10,000	4,200	170*	pr-steel..	.....	solid....	36x6	40x6d	wood-sq.	3	4-4½x5½	32.40	pairs....	opp....	cent...	z-z-t-sheet.	sing...	Bosch.....	hand....
Duplex.....D	6,000	.....	130*	pr-steel..	flexible..	solid....	36x6	36x6	wood-sq*	3	4-4½x5	32.40	block...	right...	cent...	fin-sheet...	sing...	Eisemann*	hand....
Geneva.....1	1,500	.....	96	.....	.....	solid....	34x2	36x2½	.....	2	2-5½x4½	22.10	sing.....	head...	gear...	fin-sheet...	sing...	Simms....	fixed....
Stegeman.....	3,000	1,900	150	pr-steel..	flexible..	solid....	34x3½	36x5	wood-sq.	.....	6-3½x4½	25.39	hlock...	left....	cent...	sq-t-sheet.	sing...	Westghs...	auto....
Stegeman.....	5,000	2,500	144*	pr-steel..	flexible..	solid....	34x4	36x4d	wood-sq.	.....	6-3½x5½	29.45	block...	left....	cent...	fin-cast	sing...	Westghs...	auto....
Stegeman.....	7,000	3,000	156	pr-steel..	flexible..	solid....	36x4	40x5d	wood-sq.	.....	6-3½x5½	33.75	pairs....	left....	cent...	fin-cast....	sing...	Westghs...	auto....
Stegeman.....	10,000	4,000	170	pr-steel..	flexible..	solid....	36x5	40x6d	wood-sq.	.....	6-3½x5½	33.75	pairs....	left....	cent...	fin-cast....	sing...	Westghs...	auto....
Vim.....20	1,000	635	102	pr-steel..	.....	pneu....	31x4	31x4	.....	3	4-3x4½	14.40	block...	right...	thermo.	fin-sheet...	sing...	Dixie.....	hand....

Steam Vehicles

Name and Model	Capacity in Pounds	Price of Chassis	Wheelbase in Inches	FRAME Material	FRAME Construction	TIRES Kind	TIRES SIZES IN INCHES Front	TIRES SIZES IN INCHES Rear	Wheels	BOILER Location	BOILER Type	BOILER Heating Surface in Sq. In.	BOILER Horsepower	BOILER BURNER Type	BOILER BURNER Regulation	BOILER PRESSURE Normal in Lbs.	BOILER PRESSURE Maximum in Lbs.	WATER Water Capacity in Gal.	WATER CONDENSER Type	WATER CONDENSER Circulation
Stanley.....	1,500	1,550	134	pr-steel..	semi-flx..	pneu....	34x4½	34x4½	wood-ov.	under hood	fire-tube.	14,976	20	Bunsen.	pressure.	575	625	24	cell-sheet	natural
Stanley.....	2,500	2,000	136	pr-steel..	semi-flx..	pneu....	36x5	36x5	wood-ov.	under hood	fire-tube.	22,752	30	Bunsen.	pressure.	575	625	50	cell-sheet	natural

ABBREVIATIONS: General, *, *with other options;* opt, *optional;* **Price, -c, *complete with body.* **Frame, Material,** pr-steel, *pressed steel;* rolled-c, *rolled steel, channel section;* rolled-I, *rolled steel, I section;* **Frame Construction,** semi-flx, *semi flexible.* **Tires, kind,** Pneu, *pneumatic;* cush, *cushion,* p & s, *pneumatic front, solid, rear;* s & st, *solid rubber front, steel in rear.* **Tire Sizes,** -d, *dual.* **Wheels,** pr-steel, *pressed steel;* -ov, *oval spokes;* -sq, *square spokes;* -d, *disk or web type;* -hol, *hollow spokes;* -cr, *cruciform spokes;* -x, *cross-shaped solid spokes.* **Cylinders cast,** sing, *singly or individually.* **Location of valves,** opp, *opposite, T-head motor;* r & h, *one valve at right, the other in head, L-head motor;* l & h, *one valve at left the other in head, L-head motor.* **Water circulation,** cent, *centrifugal pump;* thermo-, *thermo-syphon or natural circulation;* gear, *gear pump.* **Radiator Type,** fin, *individually finned tubes;* sq-t, *square-tubular, resembling cellular, sometimes known as flat-tubular;* z-s-t, *zig-zag tubular, resembling cellular,* cell, *cellular or honeycomb type;* tube, *plain tubes without fins;* ring, *tubes arranged in ring about blower fan.* **Radiator Case,** -sheet, *sheet metal;* -cast, *cast metal, built up.* **Ignition Type,** sing, *single;* doub, *double,* dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Conn., *Connecticut;* storage, *storage battery;* Westghs, *Westinghouse;* G & D, *Gray & Davis;* At Kent, *Atwater Kent.* **Spark Advance,** auto, *automatic;* 2-pt-fix, *two-point fixed, battery circuit in retard, magneto in advance.* **Electric System Type,** s, l & i, *starting, lighting and ignition, combination unit;* s & l, *starting and lighting, combination unit;* s & l-2, *starting and lighting, two-unit;* l & i, *lighting and ignition, combination unit.* **Electric System, Make,** Splitdf, *Splitdorf;* Al-Chal,—**(Abbreviations Continued on Opposite Page.)**

Commercial Vehicles for 1917—Continued

MOTOR										TRANSMISSION								BRAKES		CONTROL		
ELECTRIC SYSTEM			GOVERNOR			SPEED		FUEL SYSTEM			GEARSET											
Type	Make	Extra Cost	Type	Drive	Make	Motor in r. p. m.	Truck in m. p. h.	Carburetor Make	Fuel Feed	Tank Location	Clutch Type	Type	Location	Sp'ds	Total Gear Reduction in High	Final Drive	Propulsion Taken By	Torque Taken By	Hand	Foot	Steer	Levers	Name and Model
none			cent	motor	own	1,050	15	H & N	grav	seat	cone	selec	unit-m	4	8.50–1	ext-g	springs	springs	ext-sht	ext-r-w	left	cent	Walter C
none			cent	motor	own	1,000	15	H & N	grav	seat	cone	selec	unit-m	4	7.85–1	ext-g	springs	springs	ext-sht	int-r-w	left	cent	Walter B
			cent	motor	Pierce	1,100	11	Zenith	grav	seat	dry-d	selec	unit-m	4	10.30–1	worm	rad-rd	springs	int-r-w	int-r-w	right	cent	Watson, Tractor
s & l		extra			none			own	grav	seat	wet-p	selec	amid	4		bevel	rad-rd	springs	int-r-w	ext-r-w	left	c & l	White GBBE
s & l		extra			none			own	grav	seat	wet-p	selec	amid	4		db-red	rad-rd	springs	int-r-w	ext-r-w	left	c & l	White TBC
					none			own	grav	seat	wet-p	selec	amid	4		dbl chn	rnd-rd		int-r-w	ext-j-s	left	c & l	White TAD
					none			own	grav	seat	wet-p	selec	amid	4		dbl chn	rad-rd		int-r-w	ext-j-s	left	c & l	White TCD
s & l-2	Westghs	125.00			none			Stmbg	grav	seat	cone	selec	unit-j	3	7.32–1	dbl chn	rad-rd		int-r-w	int-sht	right	cent	Wichita A
s & l-2	Westghs	125.00			none			Stmbg	grav	seat	cone	selec	amid	3	7.80–1	worm	springs	springs	int-r-w	int-r-w	right	cent	Wichita K
s & l-2	Westghs	125.00			none			Stmbg	grav	seat	cone	selec	amid	3	8.66–1	worm-r	springs	springs	ext-r-w	int-r-w	right	cent	Wichita L
s & l-2	Westghs	125.00			none			Stmbg	grav	seat	cone	selec	unit-j	3	8.24–1	dbl chn	rad-rd		int-r-w	int-sht	right	cent	Wichita B
s & l-2	Westghs	125.00	cent	motor	Wauk'n	1,060	13	Stmbg	grav	seat	cone	selec	amid	3	8.75–1	worm	springs	springs	int-r-w	int-r-w	right	cent	Wichita R
s & l-2	Westghs	150.00	cent	motor	Wauk'a	1,200	11	Stmbg	grav	seat	cone	selec	amid	3	11.75–1	worm	springs	springs	int-r-w	int-r-w	right	cent	Wichita O
s & l-2	Westghs	150.00	cent	motor	Wauk'a	940	9	Stmbg	grav	seat	cone	selec	amid	3	11.75–1	worm	springs	springs	int-r-w	int-r-w	right	cent	Wichita Q
lighting		stock	cent	motor	Pierce	1,200	18	Ray*	grav	seat	dry-d	selec	unit-m	3	6.50–1	worm	springs	springs	int-r-w	int-r-w	left	cent	Wilcox S
lighting		stock	cent	motor	Pierce	1,100	16	Ray*	grav	seat	cone	selec	amid	3	7.70–1	worm	springs	springs	int-r-w	int-r-w	left	cent	Wilcox R
lighting		stock	cent	motor	Pierce	1,100	14	Ray*	grav	seat	cone	selec	amid	3	8.60–1	worm	springs	springs	int-r-w	int-r-w	left	cent	Wilcox Q
lighting		stock	cent	motor	Pierce	1,100	10	Ray*	grav	seat	cone	selec	amid	3	11.70–1	worm	springs	springs	int-r-w	int-r-w	left	cent	Wilcox P
			cent	motor	Pierce	1,050	15	Marvel	grav	seat	cone	selec	amid	3	8.60–1	worm	springs	springs	int-r-w	int-r-w	left	cent	Wilson E
			cent	motor	Pierce			Zenith	grav	seat	dry-d	selec	unit-m	3		worm	springs	springs	int-r-w	int-r-w	left	cent	Witt Will WD16
			cent	motor	Pierce			Zenith	grav	seat	dry-d	selec	unit-m	3		worm	springs	springs	int-r-w	int-r-w	left	cent	Witt Will WD16
			cent	motor	Wauk'a	1,200	15	Master	grav	seat	dry-d	selec	unit-m	3	7.75–1	worm	springs	springs	int-r-w	int-r-w	left	cent	Wisconsin B
			cent	motor	Wauk'n	1,100	14	Master	grav	seat	dry-d	selec	unit-m	3	8.75–1	worm	springs	springs	int	int	left	cent	Wisconsin C
								Zenith	grav	seat	wet-d		unit-m	3		worm-4	springs	springs	int	int	left	cent	W. S. 4
l & i*	Vesta	stock	cent	duplex	Duplex	1,200	16	Stmbg	vac	seat	dry-p	ind-c	unit-m	3	7.75–1	worm	springs	springs	int-r-w	ext-r-w	left	cent	Zoitler & Lamson
l & i*	Vesta	stock	cent	duplex	Duplex	1,200	14	Stmbg	vac	seat	dry-p	ind-c	unit-m	3	8.75–1	worm	springs	springs	int-r-w	int-r-w	left	cent	Zeitler & Lamson
l & i*	Vesta	stock	cent	duplex	Duplex	1,200	12	Stmbg	vac	seat	dry-p	ind-c	amid	3	11.75–1	worm	springs	springs	int-r-w	int-r-w	left	cent	Zeitler & Lamson
l & i*	Vesta	stock	cent	duplex	Duplex	1,200	10	Stmbg	vac	seat	dry-p	ind-c	amid	3	11.75–1	worm	springs	springs	int-r-w	int-r-w	left	cent	Zeitler & Lamson

Received Too Late to Classify

									grav	dash	wet-p	selec	unit-m	3		int-gear	springs	springs	int-r-w	ext-r-w	left	cent	Clyde C
								Stmbg	grav	seat	wet-d	selec	unit-j	3		dbl chn	rad-rd		int-r-w	ext-j-s	left	cent	Dayton H
								Stmbg	grav		dry-p	selec	amid	3		worm	rad-rd	t-arm	int-r-w	int-r-w	left	cent	Dayton
								Stmbg	grav	seat	wet-d	selec	unit-j	3		dbl chn	rad-rd		int-r-w	ext-j-s	left	cent	Dayton K
								Stmbg	grav		wet-d	selec	unit-j	3		dbl chn	rad-rd		int-r-w	ext-j-s	left	cent	Dayton M
								Stmbg	grav		wet-d	selec	unit-j	3		dbl chn	rad-rd		int-r-w	ext-j-s	left	cent	Dayton E
s & l-2	Spl-App	stock	cent	d-shaft	Pierce		20	Stewart	grav	seat	dry-p	selec	unit-m	3		int-g	springs	springs	ext-r-w	int-r-w	left	cent	Denmo 10
						1,300	18	Ray	grav	seat	dry-d	selec	unit-m	3	7.75–1	worm	springs	springs	int-r-w	int-r-w	left	cent	Diamond-T J5
						1,250	16	Ray	grav	seat	dry-d	selec	unit-m	3	7.75–1	worm	springs	springs	int-r-w	int-r-w	left	cent	Diamond-T J4
			cent	motor	Pierce	1,100	15	Ray	grav	seat	dry-d	selec	unit-m	3	7.75–1	worm	springs	springs	int-r-w	int-r-w	right	cent	Diamond-T J3
			suct	motor	Mon'rch	775	12	Ray	grav	seat	dry-d	selec	unit-m	4	6.88–1	worm	rad-rd	springs	int-r-w	int-r-w	right	cent	Diamond-T L
			suct	motor	Mon'rch			Ray	grav		dry-d	selec	amid	4	13.66–1	worm	rad-rd	springs	int	int	right	cent	Diamond-T R
s, l & i		150.00	cent	duplex	Duplex	940	12	Schch	vac		dry-d	selec	unit-m	6	12.00–1	int-g-4	rad-rd	t-arm	ext-sht	ext-sht	left	cent	Duplex D
							18	Schch			dry-p	plan	unit-j	2		dbl chn	rad-rd				right	right	Geneva 1
s & l-2	Westghs	stock	cent	motor	Pierce	1,100	18	Stmbg	grav	seat	dry-d	selec	unit-m	3	7.75–1	worm	springs	springs	int-shft	int-r-w	left	c & l	Stegeman
s & l-2	Westghs	stock	cent	motor	Pierce	1,100	15	Stmbg	grav	seat	dry-d	selec	unit-m	3	9.25–1	worm	springs	springs	int-shft	int-r-w	left	c & l	Stegeman
s & l-2	Westghs	stock	cent	motor	Pierce	1,100	12	Stmbg	grav	seat	dry-d	selec	unit-m	3	10.33–1	worm	springs	springs	int-shft	int-r-w	left	c & l	Stegeman
s & l-2	Westghs	stock	cent	motor	Pierce	1,100	10	Stmbg	grav	seat	dry-d	selec	unit-m	3	11.00–1	worm	springs	springs	int-shft	int-r-w	left	c & l	Stegeman
							25	Zenith			conc	selec	unit-m	3	4.50–1	bevel	springs	springs			left		Vim 20

Steam Vehicles

SYSTEM		ENGINE							TRANSMISSION					CONTROL					Name and Model
Feed Pump Type	Feed Control	Location	No. of Cylinders	Cylinders Cast	Valve Location	Valve Action	Valve Stroke	Reverses By	Final Drive	Gear Ratio	Axle Type	Propulsion Taken By	Torque Taken By	Throttle	Hook-up	Reverse	Steering Wheel Location	Brake Lever Location	
plunger	by-pass	unit-x	2	block	btw cyls	Stephenson	adj	links	spur-g	2 1/2–1	non-fl	rad-rd	t-arm	lever	pedal	pedal	left	left	Stanley
plunger	by-pass	unit-x	2	block	btw cyls	Stephenson	adj	links	spur-g	2–1	non-fl	rad-rd	t-arm	lever	pedal	pedal	left	left	Stanley

ABBREVIATIONS: (continued).—*Allis-Chalmers*; G & D, *Gray & Davis*; Westghs, *Westinghouse*; N-East, *Northeast*; Huff-S, *Huff-Simms*; Spl-App, *Splitdorf-Apple*. **Governor Type** cent, c't, *centrifugal*; suct, *suction or gas velocity*; l-h, *loose-ball*; hydr, *hydraulic*. **Governor Drive** motor, *from motor*; d-shft, *from driveshaft*; duplex, *from both motor and driveshaft or front wheel*; f-wheel, f-whl, *from front wheel*. **Governor Make** Wauk'a, *Waukesha*; Mon'rch, Mon, *Monarch*; Her-Sp, *Herschell-Spillman*; Milwkee, *Milwaukee*. **Carburetor Make**, Schch, *Schebler*; Ray, *Rayfield*; Stmbg, *Stromberg*; Shkspr, *Shakespeare*; Flech, *Flechler*; Zen, *Zenith*, Johns, *Johnson*. **Fuel Feed**, grav, *gravity*; vac, *vacuum*; pres, *pressure*. **Tank Location**, seat, *under seat*; dash, *in dash*; rear, *at rear*; r-bd, *on running-board*. **Clutch Type**, dry-d, *dry multiple disk*; dry-p, *dry plate:* wet-d, *multiple-disk in oil*; wet-p, *plate-in-oil*. **Gearset Type**, selec, *selective sliding gear*; prog, *progressive sliding gear*; ind-c, *individual clutch, constant-mesh*; plan, *planetary*; fric, *friction*; elec, *electric*. **Gearset Location**, amid, *amidships*; unit-m, *unit with motor*; unit-j, *unit with jackshaft*; unit-x, *unit with axle*. **Final Drive**, int-g, *internal-gear*; worm, *top worm*; dbl chn, *double side chains*; sp-bevel, *spiral bevel*; db-red, *double-reduction, bevel and spur gears*; ext-g, *external-gear*; -f, *to front wheels*; -4, *on all four wheels*. **Propulsion Taken By**, rad-rd, *radius rods*; tor-t, *torsion-tube*; sub-f, *sub-frame*; spg's, *springs*. **Torque Taken By**, rad-rd, *radius rods*; tor-t, *torsion-tube*; t-arm, *torque-arm*; sub-f, *sub-frame*; sp'gs, *springs*. **Brakes**, Type, ext, ex, *external contracting*; int, *internal expanding*. **Brake Location**, -r-w, *rear wheel*: -sht, *shaft*; -f-w, *front wheel*; -j-s, *jackshaft*; -4-w, *on all four wheels*. **Control, Levers**, cent, *center*; c & r, *gearshift center, brake right*; c & l, *gearshift center, brake left*.

Technical Specifications of 37 Electric The American Market

Name and Model	Load Capacity in Pounds	PRICE OF CHASSIS		Wheelbase in Inches	TIRES			BATTERY							MILES PER CHARGE		MOTOR	
		With Battery	Without Battery		Kind	SIZES IN INCHES Front	SIZES IN INCHES Rear	Location	Make and Type	No. Plates	No. Cells	No. Trays	Amp.-Hr. Capacity		Light	Loaded	Location and Number	Make
Atlantic.....1-C	2,000	.....	.....	103	solid....	34x3½	36x4	amid-u.....	optional.....	.....	.....	.....	.....		.....	.....	amid-1...	G.E.....
Atlantic.....2-C	4,000	.....	.....	115½	solid....	34x4	36x3d	amid-u.....	optional.....	.....	.....	.....	.....		.....	.....	amid-1...	G.E.....
Atlantic.....3-C	7,000	.....	.....	135	solid....	36x5	40x4d	amid-u.....	optional.....	.....	.....	.....	.....		.....	.....	amid-1...	G.E.....
Atlantic.....5-C	10,000	.....	.....	144	solid....	36x6	40x5d	amid-u.....	optional.....	.....	.....	.....	.....		.....	.....	amid-1...	G.E.....
C.T.....	1,000	1,925*	1,500	90	solid....	36x3	36x3	amid-u.....	Philadelphia*.....	13*	42*	.....	153*		.....	60*†	unit-x-2..	G.E.....
C.T.....	2,000	2,330*	1,800	100	solid....	36x3½	36x4	amid-u.....	Philadelphia*.....	17*	42*	5*	204*		.....	60*†	unit-x-2..	G.E.....
C.T.....	4,000	2,850*	2,200	116	solid....	36x5	36x3½d	amid-u.....	Philadelphia*.....	21*	42*	6*	225*		.....	60*†	unit-x-2..	G.E.....
C.T.....	7,000	3,910*	3,100	115	solid....	36x3½d	36x4d	amid-u.....	Philadelphia*.....	27*	42*	6*	331*		.....	50*†	unit-x-4..	G.E.....
C.T.....	10,000	4,425*	3,500	132	solid....	36x4d	36x5d	amid-u.....	Philadelphia*.....	31*	42*	9*	382*		.....	50*†	unit-x-4..	G.E.....
Couple-Gear.....H	7,000	4,200	3,500	96*	solid....	36x4d	36x4d	amid-u.....	U.S.L.*.....	23*	44*	6*	280*		40*	30*	in wheel-4	C-G.....
Couple-Gear.....AF	10,000	3,900	3,100	100*	s & st...	36x5d	64x5½	amid-u.....	U.S.L.*.....	27*	44*	6*	330*		35*	25*	in wheel-2	C-G.....
Couple-Gear.....A	10,000	4,650	3,900	96*	solid....	36x5d	36x5d	amid-u.....	U.S.L.*.....	27*	44*	6*	330*		40*	30*	in wheel-4	C-G.....
Couple-Gear.....SD	14,000	5,250	4,400	96*	solid....	36x6d	36x6d	amid-u.....	U.S.L.*.....	33*	44*	6*	400*		40*	30*	in wheel-4	C-G.....
G.V.....	1,000	.....	.....	89	solid....	36x2½	36x2½	amid-u.....	Exide-Ir*.....	9*	44*	4*	133*		.....	45*†	in rear-1..	G.E.....
G.V.....	2,000	.....	.....	104	solid....	36x3½	36x3½	amid-u.....	Exide-Ir*.....	11*	44*	5*	169*		.....	45*†	in rear-1..	G.E.....
G.V.....	4,000	.....	.....	112½*	solid....	36x4	36x3d	amid-u.....	Exide-Ir*.....	15*	44*	6*	227*		.....	45*†	in rear-1..	G.E.....
G.V.....	7,000	.....	.....	132½*	solid....	36x6	36x4d	amid-u	Exide-Ir*.....	17*	44*	6*	268*		.....	40*†	in rear-1..	G.E.....
G.V.....	10,000	.....	.....	141½*	solid....	36x7	36x5d	amid-u.....	Exide-Ir*.....	19*	44	6*	298*		.....	35*†	in rear-1..	G.E.....
Lansden.....S	750	1,850	1,175	90	cush....	34x3	34x4	u-seat.....	Edison-A4.....	.....	60	10	.....		.....	60	unit-x-1..	G.E.....
Lansden.....M	1,000	2,310	1,500	90	solid....	36x2½	36x3	amid-u.....	Edison-A4.....	.....	60	10	.....		.....	60	unit-j-1...	G.E.....
Lansden.....M	2,000	2,900	1,700	106	solid....	36x3	36x3½	amid-u	Edison-A6.....	.....	60	10	.....		.....	60	unit-j-1...	G.E.....
Lansden.....M	4,000	3,660	2,100	120	solid....	36x4	36x3d	amid-u.....	Edison-A8.....	.....	60	10	.....		.....	50	unit-j-1...	G.E.....
Lanaden.....M	7,000	4,455	2,475	130	solid....	36x5	36x4d	amid-u.....	Edison-A10.....	.....	60	10	.....		.....	50	unit-j-1...	G.E.....
Lansden.....M	10,000	5,190	2,850	142	solid....	36x6	36x5d	.....	Edison-A12.....	.....	60	10	.....		.....	50	unit-j-1...	G.E.....
Lansden.....Tractor	20,000	3,660	2,100	58	solid....	30x4	30x5	amid-o.....	Edison-A8.....	.....	60	10	.....		.....	60	rear-1....	G.E.....
Walker.....M	1,000	.....	.....	90*	solid....	34x3	36x3½	amid-u	Edison*.....	.....	60*	.....	.....		.....	75*	unit-x-1..	West.....
Walker.....K	2,000	.....	.....	92*	solid....	34x3	36x4	amid-u	Edison*.....	.....	60*	.....	.....		.....	75*	unit-x-1..	West.....
Walker.....L	4,000	.....	.....	107*	solid....	38x4	38x6	amid-u	Edison*.....	.....	60*	.....	.....		.....	65*	unit-x-1..	West.....
Walker.....D	6,000	.....	.....	126*	solid....	36x5	38x4d	amid-u	Edison*.....	.....	60*	.....	.....		.....	60*	unit-x-1..	West.....
Walker.....E	8,000	.....	.....	130*	solid....	36x6	38x5d	amid-u.....	Edison*.....	.....	60*	.....	.....		.....	60*	unit-x-1..	West.....
Walker.....N	10,000	.....	.....	136*	solid....	36x7	38x6d	amid-o.....	Edison*.....	.....	60*	.....	.....		.....	50*	unit-x-1..	Wset.....
Ward.....WS	750	760	.....	88	solid ...	32x2½	32x2½	u-seat.....	Ward*.....	.....	42*	3*	100*		.....	35*	amid-1...	West.....
Ward.....EO	1,000	1,250	.....	90	solid....	32x2½	34x6	amid-u	Ward*.....	.....	42*	3*	127*		.....	45*	amid-1...	West.....
Ward .....EA	2,000	1,500	.....	99	solid ...	34x3	36x4	amid-u	Ward*.....	.....	42*	3*	153*		.....	40*	amid-1...	West.....
Ward .....EB	4,000	1,900	.....	111	solid ...	36x4	38x6	amid-u	Ward*.....	.....	42*	3*	204*		.....	35*	amid-1...	West.....
Ward .....EC	7,000	2,450	.....	132	solid ...	38x6	40x3½d	amid-u	Ward*.....	.....	42*	3*	280*		.....	30*	amid-1...	West.....
Ward.....ED	10,000	2,950	.....	152	solid ...	40x3½d	42x5d	amid-u.....	Ward*.....	.....	42*	3*	357*		.....	25*	amid-1...	West.....

ABBREVIATIONS: General, *, *with other options;* opt, *optional.* **Tires, Kind,** cush, *cushion;* s & st, *solid in front and steel in rear.* **Tire Sizes,** d, *dual.* **Battery Location** amid-u, *amidships, underslung below frame;* front-o, *at front, over frame;* amid-o, *amidships over frame;* rear-o, *at rear, over frame;* u-hood, *under hood;* u-hood-r, under *hood in rear;* front-u, *in front, under frame;* u-seat, *under seat;* **Battery, Make and Type,** Exide-Ir, *Exide-Ironclad type.* **Miles per Charge, Loaded,** †, *half way light, half loaded.* **Motor, Location and Number,** amid, *amidships;* unit-j, *unit with jackshaft;* unit-x, *unit with axle.* Numbers following *refer to number of motors in chassis.*

Battery Service Widens

ONE of the most important developments in the electrical vehicle industry during the past year is the development of battery service systems, or as they are sometimes called, battery exchange systems. This has greatly widened the field of the electric truck and increased its efficiency in installations of one, two or three vehicles.

The system is based on the principle that it is more economical to maintain an electric truck as one of a fleet of many than as an individual vehicle. Various forms of the system are now in use in more than ten cities throughout the United States. The system's greater development in 1916 has proved one of the most far-reaching steps in the advancement of the electric truck industry during the year, and has increased the sales of trucks wherever introduced.

The larger use of battery service has occasioned a greater degree of co-operation between truck user, truck manufacturer and the central station interests who have supplied the current for the battery charging.

Detachable Battery Cradle

The system in brief consists of the purchase of an electric truckless battery, the vehicle being supplied with a specially-designed detachable battery cradle. By the use of this interchangeable cradle the company furnishing the power is enabled to exchange a discharged or partly-discharged battery for a fully-charged one in from 2 to 5 min.

The current used is sold by the mile, according to the size of the vehicle and the amount of mileage as recorded by the odometer. An additional fixed sum is charged for the battery service and inspection, and a third fixed charge if the vehicle is garaged at the point where the batteries are exchanged. Both of these latter charges are fixed for any particular size of vehicle, although of course they are graded according to the truck capacity and the rate for current decreases as the mileage increases.

For the user, the battery service system eliminates practically all of the objections which have formerly mitigated against the more general use of the electric as compared with the gasoline truck. These objections included: A high initial cost of vehicle; uncertainty in the small user's mind as to the efficiency and life of the battery and the trouble of its care and that of the charging apparatus necessary; the limited mileage on one charge of the battery and the uncertainty as to the actual cost of truck operation.

Commercial Vehicle Chassis Listed on for the 1917 Season

MOTOR					CONTROLLER			DRIVE						SPRINGS		CONTROL		
Winding	Horse-power	Voltage	SPEED IN MILES PER HOUR		Location	SPEEDS		GEARING		Total Gear-Ratio	Torque Taken By	Propulsion Taken By		Front	Rear	Steer	Controller Lever	Name and Model
			Light	Loaded		Ahead	Reverse	First Reduction	Final Reduction									
series	2.6	85*	12	10	u-seat	4	2	s-chain	dblchn	10.82-1		rad-rd		½-ell	½-ell	wheel-l	l-seat	Atlantic 1-C
series	2.6	85*	11	9	u-seat	4	2	s-chain	dblchn	10.82-1		rad-rd		½-ell	½-ell	wheel-l	l-seat	Atlantic 2-C
series	3.9	85*	10	8	u-seat	4	2	s-chain	dblchn	9.95-1		rad-rd		½-ell	½-ell	wheel-l	l-seat	Atlantic 3-C
series	6.0	85*	9	7	u-seat	4	2	s-chain	dblchn	13.48-1		rad-rd		½-ell	½-ell	wheel-l	l-seat	Atlantic 5-C
series	2.5	85*	15	13½	st-col	4	2	spur-gear	spur-gear	10.00-1	rad-rd	rad-rd		½-ell	½-ell	wheel-l	u-wheel	C.T.
series	3.2	85*	14	12	st-col	4	2	spur-gear	spur-gear	11.50-1	rad-rd	rad-rd		½-ell	½-ell	wheel-l	u-wheel	C.T.
series	5.0	85*	12	10	st-col	4	2	spur-gear	spur-gear	12.14-1	rad-rd	rad-rd		½-ell	½-ell	wheel-l	u-wheel	C.T.
series	7.0	85*	11	9	st-col	4	2	spur-gear	spur-gear	17.32-1	rad-rd	rad-rd		½-ell	½-ell	wheel-l	u-wheel	C.T.
series	7.0	85*	9	7	st-col	4	2	spur-gear	spur-gear	20.14-1	rad-rd	rad-rd		½-ell	½-ell	wheel-l	u-wheel	C.T.
series	12	88	12	9	btw seats	5	5	direct	bevel	25.00-1	rad-rd	rad-rd		½-ell	½-ell	wheel-r	btw seats	Couple-Gear H
series	10	88	9	7	btw seats	5	5	direct	bevel	25.00-1	rad-rd	rad-rd		½-ell	½-ell	wheel-r	btw seats	Couple-Gear AF
series	12	88	10	8	btw seats	5	5	direct	bevel	25.00-1	rad-rd	rad-rd		½-ell	½-ell	wheel-r	btw seats	Couple-Gear A
series	20	88	10	8	btw seats	5	5	direct	bevel	25.00-1	rad-rd	rad-rd		½-ell	½-ell	wheel-r	btw seats	Couple-Gear SD
series	2.5	85*	13½	12	u-seat	5	2	s-chain	dblchn	10.2-1	springs	rad-rd		½-ell	½-ell	wheel-l	l-seat	G.V.
series	3.4	85*	11½	10	u-seat	5	2	s-chain	dblchn	10.76-1	springs	rad-rd		½-ell	½-ell	wheel-l	l-seat	G.V.
series	4.6	85*	10½	9	u-seat	5	2	s-chain	dblchn	11.61-1	springs	rad-rd		½-ell	½-ell	wheel-l	l-seat	G.V.
series	5.6	85*	9½	8	u-seat	5	2	s-chain	dblchn	13.95-1	springs	rad-rd		½-ell	½-ell	wheel-l	l-seat	G.V.
series	6.8	85*	8½	7	u-seat	5	2	s-chain	dblchn	13.95-1	spriigs	rad-rd		½-ell	½-ell	wheel-l	l-seat	G.V.
series		60		15	u-hood	4	2	spur-gear	bevel	12.00-1	t-arm	springs		½-ell	½-ell	wheel-l	u-wheel	Lanaden S
series		60		12	u-hood	4	2	bevel	dblchn	8.00-1		rad-rd		½-ell	½-ell	wheel-l	u-wheel	Lansden M
series		60		10	u-hood	4	2	bevel	dblchn	10.00-1		rad-rd		½-ell	½-ell	wheel-l	u-wheel	Lansden M
series		60		9	u-hood	4	2	bevel	dblchn	13.00-1		rad-rd		½-ell	½-ell	wheel-l	u-wheel	Lansden M
series		60		7	u-hood	4	2	bevel	dblchn	13.00-1		rad-rd		½-ell	½-ell	wheel-l	u-wheel	Lansden M
		60		6	u-hood	4	2	bevel	dblchn	14.50-1		rad-rd		½-ell	½-ell	wheel-l	u-wheel	Lanaden M
series		60	8	5	u-seat	4	2	s-chain	dblchn	9.00-1		rad-rd		½-ell	½-ell	wheel-l	u-wheel	Lanaden Tractor
series	3.0	60*	17	15	u-seat	5	5	direct	plan	16.87-1	springs	springs		½-ell	½-ell	wheel-l	l-seat	Walker M
series	3.5	60*	16	14	u-seat	5	5	direct	plan	16.87-1	springs	springs		½-ell	½-ell	wheel-l	l-seat	Walker K
series	4.0	60*	16	14	u-seat	5	5	direct	plan	16.14-1	springs	springs		½-ell	½-ell	wheel-l	l-seat	Walker L
series	5.0	60*	13	12	u-seat	5	5	direct	plan	15.57-1	springs	springs		½-ell	½-ell	wheel-l	l-seat	Walker D
series	6.0	60*	12	11	u-seat	5	5	direct	plan	15.57-1	springs	springs		½-ell	½-ell	wheel-l	l-seat	Walker E
series	6.5	60*	12	10	u-seat	5	5	direct	plan	18.83-1	springs	springs		½-ell	½-ell	wheel-l	l-seat	Walker N
series	2					4		direct	sp-bev					½-ell	½-ell	wheel-l	u-wheel	Ward WS
series						4		chain	dblchn					½-ell	½-ell	wheel-l	l-seat	Ward EO
series						4		chain	dblchn					½-ell	½-ell	wheel-l	l-seat	Ward EA
series						4		chain	dblchn					½-ell	½-ell	wheel-l	l-seat	Ward EB
series						4		chain	dblchn					½-ell	½-ell	wheel-l	l-seat	Ward EC
series						4		chain	dblchn					½-ell	½-ell	wheel-l	l-seat	Ward ED

ABBREVIATIONS: (continued). **Controller, Location,** u-seat, *under seat:* st-col, *on steering column:* u-plat, *under platform:* u-hood, *under hood:* btw seats, *between seats.* **Drive, Gearing, First Reduction** s, chain, *silent chain.* **Final Reduction,** dbl chn, *double chain;* sp-bev, *spiral bevel gears;* plan, *planetary gears;* -f, *to front wheels;* -4, *to all four wheels.* **Torque Taken By,** t-arm; *torque arm;* sub-f, *sub-frame;* pdstl, *pedestal:* rad-rd, *radius rods.* **Propulsion Taken By,** rad-rd, *radius rods:* sub-f, *sub-frame;* pdstl, *pedestal.* **Springs,** ¼-ell, *one-quarter elliptic;* ½-ell, *half-elliptic,* ¾-ell, *three-quarters-elliptic;* trans-x-*transverse X shape or reversed elliptic.* **Control, Steer** -l, *to the left;* -r, *to the right:* -c, *in the center.* **Controller Lever,** u-wheel, *under steering wheel;* l-seat, *to left of seat;* r-seat, *to right of seat:* btw seats, *between seats,* cent, *center;* l-plat, *to left of platform.*

Electric Truck Scope

All of these objections have been overcome by the battery service plan in which the user does not buy, own or care for the batteries, but concerns himself only with the actual operation of the trucks. Without batteries the prices of the trucks are reduced anywhere from 20 to 38 per cent. In addition, the exchange battery feature of the system eliminates the limitations of battery mileage and enables the truck owner to operate his vehicle 24 hr. daily if he so desires by simply changing the batteries as fast as they become exhausted. As the charges for the battery service and inspection are fixed no matter how many batteries are used in a day and the charge for the current consumed, based on the mileage covered, the truck owner pays in exact proportion to what he receives. Furthermore, these charges can be ascertained easily and often determined in advance.

Finally, the system offers the purchaser a substantial reduction in truck investment in addition to the elimination of charging and garage apparatus. It also offers unlimited mileage and a reduction of all battery-care costs because of the savings effected in the handling of a large instead of a small number of batteries as would be the case were the truck owner to maintain his own batteries.

The advantages of the system to the truck maker are of course obvious in that it tends to increase the sales of trucks. The advantage to the central station supplying the current is that it offers a ready means of disposing of the off-peak current.

The system as outlined above is not new, the General Vehicle Co. and the Hartford Electric Light Co., Hartford, Conn., having inaugurated such a system as far back as June, 1912. Before that several department stores, mail transfer concerns, textile mills and others developed private battery exchange methods.

System Used in Many Cities

The General Vehicle Co.'s system, which is substantially that as outlined above, is now in operation in nine other cities besides Hartford, Conn., with several others pending. The cities in which vehicles are now being operated on the system include Spokane, Wash.; Boston, Mass.; Baltimore, Md.; Harrisburg, Pa.; San Francisco and Los Angeles, Cal.; Worcester and Fall River, Mass., and Wichita, Kan. In all, there are several hundred electric trucks now being operated on the Gevco or General Vehicle Co.'s system in these ten cities.

Aitken Wins Harkness Trophy Race

Peugeot Pilot Covers 100 Miles at 105.95 M. P. H., Breaking American Speedway Record—Pace 109 M. P. H., Until Resta Was Eliminated at 65 Miles

Start of the Harkness Trophy 100-mile race

Aitken at the wheel of his Peugeot after winning the Harkness Trophy race

NEW YORK CITY, Oct. 30—The old Brooklands record for 100 miles still hangs by a hair, rather to the surprise of the majority, who expected to see it beaten at Sheepshead Bay last Saturday. Actually Aitken on his Peugeot came within 7.52 sec. of the record time, and could have beaten it easily had he wished to do so, since he had been running easy from the time that his chief rival, Resta, was forced to retire, about the middle of the race.

As it was, Aitken knocked 47 sec. off his previous best time for 100 miles, made in the Astor Cup race 4 weeks ago, and worked himself back into the lead for the American speedway championship, Resta taking second place in the new ranking list..

The race was a Resta-Aitken duel. For 60 miles it was run at 109 m.p.h. with Aitken and Resta trying to outmaneuver each other at every turn of the banking. Both had to stop for tires, but both got away again so smartly that it hardly affected their relative positions. From the start to the time when the overstressed crankshaft of Resta's engine gave up the struggle Resta and Aitken had rarely been much more than a length apart.

With Resta's retirement at 65 miles, the race was over. Aitken cut down speed instantly, dropping from 109 to about 103 m.p.h., or even less, a small percentage, but enough to make a big difference in the load on his engine. Thenceforward, Aitken, Wilcox on the third Peugeot and Galvin on a Premier ran in a bunch of three with little variation, the field making some good racing among themselves a lap behind or more.

FINISHERS IN HARKNESS TROPHY RACE—100 MILES

Car	Driver	Time Hr.Min.Sec.	M.P.H.	Prize
Peugeot	Aitken*	56:37.65	105.95	$4,000
Premier	Galvin	56:45.35	105.71	2,500
Peugeot	Wilcox	57:10.53	104.9	1,500
Maxwell	Henderson	59:04.70	101.31	1,000
Duesenberg	Devore	59:05.47	101.3	600
Benedict	Benedict	59:23.88	100.9	400
Hoskins	Hughes	1:01:47. 1	98.2	....

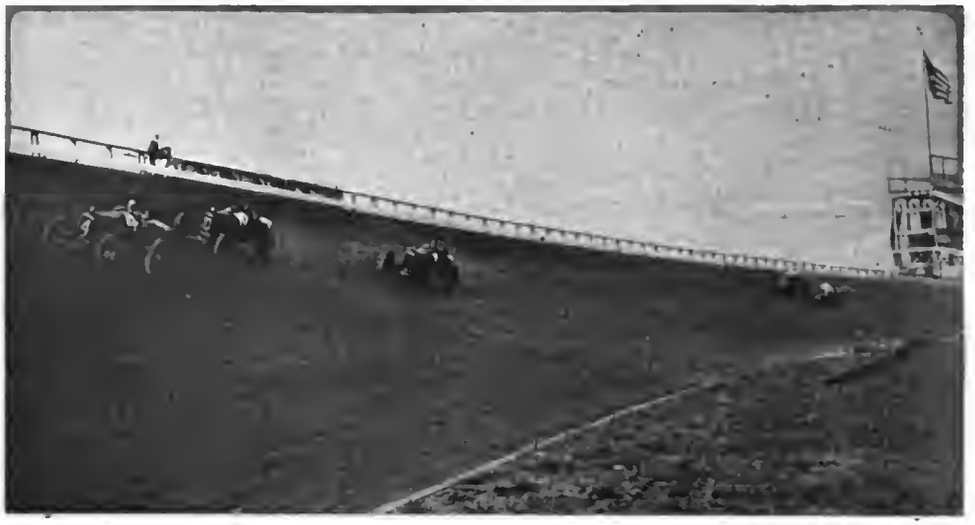
*Lap prizes, $1,400 additional; Peugeot, Resta, $1,400 lap prize.

TIMES OF FINISHERS IN 50-MILE RACE

Car	Driver	Time Hr.Min.Sec.	M.P.H.	Prize
Delage	Le Cain	28:49.59	104.2	$1,000
Duesenberg	Milton	30:15.8	99.25	600
Pugh	Meyer	30:16.36	99.1	400
Duesenberg	Devlin	30:17.11	99	300
Hoskins	Hughes	30:31.40	98.25	200
Crawford	Muller	30:32.4	98.15	....
Crawford	Klein	31:09.65	96.5	....

Possibly had there not been prizes of $50 or $100 for the leader of each lap Resta might not have set so hot a pace. He carried off the lion's share of this lap money up to the point where he went out; in short he had a two-to-one advantage over Aitken, but perhaps Aitken was as much responsible as Resta, for, drive as he would, Resta could never get a car length ahead of his rival.

Nature could offer nothing finer as a setting for so historic a conflict; the sky was the finest autumn blue, there was scarcely a breath of wind and not a cloudlet, yet the sprinkling of people through the high double-decked grandstand was pathetic. Conservatively, not 5000 saw the race from the stand. In the bleachers was a smaller number. The infield had less than 150 parked cars. It was no attendance for so great a conflict. Enthusiasm was lacking, and those outbursts of cheers that Aitken and Resta merited were lacking. When Aitken finished there was but a faint ripple, and it was not until he pulled up beside the pit after having traveled an extra lap or so for safety that the stand seemed to waken to the occasion and greeted the victor with a respectable cheer. A performance which came so near bringing a world's record to this speedway deserved more exultation. Unfortunately the stands were not well enough advised during the progress of the race, and many who might otherwise have been at fever heat were pardonably lukewarm.



Resta's Peugeot leading Aitken and Wilcox coming out of the homestretch. The cars were as close together as this on lap after lap of the 100-mile race

LEADERS AT 10-MILE INTERVALS IN THE HARKNESS TROPHY RACE

Miles	Driver	Time Hr.Min.Sec.	M.P.H.	Prize
10	Aitken	5:39.0	106.2	$100
20	Aitken	11:05.0	108.2	100
30	Resta	16:28.35	109.3	100
40	Resta	21:52.0	109.6	100
50	Resta	27:22.0	109.5	250
60	Aitken	33:49.0	106.2	100
70	Aitken	39:33.0	104.2	100
80	Aitken	45:16.0	106	100
90	Aitken	50:54.0	106.1	250
100	Aitken	56:37.65	105.95	4,000

The intermediate laps which had prizes of $50 each were divided between Resta and Aitken, so that they took $1,400 each, Aitken making the final prize of $4,000 in addition or a total of $1,400 to Resta and a total of $5,400 to Aitken.

Devigne and his Delage, winner of the 50-mile consolation event

Figures best narrate the consistency of the struggle. For 30 miles the speed was over 109 m.p.h. It started at 106.2 for the first 10 miles, jumped to 108.8 at 20 miles, was 109.3 at 30 miles, rose to 109.6 at 40, varied to 109.5 at 50 and was then pulled down to 106.2 at 60, due to stops for tire changes by both Aitken and Resta. With Resta out, there was not the incentive for Aitken to continue at his previous pace, and we find the average remaining at 106.2 at 70, then dropping to 106 flat at 80, rising to 106.1 at 90 and finishing at 105.95 at the century.

Wilcox in Peugeot No. 1 and Galvin in one of the new Premiers deserve creditable mention. Galvin drove a consistent race and made no stop. Wilcox had scarcely such good fortune with his Peugeot. He had to stop at 46 miles to change a right rear. Up to that time he was always one of the first three. The order of passing the grandstand was Resta, Aitken and Wilcox, or Aitken, Resta and Wilcox. Wilcox was rarely over 100 ft. back of the leaders. His tire change was not so good as either Aitken or Resta, as he consumed 25 precious seconds, and after that he was never alongside of the leaders.

The also-rans divided the glory, four of them finishing within the money, the cash being divided over a field of seven. Maxwell, Duesenberg, Benedict and Hoskins shared the remaining positions in the order noted. With the exception of the Maxwell, the other three used Duesenberg motors, so it might be classed as a Duesenberg day in this part of the field. With the exception of the Hoskins, all averaged over 100 m.p.h. Henderson, in the Maxwell, was less than 1 sec. ahead of Devore in the Duesenberg. Unfortunately this hard-fought duel for 100 miles was lost sight of by the majority of the spectators. It was a race within a race, and staged as a separate attraction would have been a grandstand thriller from start to finish.

The tale of the unfortunates, those that started but stopped before the allotted time, embraces the names of favorites and others. Rickenbacher's Maxwell went out with a broken piston before the race was half over. He traveled up with the first group pursuing the Aitken-Resta duet. Vail's Super-six Hudson went out at 20 miles with a burned connecting-rod bearing. LeCain's Delage was out at 40 miles with valve trouble. Lewis' Premier stopped with carbureter troubles at 50 miles and did not continue. Of the other twenty-one starters the majority were running when the seven that carried off the money finished and were then flagged off the course. Of the two Crawfords, one stopped with carbureter trouble and the other was running at the finish.

To-day's race did not afford sufficient data to secure a correct estimate on how cord tires endure at a pace of 109

Start of the 50-mile consolation race for non-winners at Sheepshead Bay speedway

m.p.h. or higher. Only two definite cases are at hand, that of Aitken's right rear at 56 miles and Resta's right rear at 64 miles. It would scarcely be correct to draw deduction from these two examples. In the 250-mile Astor Cup race on this speedway a month ago Aitken did not change a tire in that distance, but he rarely traveled at an average of over 105 miles. To-day for 30 miles he averaged over 109 m.p.h., and this added 4 miles appeared to have a serious influence on tires.

One factor entered into to-day's race that was wanting 4 weeks ago, namely, that both Aitken and Resta did immeasurably more jockeying for favorable positions, and so imposed a proportionately greater strain on the tires. They rode high on the banks to gain impetus on the stretches, a practice which imposed an added strain on the cord pneumatics.

The winner's equipment included Goodyear cord tires, Miller carbureter, Rudge-Whitworth wheels, Hartford shock absorbers, K. L. G. spark plugs, Bosch magneto, and he used Oilzum.

After the 100-mile curtain was rung down there was a consolation race of 50 miles for those not finishing in the money in the big show. Eleven cars started in this race, which proved an easy victory for LeCain in the Delage, which averaged 104.2 m.p.h. for the distance. No records were broken, and it was a procession from start to finish. The race divided itself into three groups, LeCain in the first group, making a runaway of it. He lapped a goodly portion of the field at 26 miles and had the entire field a lap back of him at 44 miles. He did not have to stop, and generally was alone on the track excepting when lapping the two groups into which the field divided itself shortly after the race had really got well under way.

The first group was made up of a Crawford, driven by Klein, Milton's Duesenberg, Meyer's Pugh and Devlin's Duesenberg running a lap back.

The second bunch included Hughes' Hoskins, Vail's Hudson, which started on five cylinders and had eventually to retire, and Muller's Crawford. Both of these groups were very much slower than the winning Delage, or nearly a lap behind the record group.

Protection of cars, track and grandstand against fire was again provided by the H. W. Johns-Manville Co., which distributed a squad of twenty-five men equipped with extinguishers around the track.

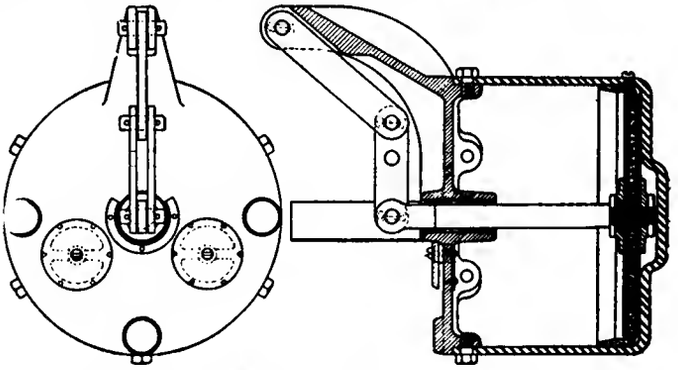
Vacuum Brake for Automobiles

System Used for Train Brakes Applied in Simple Manner to Any Car—Great Delicacy of Control

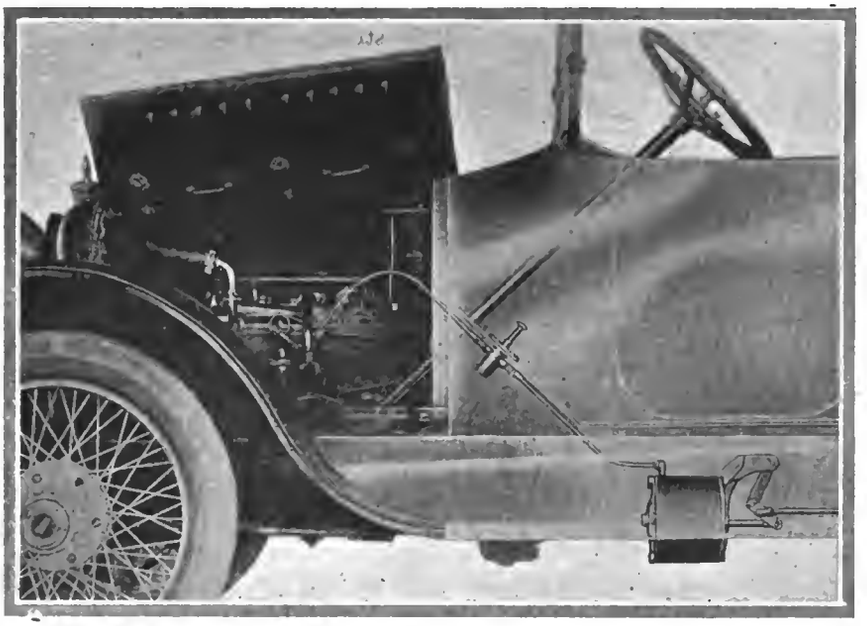
THE idea of using some form of vacuum or air brake for automobiles is not new, but the Prest-O-Lite Co., Indianapolis, Ind., has just worked out an extremely neat and simple form, this being an invention of Benjamin G. Kramer, who also was responsible for the Pierce engine governor.

The system of the brake is to utilize the suction prevailing in the intake manifolds. The few pounds per square inch difference between manifold pressure and atmospheric pressure is converted into a respectable force by the use of a large piston. It is stated that a force of about 10 lb. per square inch is available as a rule, and this is used on a piston of 7 in. diameter with an available stroke of 4 in. A system of levers reduces the travel and multiplies the force correspondingly, so that a powerful pull on the brake operating rod is obtained.

A simple little valve is placed in the pipe line connecting the intake manifold with the brake piston, and this valve can be operated either by foot or by hand, the way in which this valve permits the brakes to be applied with different degrees of intensity being extremely ingenious. To give different amounts of pull on the brake rod it is necessary to have variable depression in the brake cylinder, and we can only get



Section through the vacuum cylinder of the Prest-O-Lite brake



Shows how the Prest-O-Lite brake control is fitted to a car

this by opening the connection to the manifold, allowing a little air to be sucked out and then closing the valve again quickly, otherwise the full suction will come on at once.

This would be a delicate hand operation, so it is made automatic by the valve. The valve is opened by pressing down on a spring which in turn presses on the valve. The lower side of the valve is exposed to atmospheric pressure continuously and the upper side of the valve is exposed to the pressure existing within the brake cylinder. Thus, when the valve operating lever is moved, it presses on the spring and opens the valve. Instantly the pressure back of the valve drops, and the atmospheric pressure on the other side of the valve forces it up against the spring, so cutting off the suction. In this way the depression in the brake cylinder is made proportional to the amount of movement given to the valve operating lever or pedal. Directly the operating lever is released the valve is lifted right back and this admits atmospheric pressure to the cylinder, thus releasing the brake instantly.

The cylinder is very similar to the air-brake cylinders used in braking railroad trains. With a pressed steel shell and a cast steel head, the entire cylinder weighs in the neighborhood of 12 lb. The thin steel piston embodies a leather plunger, a duplicate in design of the type used in locomotive air-brake cylinders, which have been known to give 7 years' service before replacement was necessary.

A representative of THE AUTOMOBILE drove a Packard twin six and a Velie, the former equipped with a hand operated brake and the latter with a pedal. In ordinary driving, through traffic and over hilly country roads the flexibility of the brake could not be questioned. The Packard was put up to 35 m.p.h., the brake lever applied—with a touch of the little finger—and the rear wheels locked, both of them, so that the car slid in a straight path up the road. With one of the brakes thrown out of adjustment, it was again found possible to lock both wheels evenly, as the extreme pressure possible took up the difference through the equalizers. Then again, driving at any speed, it was possible by a shorter movement of the lever to give the brakes the very slightest touch so that their effect was hardly noticeable. Any degree of pressure between these two was easily obtainable.

The brake will operate with enough force to slip the wheels as long as the engine is turning over. As an example of this the Packard was driven by the starting motor alone, meaning that the car was traveling possibly ½ m.p.h., yet full application of the brake lever locked the wheels. It might be noted here that the brakes on the Packard were so set that in order to slip the wheels, it was necessary to throw the entire weight on the regular brake pedal which was connected to the same levers. In descending steep declines where it is possibly advisable to turn off the ignition and leave the clutch engaged, the brake will operate as efficiently as it will with the engine under power.

In the pedal operation as applied to the Velie, driving through crowded traffic was a revelation. The pedal was located directly beside the accelerator. Through the most crowded traffic operation of the car was simply a matter of oscillating the foot from the accelerator to the brake pedal and vice versa, about the same amount of foot pressure being required to operate both. The car was driven into a steep ditch, the brake applied with the foot, a shift made into reverse, the foot switched from the brake pedal to the accelerator and the car slid out without difficulty.

The release is almost instantaneous, so rapid in fact that it is impossible to shift the foot from the brake pedal to the accelerator quick enough to catch the brakes unreleased.

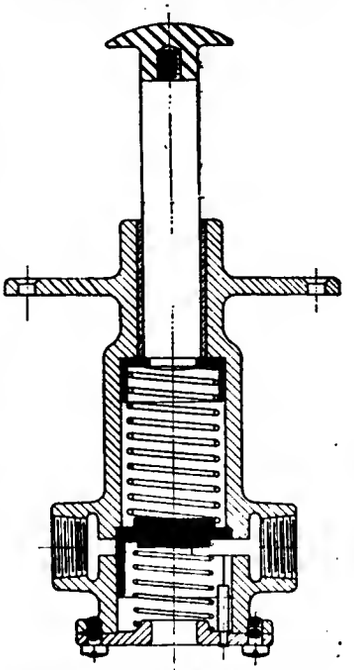
Tight connections are unnecessary. As a matter of demonstration, a system was connected up with each union turned in place with the fingers only. To aggravate conditions a pipe was inserted between the valve and the manifold, which was drilled through. Still the device worked perfectly.

To Fit All Cars

The vacuum brake will be marketed with a view of furnishing brackets for attachment for all well-known makes of cars, both as a factory equipment and retailing proposition. Although it was primarily designed for passenger car use, particular emphasis is laid on its merits as a part of truck equipment, especially in very heavy trucks where it is difficult to create sufficient leverage with a foot-operated brake acting on the rear wheels.

This invention appears to be one that may easily rank in importance with the vacuum fuel feed system. The name of the Prest-O-Lite company is sufficient to guarantee that the device has been tried out with requisite thoroughness and found free from faults and its cost, though obviously greater than that of a plain pedal or brake lever ought not to be prohibitive where quantities are required. Practically the only wearing portions of the whole outfit are the cup leathers, and we know from experience of other machinery that these will last an immense time when protected and lubricated.

It would be difficult to imagine anything much easier to fit, in fact the attachment would be as simple a job as any part of the assembly and the added weight is so small that it may be neglected.



Section of balanced automatic control valve

Australian Imports Increase 200 Per Cent

U. S. A. Supplies Over Two-Thirds of $5,381,275 Worth of Automobile Chassis and Bodies Absorbed by Commonwealth in First 6 Months of 1916—Rubber Shipments $2,643,455

SYDNEY, AUSTRALIA, Sept. 12—Shipments of automobile chassis, bodies and rubber to Australia during the first half of 1916 show an increase of 200 per cent over those of the same period in 1915. That this country is fast coming to the fore as an automobile buying power is manifested in the latest import figures, which show a total of $5,381,275 in bodies and chassis, as compared with $2,543,595 in the first half of 1915. Rubber shipments totaled $2,643,455.

The American automobile makers have taken advantage of the excellent business conditions there and have built up a large trade with each of the Australian States. Over two-thirds of the cars shipped to Australia were from the United States, this country also leading in each of the States. New South Wales, which is the largest automobile buying state in Australia, bought nearly one-half of the cars sent from the United States to that country and increased its imports from that country nearly six-fold over those in the first half of 1915.

$4,297,360 in Chassis

Chassis shipments to the Commonwealth during the first half of 1916 amounted to $4,297,360 as compared with $2,093,740 in the same period in 1915. Of this amount, $2,781,565 was from the United States against $864,840 in the first half of 1915. With the exception of the United Kingdom and Germany, the rest of the countries showed large gains during that period. British imports dropped nearly 60 per cent, or from $587,505 to $312,300; German imports dropped from $17,460 to $1,705. Canada, France and Italy, however, marked up large gains, especially Canada, which shipped cars worth $820,130 as against $356,380. France shipped cars worth $114,675 as against $99,460. and Italy nearly doubled her shipments to that country, totaling $249,740, as against $141,880.

Body shipments were more than doubled despite the fact that this country is a very important one in the matter of body building. Body shipments totaled $1,083,915, as against $449,855 in the first half of 1915. The United States also led in these shipments, sending over bodies valued at $866,490, as compared with $236,235 in the 1915 period. Canada, France and Italy also showed substantial gains over their shipments during 1915. Canadian shipments totaled $163,430, compared with $80,310; French shipments totaled $10,580, as against $2,550; and Italian shipments totaled $10,925 as against $7,910. The United Kingdom, which did a large business of $120,240 worth in the first half of 1915, fell off considerably in 1916, her total being $31,680.

N. S. W. Absorbs Most

In both the chassis and bodies, New South Wales was the leader with $1,757,640 and $454,230, respectively. Victoria was a close second in chassis and bodies with a total of $1,169,585 and $271,955, respectively.

New South Wales is a fertile field for automobile sales. The State is prominent as a farming and pasturage district, and as a result automobiles are in demand especially by the farming element. Not only in this State, but in the whole of Australia is there prosperity. The war has benefited the Australians instead of hampering them. From the very beginning of the war the Australian Government was busy bettering trade conditions. Exports were increased by the purchase of cargo steamers, offsetting the excessive freight rates and the general difficulties in obtaining merchandise.

There is a large demand for commercial vehicles in the farming districts. The farmers are in the field for conveyances that will speed their products to the markets.

AUSTRALIAN IMPORTS OF CHASSIS AND BODIES FROM JAN 1 to JULY 1, 1915

Chassis for Automobiles, Etc.

Country of Origin	N.S.W.	Vic.	Q'land	S.A.	W.Aus.	Tas.	C'wealth
United Kingdom	252,670	148,975	53,635	71,665	41,355	18,205	587,505
Canada	39,945	92,900	54,830	57,005	42,220	19,480	856,380
Belgium	18,705	1,945	790	1,875	1,305	.....	24,620
France	29,190	50,345	4,580	12,980	2,365	.....	99,460
Germany	7,140	6,990	3,330	.....	.....	.....	17,460
Italy	72,665	54,175	3,850	9,590	160	.....	141,880
U. S. A.	289,555	95,745	327,185	70,265	76,535	5,555	864,840
Switzerland	.....	1,595	.....	.....	.....	.....	1,595
Total	759,870	453,670	489,200	113,880	165,380	43,240	2,093,740

Bodies for Automobiles, Etc.

Country of Origin	N.S.W.	Vic.	Q'land	S.A.	W.Aus.	Tas.	C'wealth
United Kingdom	52,065	26,940	14,295	12,685	10,850	4,405	120,240
Commonwealth	330	.....	.....	.....	.....	.....	330
Canada	23,095	23,265	14,175	6,120	9,510	4,145	30,310
France	1,510	100	375	420	145	.....	2,550
Germany	1,280	570	.....	.....	.....	.....	1,350
Italy	4,945	1,400	695	870	.....	.....	7,910
U. S. A.	84,455	21,215	89,800	15,300	23,840	1,625	236,235
Belgium	.....	220	160	.....	.....	.....	380
Total	167,680	73,210	119,500	85,395	48,845	10,175	449,355

AUSTRALIAN IMPORTS OF CHASSIS, BODIES AND RUBBER FROM JAN. 1 TO JULY 1, 1916

Chassis for Automobiles, Etc.

Country of Origin	N.S.W.	Vic.	Q'land	S.A.	W.Aus.	Tas.	C'wealth
United Kingdom	140,910	80,500	55,730	26,255	50,595	3,310	312,800
Canada	278,775	267,505	88,680	103,385	52,955	38,880	820,130
New Zealand	.....	.....	.....	.....	80	.....	80
Belgium	1,400	.....	.....	.....	.....	.....	1,400
France	66,715	39,960	15	7,915	70	.....	114,675
Germany	820	885	.....	.....	.....	.....	1,705
Italy	112,860	122,640	.....	14,240	.....	.....	249,740
Sweden	840	.....	.....	.....	.....	.....	840
Switzerland	4,365	45	6,015	.....	.....	.....	10,425
U. S. A.	1,255,955	653,000	488,895	294,315	197,595	37,305	2,781,565
Total	1,757,640	1,169,585	588,885	446,110	256,295	74,445	4,297,360

Bodies for Automobiles, Etc.

Country of Origin	N.S.W.	Vic.	Q'land	S.A.	W.Aus.	Tas.	C'wealth
Commonwealth	165	.....	.....	.....	.....	.....	165
United Kingdom	18,720	8,700	4,035	1,370	1,025	2,730	81,680
Canada	61,735	52,065	18,085	16,250	11,195	4,100	168,430
Belgium	450	.....	.....	.....	.....	.....	450
France	9,305	1,275	.....	.....	.....	.....	10,580
Germany	195	.....	.....	.....	.....	.....	195
Italy	6,560	4,225	.....	140	.....	.....	10,925
U. S. A.	857,100	210,690	138,830	90,150	63,620	11,100	866,490
Total	454,280	271,955	156,000	107,910	75,840	17,980	1,083,915

Rubber Manufactures, N.E.I.

Country of Origin	N.S.W.	Vic.	Q'land	S.A.	W.Aus.	Tas.	C'wealth
Commonwealth	1,825	13,405	.....	.....	.....	.....	14,730
United Kingdom	224,660	105,480	28,475	44,225	31,450	8,960	433,350
Canada	70,685	24,990	27,715	24,695	18,840	7,620	169,045
India	.....	.....	.....	.....	.....	10	10
New Zealand	.....	2,355	5	.....	.....	110	2,470
Belgium	400	.....	.....	.....	.....	.....	400
France	51,000	61,290	16,810	3,405	90	.....	132,595
Germany	415	1,020	.....	55	.....	.....	1,490
Italy	22,435	9,080	.....	2,090	560	.....	34,115
Japan	2,545	8,235	495	145	5	.....	11,425
Russia	85	5	.....	.....	10	.....	100
Sweden	20	40	20	70	.....	.....	150
Switzerland	.....	40	.....	.....	.....	.....	40
U. S. A.	1,302,530	215,670	135,580	100,160	70,160	18,935	1,843,035
Total	1,676,100	441,560	204,100	175,445	115,615	30,685	2,643,455

Gasoline from Natural Gas

75,000,000 Gal. of Casing Head Gasoline Produced in 1915—100,000,000 Gal. Is Estimate for 1917—Costs 8 Cents Per Gal.—Old Oil Wells Valuable

By Bernard N. Glick

EDITOR'S NOTE:—According to government reports the casing-head gasoline industry, or production of raw gasoline from natural gas, increased 53 per cent in 1915 over 1914, an average price of 7.9 cents per gal. being received for the unblended product. The same authority estimated that 24,000,000,000 cu. ft. of natural gas was utilized, with an average recovery of 2.57 gal. of gasoline per 1000 cu. ft. Mr. Glick has made an exhaustive study of this growing industry with a view to its possibilities as a relief to the situation caused by the ever-increasing demand for gasoline as a fuel for automobiles and motor trucks.

IN these days when rumors of scarcity of crude oil and higher prices of gasoline are general, it is overlooked by many that a new industry in the manufacture of gasoline has been developing during the last 10 years. This is the manufacture of gasoline from natural gas, the natural gas being produced along with oil from the wells from which crude is obtained.

During the year 1915, a total of 75,000,000 gal. of "casing head" gasoline, as this gasoline is named, was produced and the estimated production for this year is over 100,000,000 gal. Since this casing head gasoline is blended with about an equal volume of petroleum distillate before it is marketed as an automobile fuel, the total production of gasoline from this source will be round 200,000,000 gal.

The total production of gasoline from various sources last year was about 1,000,000,000 gal., so that this process in its relatively undeveloped state, already represents a 20 per cent factor of the total supply.

In the production of gasoline from natural gas, from 400 to 500 cu. ft. of gas are needed to produce a gallon of gasoline. At present rates the gas for manufacturing purposes sells for about 10 cents per 1000 cu. ft. With operating expenses in the neighborhood of 2.5 cents per gallon, it costs approximately 7.5 to 8 cents to produce a gallon of gasoline from natural gas. Losses by evaporation, storage and transportation charges have to be added to this but there is evidently left a wide margin of profit with gasoline at present figures.

All Gas Not Available

All grades of natural gas are not suitable for the manufacture of gasoline, in fact, only a small percentage is satisfactory. The variety used is known as "wet gas" and issues from wells along with oil. In some cases where the natural oil flow has stopped the gas is pumped out under reduced pressure, and a number of oil wells which have not been producing oil for several years have been pumped during the past year for natural gas which is eminently suited for this purpose.

Naphtha Treatment Required

The gasoline so manufactured is not used in automobiles directly as produced. It is far too volatile and before it can be so used it has to be blended with refinery naphtha of approximately equal volume. Once blended the fuel is handled just the same as refinery gasoline and is equally satisfactory in use.

The manufacture of gasoline from natural gas was started in 1904, since which time its expansion has been rapid. This industry first reached its highest development in the Appalachian fields extending through Pennsylvania, New York, Southern Ohio, West Virginia and Kentucky, but has since spread to the Middle West and Western States, and just as in the production of gasoline from crude the west has taken the lead, so has it taken the lead in the production of gasoline from natural gas.

In the manufacture of "casing head" gasoline two processes are now used, a third and very promising one being in process of development.

The first, known as the compression and condensation process, and accounting for the major part of the production, is described below.

Refrigeration Used By Few

The second, confined to a few plants, is known as the refrigeration process, cold alone being used to condense the gasoline vapors in the natural gas. The cooling agent used is ammonia, and the process is somewhat similar to the manufacture of ice from water, the heat necessary to volatilize the liquid ammonia first formed by compression being taken from the natural gas, which is thereby cooled sufficiently to deposit the gasoline vapors as a liquid.

The third process, known as the absorption process, is comparatively new, and consists in bringing natural gas into contact with some heavy oil (usually a petroleum distillate) letting this absorb the gasoline from the natural gas and then separating the gasoline from it by distillation. By this method it is possible to treat natural gas that is unsuitable for compression owing to the small percentage of gasoline vapors contained, and it promises to rival in volume of production the older compression process, when developed.

The compression process is the one by which the majority of the gasoline coming from natural gas is produced. The natural gas is compressed in a series of cylinders and after being compressed is passed through a coil of cooling pipes where it condenses and is collected in the form of gasoline. In this process there are several stages of condensation and compression. The first pump compresses to a pressure of 50 lb. after which the compressed gases are chilled in a series of pipes; the second pump compresses to a pressure of 250 lb., receiving its supply of gas from the series of pipes following the first pump. From the second pump the gases are passed into a cooling coil and liquid condensing is collected and any gas remaining passed on to another pump. An equipment for forming gasoline by this compression process will produce 300 gal. of gasoline per day and cost from $11,000 to $12,000.

The apparatus necessary for compression is neither very

Members of Standards Committee of S. A. E. and

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Third row—W. M. Britton, Quartermaster's Department, U. S. A., F. J. Jarosch, Councilor George W. Dunham, J. E. Diamond, guest, T. L. Lee, Treasurer Herbert Chase, B. B. Bachman, R. S. Lane, B. D. Gray

Bottom row—Secretary Coker F. Clarkson, S. G. Averill, consulting engineer, U. S. Signal Corps, George R. Bott, C. E. Bonnett, J. C. Manternach, C. B. Williams

extensive nor involved. Quite a number of the compression plants obtain their gas from wells quite some distance away, whence it is brought in pipe lines under reduced pressure. Some of the finest gas for compression purposes is got from wells not delivering oil, under pressures sometimes as low as 2 or 3 lb. The compression operation proper is usually performed in two stages the gas being first of all subjected to pressures varying from 20 to 50 lb. per sq. in.

While the gas is still at this pressure it is cooled by passing through 2-in. iron pipes about 100 ft. long for every 100 cu. ft. of gas passed per minute, anything condensing being retained for mixing with the final product. Usually only a little liquid is obtained at this stage, but in some cases where the gas is very rich in gasoline vapors, as much as 5 or even 10 per cent of the total yield is got here; although this latter figure is rather exceptional.

After the gas has left the cooling pipes it is led into the high-pressure cylinder and is there subjected to pressures varying from 200 to 350 lb. per square inch. The temperature during this operation rises to somewhere around 250 deg. C. (482 deg. Fahr.) and, of course, no liquefaction takes place in the cylinder as this is way above the condensation point of any of the gases involved. The compressed gas is then cooled as before by passing through pipes cooled by water.

In some plants advantage is taken of the fact that when a gas is allowed to expand suddenly from high to low pressure the gas is thereby cooled considerably and this cooled gas is then circulated round the issuing gas to cool it before it also is allowed to expand, thus getting a cumulative cooling effect similar to that employed in the liquefaction of air. The most suitable pressure to use in the high-compression cylinder is usually determined by actual practice. The yield increases with increased pressure, but there is a very definite point beyond which it is inadvisable to go. If this is ignored the resulting product is known in the trade as "wild" and sometimes as high as 60 or 70 per cent of it vanishes on exposure to atmospheric conditions. Even when the pressures used in the second stage of the operation are not too high the liquid produced is still rather unstable for varying weather, storage and transportation conditions and at present practically all this condensation product is blended with refinery naphthas to obtain a more stable product still capable of use as gasoline.

These blending agents are the lower distillation products of petroleum:

Rhigolene, boiling point	18 deg. Cent.
Petroleum ether, boiling point	70-90 deg. Cent.
Naphtha, boiling point	90-120 deg. Cent.

While these petroleum distillates are not volatile enough for use in gasoline engines, by blending with the almost too volatile natural gas condensate, a stable gasoline substance

Guests at Bureau of Standards, Washington, D. C.

Top row—A. D. T. Libby, W. H. Palmer, Jr., W. H. Conant, E. H. Ehrman, H. G. Osburn, Berne Nadall, Stenographer Arthur W. Kelly, E. J. Ross, Jr., E. R. Whitney

Second row—J. E. Hale, H. D. Church, F. A. Whitten, W. R. Strickland, Professor W. T. Fishleigh, A. F. Milbrath, Robert McA. Lloyd, Professor D. L. Gallup, Councilor J. G. Utz, Recorder A. C. Woodbury

Third row—Lieut. Col. George O. Squier, charge aviation section, U. S. Army, Director S. W. Stratton, Bureau of Standards, H. J. Stagg, Jr., guest, G. Douglas Wardrop, Chairman A. Ludlow Clayden, H. L. Horning, Clarence Carson, Andrew L. Riker

Bottom row—Russell Hoopes, Charles M. Manly, W. J. Hart, Raddford Pitt, Councilor David Beecroft, L. C. Fuller

is obtained, capable of being stored and shipped in barrels and tank cars without serious loss.

In this process only about 15 per cent of the gas is removed, although in some places where exceptionally rich gas is used as high as 50 per cent or more disappears during compression, and the residual gas is still a very valuable product. Its thermal efficiency compared with the original gas is almost unimpaired, while for lighting and power purposes it is in many cases improved. With wet gases trouble is often caused in gas engines by premature ignition due to the contained gasoline vapors, and similarly, when burned in standard burners, sooty flames are produced, owing to their incomplete combustion. The wet gas really has merely been changed during the operation into a comparatively dry one, comparative only, for in plant practice all the gasoline constituents are never removed. This residual gas therefore is often turned into the ordinary gas mains or used on the least for running the engines and pumps, while some plants compress it in steel cylinders and sell the product for various purposes under the name of "gasol."

125,000 Cu. Ft. Per Day

The usual sized plant handles round 125,000 cu. ft. of gas per day which, averaging round 2.5 gal. of gas per 1000 cu. ft., will produce about 300 gal. of gasoline daily; smaller plants not having been particularly successful.

The equipment for plants handling up to about 500,000 cu. ft. of gas daily and producing about 1200 gal. of condensate will cost in the neighborhood of $8,000 to $10,000 under normal conditions, pipe lines to wells, railroad sidings, storage tanks, etc., being extra, and can be operated night and day without any undue exertion by two or three men, a plant handling up to 1,000,000 cu. ft. being easily cared for by six.

A case quoted in a government bulletin gives details of two plants costing $40,000 for complete equipment. Operating expenses, including salaries and repairs, for the year 1913 were $11,000. The two plants sold 490,000 gal. of gasoline, for most of which they received 13½ cents per gallon. Taking 11¼ cents as an average, the gross income was $55,125, the net income $44,125 or round 110 per cent on the original investment. Some idea of the value natural gas has attained may be derived from the fact that in the States of West Virginia and Pennsylvania, two of the greatest oil producers, the value of the natural gas produced in 1914 surpassed by a comfortable margin that of the crude oil.

Natural gas has long been known as one of the most efficient of fuels. It is clean, easily handled, has high calorific power and efficiency of combustion and competes very successfully with coal as a source of power. Its slight toxic effect combined with these properties renders it also particularly suitable for domestic lighting and heating, no new

Casing Head Gasoline Production Statistics for Ten States

STATE	NATURAL GAS PRODUCED			GAS USED FOR COMPRESSION PLANTS			GASOLINE PRODUCTION		
	Quantity (M. Cu. Ft.)	Avge. Value (M. Cu. Ft.)	Total Value	Quantity (M. Cu. Ft.)	Total Value	Gasoline (M. Cu. Ft.)	No. of Plants	Daily Capacity, Gal.	Quantity, Gal.
Oklahoma	78,167,414	10.30	$8,050,039	5,738,549	$273,940	3.01	58	74,793	17,277,555
West Virginia	238,740,162	14.87	35,515,329	3,005,292	172,396	3.58	121	34,460	9,278,108
California	17,828,928	16.33	2,910,784	5,129,709	197,066	1.48	19	32,360	7,581,309
Pennsylvania	108,494,387	18.80	20,401,295	1,560,064	125,690	2.89	119	21,456	4,611,738
Ohio	68,270,174	21.48	14,667,790	852,277	68,935	2.86	47	9,319	2,440,171
Illinois	3,547,841	12.32	437,275	462,321	43,017	2.52	14	5,300	1,164,178
Kansas	22,627,507	14.76	3,340,025				3		
New York	8,935,187	29.10	2,600,352	146,345	8,862	2.03	3	1,665	299,573
Colorado	Not available						2		
Kentucky	1,421,818	34.52	490,875				0		
	591,866,733	19.16	88,413,764	16,894,557	889,906	2.43	386	179,353	42,652,632

fact, for it is said the ancient records of China and Japan contain many allusions to its use for these purposes. Its value as such, however, has always been restricted by an area that could be conveniently covered by pipe line transportation from central compression stations, and this has certainly helped to keep its properties and uses of merely local importance.

Occurs in Oil Fields

The gas occurs in most of the States where oil is found, sometimes along with the oil, but often entirely separate from it. Where the two occur together it is still unfortunately the custom to waste the gas, especially in large scale operations, owing to the desire to produce and market the more easily accessible oil as soon as possible. When the well is first opened the quantity of gas that is allowed to escape is enormous, often reaching 10,000,000 to 15,000,000 cu. ft., a custom doubtless responsible for the premature ending of what might be otherwise productive gas fields. It is an eminently uneconomical method of exploitation in the long run, for while the reduction of pressure caused by this blow off of gas may cause a greater initial flow of oil from the surrounding strata into the well, there is little doubt that the lessening of the expulsive force that follows results in a shorter productive life. Were the gas retained in the oil-bearing strata the pressure it exerts would keep the well producing naturally much longer and also stave off the inflowing of water or brine usually occurring along with the oil.

Some idea of the extent to which this industry has attained can be got from the following figures gleaned from various government reports. The value of the natural gas consumed in the States, excluding the millions of cubic feet that simply come to the surface and escape having served no useful purpose, has increased 500 per cent in the last 15 years.

Year	Value	Year	Value
1899	$20,000,000	1913	$88,000,000
1905	40,000,000	1914	94,000,000
1912	84,000,000	1915	100,000,000

This rise has been due in a large measure to increased production, helped along by increasing prices since 1906. Of this gas only a small percentage is available for use in the production of gasoline, most of it being "dry." In 1914 with a total consumption of 592,000,000,000 cu. ft. only 17,000,000,000 cu. ft., or about 3 per cent, was utilized in the production of gasoline. The prices obtained for this gas varied according to its use, about 34 per cent or 203,000,000,000 cu. ft. being utilized for domestic purposes at an average cost of 28.04 cents per 1000 cu. ft. and the remainder for industrial purposes round 9.56 cents. The number of condensation plants, their capacity and production, has gone up in leaps and bounds as is eloquently shown by the following table:

Year	Plants	Daily Capacity, Gallons	Gasoline Production, Gallons
1911	176	37,100	7,500,000
1912	250	61,268	12,000,000
1913	351	152,415	24,000,000
1914	386	179,353	42,500,000

The price obtained for this gasoline was in the neighborhood of 10 cents per gallon, those doing their own blending realizing up to 12 and 15 cents. By States the complete statistics relating to the condensation and compression for the year 1914, the latest available, are summarized above.

(*To Be Continued*)

1916 Output To Be 98,000 Trucks

(*Continued from page* 745)

and accessories were among the most difficult articles to obtain, and some companies were seriously upset by the fluctuating and irregular quantities available. Another difficulty was in obtaining trailers, which were in much greater demand during the past year than ever before, and still another factor which made things harder for the truck makers was the freight car shortage and its attendant worries as to delivery.

180,000 Trucks in Use

As for the number of trucks in use, although no accurate statistics are available for all the States, it is significant that on July 1 there were 71,000 motor trucks in use in only seventeen States, not including such important centers as Illinois, Michigan, Minnesota, California, Connecticut, etc. This makes a striking comparison with the total of 23,855 registered in all the States at the end of 1911. A conservative estimate would place the total number of motor trucks in use in the entire country at the present time at close to 180,000, this figure not including the various types of converted passenger cars and similar makeshifts.

Domestic Demand Much Larger

Altogether, the developments of the past year indicate that the motor truck industry has made another enormous stride forward and that although the war orders have been large and remunerative, the domestic demand has grown in a way that completely overshadows export business.

Three years ago the truck industry needed a period of general good business, a period when the business men of America had money in their pockets and were willing to try something new. That period came with the beginning of 1915 and the industry leaped forward to take advantage of its opportunity.

Steam Cars, Past and Present

Modern Vehicle Vastly Better than Old Types—Causes of Trouble Eliminated from Modern Steam Cars*

By Abner Doble

THE Stanley steam car has been consistently manufactured since 1898 without cessation. The Stanley Bros. have maintained a production of about 600 cars a year, without paid advertising of any description, although they have very recently started a campaign. Their sales force has always been very meager, largely because people interested in steam cars simply went and bought them.

The evolution of their car has been gradual and conservative and Stanley cars have enjoyed a well merited reputation for service at low cost. They have used a fire-tube boiler and locomotive-type engine from the very first, and were not led astray by such faddish brain storms as single acting engines and red hot steam, which served to kill off such a large percentage of early builders. Improvements were added only when there was a well recognized demand from their customers. They have thus accumulated those necessities of modern motor cars, such as dynamo, electric lights, streamline bodies and one-man top, including a condenser, which they adapted to their car in 1914, and which allows about 200 miles' run on one filling. They now burn kerosene in the main burner (with gasoline for starting and for the pilot), and secure a very large mileage per gallon.

The fusible plug and its terrors were abandoned in favor of a thermostat for shutting off the fuel in case the driver ran short of water. Altogether the Stanley car has proved a very remarkable exception to regular automobile production.

Increased Water Mileage

One great disadvantage that steam cars labored under was insufficient mileage on the amount of water which could be conveniently carried. This was accompanied by the emission of good sized clouds of steam, and necessitated considerable searching at inopportune times for a further supply. Several steam cars were equipped with an apparatus intended to condense the steam, but a continuous run of a hundred miles without refilling was exceptional. Due to the use of heavy cylinder oil, these condensers as well as the water tank required periodical cleaning, which was an exceedingly distasteful job. Steam cars not so equipped would run approximately 30 to 35 miles on a tankful, about 35 to 40 gal. In order to handle such large quantities of water, a steam syphon was used to fill the tank.

On making our preliminary investigations we found that no one apparently had considered using a honeycomb radiator, which would, in the same size, give approximately six times as much radiating surface. The reasons advanced against this use were that the thick oil was liable to clog the extremely small passages, and that the exhaust steam (particularly in cars with flash boilers) was liable to melt the solder. We also found a superstition to the effect that oil would injure the boiler and cause violent foaming. It was also believed that the successful lubrication of a steam engine required a heavy oil with a molasses-like behavior. It was particularly hard to reconcile these beliefs, and we determined that the best thing to do was to put a honeycomb radiator onto a car and operate it in conjunction with a fire-tube boiler. This we succeeded in doing late in 1913, and realized several startling results. The car would run anywhere from 1000 to 1500 miles on one supply of 24 gal. of water. The boiler in its operation was entirely oblivious to the fact that all of the oil used by the engine cylinder was pumped into it. Having established with absolute certainty that it was possible to travel an adequate distance on one supply of water, we turned to the study of the steam-generator, with special regard to its operation when fed with water containing oil, graphite, and in winter, alcohol.

Defects of Flash Boiler

The so-called flash boiler, comprised of a series of coils forming, in effect, one continuous tube, was naturally out of it, as its entire absence of steaming stability was a source of constant aggravation to a driver in a hilly country. However, it had the immense advantage that the direction of the water-flow was opposite to the flow of the gases of combustion, which placed the coolest water in position to take the last possible B.t.u. out of the flue gases. Its all steel construction with the consequent immunity from leaks due to low water was also a great advantage. These were worth having, so we marked them down on our specification of the perfect boiler.

The vertical fire-tube boiler was also out of the question for production, on account of its great weight, potential danger present with a large diameter shell, the high cost due to the apparent necessity for winding the shell with a mile of piano wire, liability to leaks from oil working through the expanded joints where the tubes are fastened into the heads, and to overheating with low water. Notwithstanding these formidable disadvantages, it was the nicest boiler from the driver's standpoint when in good condition, due to its large reserve of water heated to the steam temperature, which admitted of a perfectly terrifying acceleration, and gave a feeling of absolutely unlimited power. It was also the most efficient boiler due to the regular close arrangement of the heating surface with extremely short distance through which the gases radiated their heat to the tubes. These advantages were therefore added to our specification.

The water-tube boiler, which has been built in almost every conceivable shape for motor vehicle service, had a black eye, and yet seemed to offer a basis on which the good characteristics of the flash and water level types of boilers might be combined. This at first seemed a very forlorn hope, as the maze of apparently conflicting conditions seemed unreconcilable.

Deposits of scale occurred in every type of boiler, with a resultant drop in efficiency and added liability of burning the already highly stressed heating surface.

In the water-level types of boilers, this scale would settle particularly in non-circulating portions of the boiler, such as the water column, and blow-off connections. This condition was the cause of most of the little bothers which beset the steam-car user.

In studying the apparently conflicting phases of this situation, we could see that every function was closely re-

*Paper read before Cleveland Section S. A. E.

lated to all others. That is, a water-level type of boiler held the temperature of the medium practically constant, with no possibility of temperatures high enough to effect a deleterious change in the lubricating oil. This allowed the continuous re-use of the oil. It also allowed the use of a soldered radiator to condense the exhaust steam. The honeycomb radiator condenses such a large portion of the exhaust steam, that very little make-up water is required, with the result that much less scale is introduced into the system. Since very little medium is lost, especially in winter, alcohol can readily be used in large enough proportions to keep the car from freezing up. The use of a mixture of alcohol and water results in an imperceptible drop in power due to the large amount of heat carrying medium that must be circulated. By using regular gasoline engine cylinder oil for the lubrication of those parts in contact with the steam, we were able to make a steam generating and condensing system of this kind practical. First, it is more agreeable to handle and easier to procure than heavy steam oil. After it is introduced into the circulating medium, it rapidly goes into an emulsion with the water, due to the violent agitation and intimate contact. It cannot form clots and clog up the radiator passages, and since the return from the radiator is introduced into the bottom of the water-tank, the agitation of the contents of the tank is sufficient to maintain the emulsion. This insures that the oil is regularly pumped into the boiler along with the water. The oil that thus finds its way into the boiler performs several valuable functions. First, it thoroughly coats every portion of the interior of the boiler with an exceedingly thin coating of oil. While this coating is extremely thin at ordinary temperatures, it is very much thinner at 485 degrees Fahr., which is the approximate temperature of the boiler at 600 lb. pressure.

Scale Cannot Stick

No scale will stick to a surface coated with oil, so that the interior of the boiler is absolutely protected from accumulations of scale as well as from rusting. Although there is very little scale bearing water introduced into the system due to the efficient condenser, in several years' operation, there would be an accumulation of the scale formed large enough to render a boiler useless, even though no scale adhered to the tubes. The second function of the oil in the water is to combat this condition, which it does with thoroughness and dispatch. As soon as a particle of scale material is thrown out of solution it is thoroughly coated with oil, which renders it incapable of sticking to any other particle of scale material. This scale, therefore, remains in suspension, and due to the violent ebullition and constant flow of the medium toward the steam outlet, is carried along and out with the steam, finally ending up in the water-tank. This action appears to be exceedingly thorough, and in several years' use no accumulation of scale can be detected in any portion of the boiler.

The steam generator, which has been worked out to fulfill these inter-related conditions, is a flash-generator in theory, and yet has the appearance of a water-tube boiler and carries a water-level in the evaporating zone. The close regular heating surfaces duplicate the heat transference conditions of a fire-tube boiler, and yet the progressive water flow, counter to the flow of the gases, with no circulatory flow, is true of the flash type. The water enters the bottom of the economizer-zone, and flows to the top under the action of the pumps, and gravity, which means that the hottest water collects at the top. From here the water overflows through a connecting pipe into the evaporating-zone, where it is converted into steam. The water level is maintained about half way up the generator by means of an automatic by-pass valve, so arranged that when the regulator tube is filled with steam and consequently hot, the by-pass valve is closed by the expansion of this tube, forcing the water from the pumps to lift the check valve and enter the generator. As the water level rises, the regulator tube is filled with water from an exposed pipe leading from the water manifold. This water is not in circulation in the generator, and, therefore, remains quite cool. The regulator tube contracts, opening the by-pass valve, allowing the water to return to the tank.

Perhaps the greatest disadvantage of steam cars was that known as "firing up," or getting the burner started to raise steam. After a fairly discouraging series of experiments, we discovered that kerosene could be ignited by an electric-spark with absolute certainty and regularity if certain conditions were observed. These conditions were: First, the kerosene must be broken down mechanically so that the individual particles are sufficiently small to insure a rise in temperature past the point of ignition in the time element during which they absorb heat from the spark. Second, the spark must occur near the atomizing nozzle where the fog is dense enough, so that one group of kerosene particles igniting would invariably ignite the rest before being consumed. Third, the velocity must be sufficiently low so that the particles have time enough to absorb sufficient heat from the spark to pass the igniting temperature. Fourth, the mixture must be very much richer at the place where ignition is to occur than the best mixture for efficient combustion.

In connection with the mixing and igniting apparatus, it is necessary that the combustion shall occur in a refractory chamber so arranged that it attains a very high temperature. The intensely hot chamber gives an ideal thermal condition, and complete combustion of a large amount of fuel can be obtained in a very small space.

Thus, in the complete apparatus, we have an electric-motor, direct connected to a multivane blower, and a graduated kerosene pump. The kerosene pump draws a measured quantity of fuel from the supply tank and forces it through the atomizing nozzle; the resultant fog is ignited by a spark plug. A measured amount of air is forced in by the multivane blower, which whirls this rich ignited mixture down through an inlet tube against the bottom of the refractory combustion chamber, where the fuel is consumed. To stop the combustion it is only necessary to break the blower-motor circuit. This is done automatically by means of a regulator set to operate at a pre-determined steam pressure.

Having thus reviewed the situation, and having described what specific mechanism has been designed (and tested) with a view to bringing the steam power plant as near perfection as possible, it might be well to consider what advantages may be rightly expected with a perfected steam power plant, and to compare the operation of the present day gasoline car.

Steam Car Qualities

1. 100 per cent torque range, with maximum torque available at zero speed, thus making superfluous change gear mechanisms and clutch. The M. E. P. (and its equivalent D. B. P.) always under control of the operator, and variable by means of the throttle from zero to maximum, a maximum which is limited only by the tractive capacity of the driving wheels.

2. Utmost mechanical simplicity, with not over 25 moving parts in the entire car, and only 15 in the engine.

3. Perfectly smooth and quiet, due to very low engine speed with one to one ratio, and to location of engine on axle.

4. Low running cost due to use of kerosene or crude oil for fuel.

5. Low manufacturing cost due to simplicity—to lack of fussy work in production.

6. High thermal efficiency, which should be at least twice the efficiency of an internal combustion engine at ordinary driving speeds. As the maximum performance of automobiles is pushed higher, the greater will be the advantage of the steam plant under everyday operation.

7. Entire absence of lubrication troubles, since no contamination of the crank-case oil, by kerosene, gasoline, water, road-dust, and carbon, can take place. The internal lubrication of cylinders, etc., is mostly accomplished by the water in the steam.

Industrial Miscellany

Factory

McIntyre Manufacturing Co., Columbus, Ohio, maker of the Farm Boy Tractor, has received an order for three tractors to be shipped to London, Eng., at once. Other orders from abroad are in prospect. In fact, business is so good that the present plant, located at 172 West Locust Street, is too small and the company is casting about for a location to erect a larger plant.

Xcell Manufacturing Co., located at 321 Mount Vernon Avenue, Columbus, Ohio, manufactures a device for the raising and lowering of Ford tops.

Crow Motor Co.'s plant, Elkhart, Ind., is being enlarged with a two-story addition, 125 by 60 ft. The addition is made necessary by the increased business of the company. The trimming and body departments will be located in the new building.

Elgin Motor Car Co., Chicago, Ill., is planning an addition to cost $75,000.

Perlman Rim Co., Jackson, Mich., is building an addition, 100 by 440 ft., and another, 80 by 380 ft., in addition to a former enlargement earlier in the season.

Simplex Automobile Co., New Brunswick, N. J., is planning the erection of a new plant for the manufacture of automobile bodies. A new factory for the manufacture of aeroplanes is also under consideration.

Goodyear Tire & Rubber Co. factory staff met the managers of the Southeastern District and their salesmen in Atlanta, Ga., recently for a 3 days' convention. All phases of the business of the past year and plans for the future were discussed. During the meeting it was announced that J. E. Taylor, sales-manager of the Atlanta branch, had been promoted to a place in a new department of sales promotion at the factory. Mr. Taylor had been in Atlanta 4 years and Charlotte, N. C., 3 years in Goodyear service.

Columbus Auto Parts Co., Columbus, Ohio, is doing a large business in automobile hardware, which is its specialty. Included in the list are wind-shields, robe brackets, foot rests, hub caps and other accessories. The company has recently booked large orders from automobile factories. C. J. Krag is president and R. E. Klager, secretary-treasurer.

C. A. S. Products Co., Columbus, Ohio, which manufactures gears, has booked an order for $75,000 worth of gears from a Cleveland automobile plant. This order, with others already on the books, will keep the plant busy for the coming year. The concern now employs 130 men. The plant is too small for the development of the business and an effort is being made by Adrian, Mich., to have the plant removed to that city.

Auto Cushion Fender Co., Columbus, Ohio, which was recently reorganized from the Welton Fender Co., is progressing nicely at its new place of business, the Columbus Auto Brass Co. Two sizes of fenders are now being manufactured. Dr. John M. Thomas is president; Dr. Fred Fletcher, secretary-treasurer, and J. W. Howe, general manager.

Personal

C. F. Barth has been appointed works manager for the C. F. Wilson Body Co., Detroit, Mich. Mr. Barth was formerly the factory and production manager for the Murphy Chair Co.

Willis Hollingsworth, South Bend, Ind., who has been connected with the Overland company, sailed Oct. 21 on the St. Paul, for London, where he will become instructor mechanic for the Overland company of Great Britain.

J. H. Guy, his wife, and Master Arthur Guy, of Laporte, Ind., were passengers of the Alaunia, of the Cunard line, which left New York for Falmouth and London, and struck a mine in the English Channel Oct. 19 and sunk. Mr. Guy was formerly vice-president of the Advance-Rumely Co. of Laporte, and resigned recently from the office. They were rescued from the steamer.

P. J. Wood has become sales manager of the Montreal, Que., branch of the McLaughlin Motor Car Co. Mr. Wood succeeds the late C. M. Bennett, and has been for many years with the McLaughlin company, previous to which he was connected with the Pope-Hartford Motor Car Co. of Canada.

Joseph Livingston, formerly assistant branch manager of the Studebaker Corp., at Omaha, Neb., has become manager of the Cleveland branch of the Maxwell company.

T. W. Warner, formerly with the Warner Mfg. Co., is manager of the Chevrolet Motor Co., Toledo.

E. L. Baker, Indianapolis, has been appointed president and general manager of the recently organized New Madison Sales Co., which will distribute Madison Sixes in Indiana. The Madison Motors Co., Anderson, Ind., recently was reincorporated with a capitalization of $2,000,000.

W. J. Hearn, head of the Hearn Tire & Rubber Co., dealer in automobile tires of Columbus, died suddenly of acute indigestion at the age of 52 years.

The Automobile Calendar

ASSOCIATIONS

Nov. 22—Boston, Mass., National Assn. of Automobile and Accessory Jobbers' Meeting.

Dec. 2-9—Electricians' Country-wide Celebration.

Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.

Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore. Special performance Ziegfeld's Midnight Follies.

CONTESTS

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race. Arizona State Fair.

Nov. 24 and 25—Newark, N. J., 24-Hr. Endurance Run of N. J. Automobile and Motor Club.

Nov. 30—Uniontown, Pa., Speedway Race.

Nov. 30—Los Angeles, Cal., Ascot Speedway 200-mile Championship Race.

1917

April—Los Angeles to Salt Lake City Road Race.

May 19—New York Metropolitan Race on Sheepshead Bay Speedway.

May 30—Indianapolis Speedway Race, Championship.

June 9—Chicago, Ill., Speedway Race, Championship.

June 23—Cincinnati, Ohio, Speedway Race.

July 4—Omaha, Neb., Speedway Race, Championship.

July 14—Des Moines, Iowa, Speedway Race, Championship.

July 28—Tacoma, Wash., Speedway Race, Championship.

Aug. 4—Kansas City Speedway Race.

Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.

Sept. 15—Providence, R. I., Speedway Race, Championship.

Sept. 29—New York, Speedway Race, Championship.

Oct. 6—Kansas City Speedway Race.

Oct. 13—Chicago Speedway Race.

Oct. 27—New York Speedway Race.

SHOWS

Nov. 10-18—Providence, R. I., Show, Rhode Island Automobile Dealers' Assn.

Nov. 20-25—Worcester, Mass., Show, Worcester Casino; Worcester Automobile Dealers' Assn.

Dec. 2-9—Springfield, Mass., Show, Auditorium. H. W. Stacey, Mgr.

Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 9-10—Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.

Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.

Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.

Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.

Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.

Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.

Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

March 6-10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

March 14-17—Davenport, Ia., Show, Coliseum Bldg., Tri-City Automobile Trade

M. L. Gallagher has been named as manager of the J. Mann Motor Co., Spokane, Wash., Studebaker distributor.

George L. Trotter Co., Seattle agent for the Stearns-Knight, Reo, and Stewart trucks, will soon erect a building near the corner of Bellvue and E. Pine Street, which will be of reinforced-concrete and brick construction, two stories high, and 50 by 107 ft. in dimensions.

B. E. Scearce, assistant manager of the Seattle branch of the Motor Car Co., has been appointed factory representative for the company in charge of the Montana territory. He will be succeeded by William Bradshaw.

A. J. Shorrock has been appointed manager of the Auto Tire & Rubber Co., Seattle.

W. A. Wallace has taken the agency for the Ford car in the E. Pike Street district of Seattle, Wash.

Harry Gowdy, better known as "Hank," the hero of the 1914 world's baseball series when with the Boston Braves, has taken a position as salesman with the Campbell-Gilchrist Sales Co., 15-17 North Fourth Street, agent for the Empire and Pennsylvania tires.

E. M. Dalley, proprietor of the Paige Motor Car Co. at New York, has bought an interest in the agency at Boston and the company there has been reorganized as a result. At first it was believed that the New York Paige agency would absorb the New England one. A new company has been formed now with Sherwood Hall, Jr., who has handled the car at Boston for some years as president, but Mr. Dalley is treasurer. W. B. Hennigan is sales manager. The company will occupy a new building that is to be erected at the corner of Commonwealth Avenue and Beacon Street.

H. F. Reid has become a stockholder and been appointed purchasing agent of the Fen Far Co., Cleveland. He has severed his connection with the M. & M. Co., Cleveland.

A. L. Edwards has been made manager of the Detroit branch of the Kelly-Springfield Tire Co. He is a son of G. D. Edwards, who died recently, and was manager up to the time of his death.

G. F. Weaver, formerly branch manager for the Jeffery in Cleveland, and later sales manager of the Philadelphia agency, has been appointed manager of the J. Harry Schumacker Co., which handles the Dorris and Moon cars in this city.

Dealer

Hainsworth Motor Co. has opened a branch in Tacoma, Wash., where the Oldsmobile will be sold under the management of A. B. De Castellane.

E. M. Lang has taken the agency for the Maxwell, Oakland and Chalmers cars at Auburn, Wash.

Knight Tire & Rubber Co. has closed its Seattle branch, and its products will be handled locally by the Pacific Tire & Rubber Co. in the future.

Mitchell Motor & Service Co., Seattle, have been appointed distributors of the Hal. Twelve in western Washington.

McNatt & Ferguson have taken the agency in the state of Washington for

H. Johnson has purchased the Commercial Auto Co., Tacoma, and has appointed Arthur Contay as chief of the mechanical department.

the Sun Light Six. They will have salesrooms at North Yakima, Seattle and Spokane.

Seven-Seven Co., distributor of Dodge cars in Spokane, Wash., has contracted to handle the Kissel line in Spokane and the Inland Empire.

Siler Auto Co., Spokane, Wash., has taken the agency in the Inland Empire for the Allen.

Maxwell Motor Sales Corp., Philadelphia, has located in its new service station at Twenty-second and Spring Garden Streets, formerly the Park Garage.

Buick Motor Co., Philadelphia, recently moved into its new building and service station at Broad and Poplar Streets.

John G. Wollaeger Co., 417-421 Wells Street, Milwaukee, Studebaker distributor for Wisconsin, has been appointed Milwaukee dealer for the Peerless Eight.

Calumet Garage Co., Calumet, Mich., has been appointed dealer in Jordan and Liberty cars.

F. D. Halferty, Antigo, Wis., is a new Dodge Bros. dealer for Langlade County.

Pathfinder Sales Co., 163 Eleventh Street, Milwaukee, has been appointed state distributor of Empire cars.

Wallace C. Hood, president of the Wallace C. Hood Service Bureau, Detroit, has enlarged his office space in the Dime Bank Building.

St. Louis Battery Co., St. Louis, has opened a sales and service station for Ever-Ready batteries at 3215 Locust Street.

Efficiency Oil Co., St. Louis, announces a service station for Mileometer tape at 3213 Locust Street.

Springfield Body Co. has opened a New York service station at 22 West Sixty-first Street. Chas. Baasch, formerly located at the factory in Springfield, Mass., is manager of the station.

KisselKar will for the first time be represented in Detroit by the George W. Franklin Co., 698-700 Woodward Avenue.

McCurdy-Brainard Co., Philadelphia, has been formed and will handle the Jordan car in Pennsylvania, New Jersey and Delaware. The company is headed by R. P. McCurdy, formerly Pierce-Arrow agent in Pittsburgh.

The Hudson-Stuyvesant Co., Cleveland, plans to erect a $500,000 plant devoted entirely to the sale of Hudson cars in Cleveland.

Gomery-Schwartz Co., Philadelphia distributor of the Hudson, has awarded the contract for the erection of a ten-story concrete building at Broad and Cherry Streets, costing about $400,000. The building will measure 137 by 180 ft.

O'Meara-Green Motor Co., Denver, has opened a Ford agency and service station at 1439 Cleveland Place.

Southwest Motor Co., Kansas City, Mo., has employed C. C. Tanner, formerly with the Halladay Motor Co., St. Joseph, Mo., as district manager for the Reo in Kansas and Missouri. C. B. Haycox, formerly district manager of the Velie Motor Car Co., Oklahoma City, and E. B. Baxter, formerly with the Buick and Studebaker companies of this city, have been added to the force.

Ebbeler Motor Car Co., St. Louis, distributor of Mitchell cars, has added the Metz for Missouri, southern Illinois and northern Kentucky.

Hathaway Motor Co., Kansas City, Mo., has taken on the Monroe and the Oldsmobile.

Buick Motor Co. has discontinued the sale of cars at retail in Milwaukee. The West Side Buick Co. will be Buick distributors under E. M. Jordan, formerly connected with the Buick Motor Co.

Fisk Tire Co., St. Paul, has moved to new quarters at 179 West Sixth Street with service station for forty cars at 402-404 North Exchange Street.

St. Paul Chandler Co. and White Auto Co. have opened new quarters at Sixth and Seventh Streets.

Detroit Electric Car Co., St. Paul, has begun erecting a sales and service station at Grand Avenue and Milton Street.

Elgin Motor Sales Co., Minneapolis, has been incorporated at $20,000 by H. S. Baker and R. G. Rowland of Minneapolis and G. S. Bannon of St. Paul.

Carlson Motor Car Co., Minneapolis, has been incorporated at $50,000. It will handle Kisselkar in the Northwest. W. T. Carlson is president and manager.

Wayne Oil Tank & Pump Supply Co., Davenport, Iowa, has purchased a lot on Seventeenth Street, near Second, in Rock Island, Ill., and will erect an oil service station of brick, one story in height. It has been decided to establish a series of these independent oil stations in the leading cities of the Middle West in order to take care of the automobile trade.

Bosch Magneto Co. has purchased a large plot of ground in Chicago upon which it will build a new and enlarged branch building. The erection of a new building has been rendered necessary largely by the big increase in general business of the Middle Western section. The present location, which is at Michigan Avenue and 24th Street, having an area of 6000 sq. ft., will be vacated about Dec. 1 for the new branch building located on the corner of Michigan Avenue and 37th Place, a location somewhat further south on Michigan Avenue and about midway between the old and new automobile districts. The spare parts, sales and repair departments will be on the main floor, as well as the stock room, the disassembling, washing and testing department, packing department and installation departments. The second floor will house the reception room, manager's office and trade department, as well as the superintendent's office, general office, financial department and drafting room.

Detroit Lubricator Co., Detroit, has issued a new folder descriptive of the latest Stewart carburetor installation for Ford cars.

Stearns Motor Car Co., St. Louis, has been reorganized to handle the Stearns-Knight car. The company will be reincorporated with G. B. Self, Howard L. Austin and A. L. Walsh as chief stockholders. A show room, 40 by 75, with a service room in the rear, has been leased in the Missouri Life Building at 1507 Locust Street.

Lackawanna Automobile Co., Packard, Chalmers and Saxon dealer, has let a contract for the erection of a five-story sales and service building at Vine and Wyoming Streets, Scranton, Pa. The building will have a floor space of 40,000 sq. ft. and will be ready for occupancy in March.

Elcar Motor Sales Co., Indiana distributor for the Elcar, last week closed a lease for two automobile display rooms being erected at 327 North Capitol Avenue, Indianapolis.

The AUTOMOBILE

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Advertisers' Index—Next to

STRONGER THAN EVER

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The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, NOVEMBER 9, 1916—CHICAGO NO. 19

New Co. Takes Over Pierce-Arrow

Pierce-Arrow Motor Car Corp. Formed to Acquire Present Company Stock

NEW YORK CITY, Nov. 8.—The Pierce-Arrow Motor Car Co., Buffalo, N. Y., will be taken over by the Pierce-Arrow Motor Car Corp., which has been formed with 100,000 shares of 8 per cent convertible preferred stock and 250,000 shares of common without par value. A syndicate of New York bankers, headed by J. & W. Seligman & Co., will underwrite the new issues.

The new capital will be used to increase the factory facilities.

George K. Birge, now president of the company, and prominent in the wallpaper business, will retire, and Col. Charles Clifton, now treasurer of the concern and for several years head of the N. A. C. C., will succeed him. Otherwise there will be no change in the organization.

Details of the refinancing plan so far determined provide that the preferred stock will be redeemable at 125, and will be convertible for common on a share-for-share basis. It is also provided that for every dollar in dividends paid on the common stock in excess of $5 a share there shall be set aside $1 for the purchase of the preferred stock. This preferred stock, when acquired, will be exchanged for common, and will be considered available for any stock dividends which may be declared. All of the stock of the existing company will be acquired and arrangements are being made to retire the $1,250,000 of 6 per cent bonds on Feb. 1.

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Firestone Capital to Be $15,000,000

AKRON, OHIO, Nov. 3—An increase from $4,000,000 to $15,000,000 in the capital of the Firestone Tire & Rubber Co., this city, was authorized yesterday by the stockholders. Two-thirds of this will be preferred and one-third common. Of the preferred, $5,000,000 is to be outstanding for the present. The nominal value of the common stock will be reduced from $100 a share to $10 a share and present shareholders will receive ten shares of new for each share held. Thus $3,000,000 new common will be outstanding. In addition the stockholders authorized the company to sell a maximum of 50,000 shares of new common at not less than $100 a share to employees of every grade. The company will begin dividends on the new common at the rate of $4 a year, which doubles the income of present stockholders. The shareholders authorized the company to set aside $1,000,000 for a fund to be used for insurance of employees, care of dependents, a pension plan, or such other welfare work as the directors shall determine.

The $5,000,000 preferred stock has been underwritten by the Cleveland Trust Co., the price to net the Firestone company par.

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Dolbeer Willys-Overland Treasurer

TOLEDO, OHIO,, Nov. 9—F. K. Dolbeer has succeeded Walter Stewart as treasurer of the Willys-Overland Co. Mr. Dolbeer was formerly with the financial department of the Victor Talking Machine Co. Mr. Stewart continues as a director.

—

King Raises Car Prices $50

DETROIT, MICH., Nov. 6—The King Motor Car Co. has raised the prices of its products. The sedan selling for $1,900 now sells for $1,950 and the seven-passenger touring car and the three-passenger roadster, both of which were $1,350, have been raised to $1,400.

The company announces that there may be an additional increase in the near future, owing to the constantly increasing cost of materials.

Steinmetz's Electric To Be Built

Dey Corp. To Build Lowest-Priced Electric for Utility and Other Uses

NEW YORK CITY, Nov. 8—The low-priced electric utility vehicle which Dr. Charles Steinmetz, engineering authority of the General Electric Co., has been advocating for several years seems near the point of realization. Such a vehicle will be manufactured by the Dey Electric Corp., with offices at 45 Broadway, N. Y. This concern has engaged show space for the Grand Central Palace show, New York, where these new electric vehicles will be on display, and it is planned to have production under way for the 1917 market.

A comprehensive line of what is described as the lightest, lowest-priced and highest efficiency electric vehicle ever built will be manufactured. The Dey company has secured a factory in the Metropolitan zone, and will specialize on a runabout intended primarily for utility work, such as solicitors, etc. The car is not a passenger type, nor yet a truck, but essentially a utility vehicle. In addition to this runabout a closed type of passenger vehicle will be produced. The company will manufacture what might be termed a utility chassis suitable for taxicab purposes, as well as passenger bodies and light truck uses.

That the designs of this lowest-priced electric are practically completed is apparent in that the cars will be at the New York show. That the company will go forward with an interesting manufacturing program is also apparent in that it is strongly financed and presumably closely connected with one of the large electrical manufacturers.

The dream of the $500 electric, as it

(*Continued on page* 788)

Injunction Holds Up Ford Profits

Dodge Bros., in Suit, Seek to Prevent Investment of Surplus Money

DETROIT, MICH., Nov. 3—A temporary writ of injunction against Henry Ford to restrain the Ford Motor Co. from distributing and investigating as fixed capital assets surplus profits that would otherwise be available for dividends, was issued in the Wayne circuit court yesterday.

The plaintiffs, John F. Dodge and Horace E. Dodge, stockholders in the company and also owners of the Dodge Bros. automobile plant, want the accumulation of cash surplus in the form of special dividends.

The cause of the writ, according to the Dodge bill of complaint, was the declaration by Mr. Ford at the end of the last fiscal year, that no special dividends would be declared in the future by the company and that surplus earnings would be used to extend the business.

The announced policy of Mr. Ford to engage in a multiplicity of undertakings was declared in the bill to be reckless in the extreme and to jeopardize seriously the interests of the stockholders. The bill states that Mr. Ford is engaged in negotiations to invest several million dollars in iron ore mines in Northern Michigan or Minnesota, to build ships transporting ore to smelters and to erect steel manufacturing plants, "thereby depriving stockholders of fair and reasonable returns upon their investment."

Mr. Ford owns 58 per cent of the capital stock of the Ford Motor Co. The authorized capital stock was placed at $2,000,000 in 1908. John F. and Horace E. Dodge each held 1000 shares par value $100 at that time. The Dodge Bros. contend that though the regular monthly dividends—5 per cent, or 60 per cent a year—are large on the $2,000,000 capital stock, the dividends amount to only a fraction of 1 per cent of the capital actually invested when the surplus is taken into account. They also allege that they have been unable to make any arrangements to discuss the plan with Mr. Ford and that he claims that since the profits are to be represented by investments in plants and capital, the stockholders should have no right to complain.

The defendants will be given a hearing to show cause why a permanent injunction should not be granted.

Ford Replies to Charges

The present plans of expansion contemplated by the Ford Motor Co. are only in accordance with the past policies of the company. Dodge Bros. have drawn $5,571,500 in dividends from an investment of $10,000 and still have holdings valued at $50,000,000. Political motives are behind the suit against the Ford company. These are statements by Henry Ford and his attorney Alfred Lucking in their replies to the suit instituted by Dodge Bros.

"At the founding of the Ford business," said Mr. Ford, "Dodge Bros. invested $10,000, but I don't think any of it was in cash. That was in 1903, and since then they have drawn out dividends amounting to a total of $5,571,500 in cash. Of course, they still have a 10 per cent interest in the business that is worth, on their own valuation, $50,000,000. Besides that during the life of the company we have paid them more than $27,000,000 in cash for material and parts made for us, on which I believe they made a profit of at least $10,000,000. It is on the profit of these payments and their dividends drawn from the Ford Motor Co. that their present fortune is built."

Mr. Ford made light of the allegation in the Dodge bill of complaint that his proposed expansion would injure them.

—

Velie Companies May Consolidate

MOLINE, ILL., Nov. 6.—A special meeting of the stockholders of the Velie Motor Vehicle Co. will be held Nov. 14 at Moline, Ill., to consider a proposition to consolidate with the Velie Engineering Co. under a single corporation under the style Velie Motors Corp., with a capital stock of $2,000,000.

—

Madison Motors Acquires Anderson Plant

ANDERSON, IND., Nov. 3—The Madison Motors Co., this city, has consummated a deal for the acquisition of the buggy and wagon plant of the Anderson Carriage Co. This plant will be known as the Madison plant No. 2, and is to be used for manufacturing and finishing bodies and tops as well as final assembly. Plant No. 1, the old Rider-Lewis building, later occupied by the Nyberg company, will be used for chassis manufacturing and assembly only. The addition of the Anderson carriage plant gives the company additional floorspace of about 175,000 sq. ft.

—

Woodard Resigns from N. J. Car Spring

JERSEY CITY, N. J., Nov. 6—S. P. Woodard has resigned from the New Jersey Car Spring & Rubber Co., this city. He has been for the past 2 years general and sales manager of this company. He will not be actively connected with the company in the future.

His immediate plans are uncertain. It is rumored that he is negotiating with a large western tire manufacturer and may handle the entire output of mechanical rubber goods and tires.

United Motors Buys Houk Co.

Ninth Company To Be Taken Over—Management Will Remain Unchanged

BUFFALO, N. Y., Nov. 6—The Houk Mfg. Co., maker of Houk wire wheels, has been purchased by the United Motors Corp., which brings the total number of concerns owned by this corporation up to nine. As with its previous purchases the Houk company will continue as a separate manufacturing organization, and George W. Houk, founder of the Houk company and the one person in the U. S. A. responsible for the present status of wire wheels, will continue as manager.

As with other properties purchased by the United Motors, the Houk Mfg. Co. will be largely increased. There are 500 men at present on the payroll but this number will be increased by 300 at once. Previous to Nov. 1 the capacity was 1000 wheels per day, but it is now up to 2200, and it will be 4500 per day by Feb. 1, according to present plans.

Approximately $1,000,000 will be expended on new buildings and equipment, the work connected with which will be started at once. The capacity of the plant will be doubled.

The progress of the wire wheel in America has been almost entirely connected with the name of George W. Houk. His work in this country started as a licensee of the Rudge-Whitworth company of England. He started manufacture Sept. 23, 1913, and first deliveries were made in February, 1914. To-day the company has an account with eighty-five different car makers, and during the last 12 months has averaged approximatelly 800 wheels per day. The company is at present manufacturing 40 per cent of the wire spokes used in its wheels. The spoke manufacture was started in March, 1915, when Houk purchased the American Spoke and Nipple Co., of Detroit, and moved the factory to Buffalo.

The month of October was the largest month in the history of the company. Total shipments were 19,461 wheels. On Oct. 24 unfilled orders on the books of the company totalled 197,205 wheels.

—

M. A. M. Annual Banquet Jan. 10

NEW YORK CITY, Nov. 3—The Motor and Accessory Manufacturers will hold their annual banquet at the Waldorf Astoria Hotel, this city, on Jan. 10. W. M. Sweet, former manager and now assistant to the president of the United Motors Corp., has been elected chairman of the banquet committee.

Fisher Body Buys Regal Plant

Also Adding Two Buildings Costing $260,000 and $225,000 —In Operation Next May

DETROIT, MICH., Nov. 2—The Fisher Body Corp. has purchased the factory of the Regal Motor Car Co. located opposite the main Fisher plant here. The Regal unit is already in active operation and with this additional capacity, the Fisher Co., it is stated, is now turning out about 60 per cent of all the closed automobile bodies being made in the United States.

Notwithstanding the increased production the corporation was not able to accept contracts recently offered them to furnish bodies to two of the large producers and therefore is adding to its already extensive plant in Detroit two large buildings, one costing $260,000 for general body construction and one costing $225,000 for service and repair departments, both of which will be in full operation next May.

Charter Oak Car Under Way

HARTFORD, CONN., Nov. 6—The Eastern Motors Syndicate, organized some time ago for the development of a high-grade automobile, has the designing work well advanced and plans are practically completed for construction of a building to meet the manufacturing requirements. The car will be known as the Charter Oak in honor of the city of Hartford, where the famous tree was located. The manufacturing organization will be known as the Eastern Motors, Inc., which will take over the present syndicate and has been incorporated for $1,000,000.

Ricker Heads Ricker Oil Co.

INDIANAPOLIS, IND., Nov. 7—Chester S. Ricker, consulting engineer, was elected president of the Ricker Oil Co., which was recently incorporated at Indianapolis. Associated with him are S. H. Penfield, vice-president of the Sakusvyrt Wheel & Mfg. Co., Jamestown, N. J., and president of the Peru Auto Parts Mfg. Co., Peru, Ind., as vice-president and Robert B. Denham of Indianapolis as treasurer.

Chalmers Motor Corp. Chartered

ALBANY, N. Y., Nov. 3—The Chalmers Motor Corp. formed last week to succeed the Chalmers Motor Co. as a result of the refinancing of the company, has filed articles of incorporation here. The company has 600,000 shares without par value. The directors are Benoni Lockwood, F. A. Gaynor and R. G. Goad, of 43 Cedar Street, New York City.

The Chalmers stock is now on the Curb market, having been offered by J. S. Bache & Co. and C. D. Barney & Co. at $35 a share. Common shareholders, according to the new financing plan, will receive for each share held four shares of the new, while preferred shareholders may have their shares redeemed at $115 or exchange on the redemption basis, about 3½ shares of the new for each share held. The new corporation will keep 135,000 shares in the treasury and use 200,000 shares for exchange purposes. Net proceeds of the 265,000 shares offered, or more than $9,000,000, will go into the treasury.

International Motors Co. Reorganization Plan Is Approved

NEW YORK CITY, Nov. 6—The reorganization plan of the International Motors Co. has been approved by the stockholders and creditors, over 93 per cent of the preferred and 94 per cent of the common being deposited with the two committees. A reorganization plan was adopted in September by which a new company of the same name will be formed to take over the present concern. Additional capital of $1,500,000 was raised and the $2,881,000 notes maturing the first of this month was obliterated.

By this plan the new company's securities will be exchanged on an equal basis for those of the present organization and will consist of $4,381,000 in 7 per cent cumulative first preferred stock, $2,723,000 second preferred and 53,638 shares of common of no par value. Of the first preferred, $2,881,000 is to go to the holders of the notes at par, and the balance will be issued for cash to provide working capital, being offered to stockholders at par with common stock thrown in. Holders of the present $3,600,000 preferred will receive 60 per cent in new second preferred and 10 per cent in new common. For the outstanding $5,628,000 common, 10 per cent in second preferred and 10 per cent in new common is to be exchanged.

Rochette Sails for S. A.

NEW YORK CITY, Nov. 4—Edward Rochette, special representative of the Willys-Overland Co., sailed to-day on the steamer "Pastores" for South America by way of Panama Canal and the West Coast. His destination is Valparaiso, Chile. Mr. Rochette has represented Willys-Overland for some years in the South American field, where he makes headquarters at Buenos Aires.

Winckler with Pittsburg Engine

RACINE, WIS., Nov. 6—A. E. Winckler, formerly chief engineer of the automobile department of the J. I. Case T. M. Co., Racine, has become chief engineer of the Pittsburg Model Engine Co., Pittsburg.

S. K. F. Controls Hess-Bright?

Control of Conrad Ball Bearing Patent License Royalties a Part of Transaction

NEW YORK CITY, Nov. 8—Control of the Hess-Bright Mfg. Co., Philadelphia, Pa., manufacturer of ball bearings, has been secured, it is rumored, by the same financial interests that own the S. K. F. Ball Bearing Co., Hartford, Conn. It is understood that over 50 per cent of the Hess-Bright stock has been secured by the latter concern. No statement has been issued by the S. K. F. company. It is assumed the Hess-Bright factory in Philadelphia will be operated as formerly, and perhaps on an increased scale.

Conrad Patent Included

With the purchase of the Hess-Bright company goes the now celebrated Conrad patent, which was adjudicated in the courts a year ago and which patent has been a valuable asset of the Hess-Bright company. This patent refers to an annular type of bearing in which the balls rotate in a groove presenting a continuous surface. Several bearing concerns have been licensed by Hess-Bright under this patent, these including: New Departure Mfg. Co., Standard Roller Bearing Co. By securing control of the basic patent the S. K. F. Ball Bearing Co. will receive all royalties accruing therefrom. These royalties are a large figure at present and will naturally increase with the greater development of the industry.

Republic Truck Shipments Gain

ALMA, MICH., Nov. 3—Shipments of the Republic Motor Truck Co. in October amounted to 626 trucks, compared with 190 in 1915 and thirty-five in 1914. For the first 10 months of this year the shipments were 4902 trucks, against 1442 in the corresponding period of last year.

Commercial Auto Body Co. Formed

BAY CITY, MICH., Nov. 1—The commercial Auto Body Co., this city, has been formed to manufacture commercial bodies for Fords. The incorporators are W. B. Fitzgerald, Henry Kinney, Robert Woodworth, A. E. Hubbell, Adam Schepper, Edward Covert, W. P. Kavanagh and W. H. Kelly.

Gasco Mfg. Co. Organized

LANCASTER, PA., Nov. 1—The Gasco Mfg. Co. has been formed in this city to manufacture specialties for Fords. R. W. Shreiner is president and general manager. One of the articles to be manufactured is a new cowl dash light for Fords. This company will also put out a new heater for Fords.

Supreme Court Hears Tax Case

Arguments Heard in N. J. Test on Legality of Taxing Non-Residents

WASHINGTON, D. C., Nov. 8—Whether a State can tax an automobilist from another State for the use of its roads will be decided shortly by the United States Supreme Court, the argument for the so-called New Jersey test case prepared by the American Automobile Assn. and the National Automobile Chamber of Commerce having been presented Oct. 31. The case is that of Frank J. Kane against the State of New Jersey, based on his interstate journey from New York to Pennsylvania, which resulted in his being convicted and fined for violating three provisions of the New Jersey law, first that he had failed to register his car in New Jersey; second, that he failed to pay the tax imposed on non-residents; and third, that he failed to file with the Secretary of State a power of attorney.

The American Automobile Assn. was represented by John W. Griggs, former attorney general of the United States, and Charles Thaddeus Terry appeared for the N. A. C. C. The argument presented by them set forth these contentions:

1—It being admitted in the record that the fees charged for the operation of automobiles over the highways of New Jersey result in a large surplus revenue to the State over and above the expenses of examination, licensing, registering and inspecting the automobile traffic on the highways, the charge is a tax which is not in conformity with proper tax laws in that the motor vehicle is burdened with a heavy impost, irrespective of its value, whereas other property is taxed only according to its value.

2—The so-called "license-fee" being in reality a tax, is unreasonable and void as such tax because even assuming that it is a charge for the use of a special facility, to wit—the improved roads furnished by the State of New Jersey, it is unreasonable because a lump sum is charged irrespective of the question how much or to what extent the automobile uses the roads. For example, the same fee is charged for the right of the automobile to go a few hundred yards, as is charged to the automobile which traverses the roads of the State for a whole year covering thousands of miles. Thus the charge is unequal, disproportionate and not upon any scientific or logical basis, and, therefore, improper and illegal.

3—The improved roads of a State are not a "special facility" afforded by the State to automobiles, but their construction and presentation to the public are simply governmental functions which should be paid for out of the general tax fund in the same way that the police force and the fire department are afforded for the use of all the citizens irrespective of the amount of use. Therefore, no special charge or impost can be levied for their use to any particular class of users.

4—That the law is discriminatory and class legislation in that even assuming that the license fee is a charge for the use of the roads, it is not imposed equally upon all the users of the roads. Horse-drawn vehicles use the roads and use up and destroy the roads in a large degree, and, therefore, if the tax were to be an equal and uniform tax, it must be imposed upon horse-drawn vehicles as well as upon automobiles.

5—The requirement that before any non-resident shall use the highways of the State, he must file a power of attorney with the Secretary of State, and authorize such secretary to receive service of process for him, is ousting him of his domicile and imposing a requirement which is not imposed upon any other class of non-resident citizens of the United States going into the State of New Jersey. It is assuming in advance that the automobile user is likely to commit a criminal act which is absurd on the face of it. He is no more likely to commit a criminal act than any other non-resident entering the State of New Jersey, and even if he were, such a method of enforcing the criminal law is unknown to our jurisprudence.

6—The requirement of a power of attorney from non-residents and the imposition of a tax upon non-residents and the requirement that before the highways shall be used by non-residents they shall make application and take out registration, are burdens on interstate commerce which the Constitution of the United States forbids under the Fourteenth Amendment thereof.

It is expected a decision will be rendered by the court before the holiday recess.

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Ypsilanti Motor Truck Co. Organized

DETROIT, MICH., Nov. 6—Stockholders of the Globe Motor Truck and Body Co. met Nov. 3 and organized the Ypsilanti Motor Truck Co. with a capitalization of $100,000.

The board of directors includes: H. R. Scoville, Charles N. Haviland, D. L. Davis, F. W. Paton, Frank R. Welsh, H. F. Shaefer and Gilbert E. Porter, all of Ypsilanti. A factory will be built.

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Steinmetz Electric To Be Built

(*Continued from page* 785)

was styled 2 years ago, has been a cherished matter with Dr. Steinmetz. It has been known for several years that he has been perfecting features of design which would make it possible to produce a utility electric vehicle at practically the same price as the cheaper gasoline machines. Dr. Steinmetz strongly advocated this type of vehicle before the different electric interests, as well as before the electric vehicle manufacturers. It was generally considered impossible to build such a vehicle that would give the desired service. The possibility of producing such a vehicle resulted in many strenuous arguments on convention floors, between central station concerns, or companies manufacturing electric current, and those engaged in vehicle manufacture. The central station interests were strong for such a vehicle, as it would naturally be a great source of revenue if manufactured in large quantities. On the other hand, electric vehicle makers were catering to public requirements for larger and more luxurious types of electric vehicles.

The price of the new lowest-priced electric to be built by the Dey corporation has not been determined, but it is understood that it will be under $1,000 and that eventually the dream of Dr. Steinmetz for a $500 vehicle may be attained, if not carried further.

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$9,000,000 for Freight Cars by M. C.

DETROIT, Nov. 3.—The Michigan Central Railroad has just closed a contract for the construction of 6750 freight cars, of which 4000 will be cars equipped for carrying automobiles.

Overland Convention in Dec.

Co. Will Be Host to 4000 Dealers of U. S. and Canada

TOLEDO, OHIO, Nov. 4—December is to be the month for the grand welcome to the 4000 Overland dealers of the United States and Canada, and plans are now being formed to make it an epochal month in the history of the big Willys-Overland organization. Beginning about Dec. 4 and ending Dec. 23 there will be a series of gatherings of the Overland dealers here. It is planned to make it the biggest event of its kind ever held in the automobile industry.

Entertainment in Relays

The country is being divided so that the agents from one section will follow those of another every few days until the entire organization has been entertained. Each division will spend about 2 days and 3 nights in the city, and there will be visits to the factory and talks in the new administration building.

President John N. Willys plans to be on hand, so that he may have a chance to talk to all his dealers and give them some word of encouragement for the forthcoming season. At that time he will be ready to announce what the production is going to be, and if there is to be any change in the style of models, prices, etc. From the factory no inkling has been given out as to any proposed announcements, but it would not surprise many of the dealers if new models or new prices were planned, and they were let into the secret just before the big shows, so that they could begin their operations for the new year.

The factory will be the host of the visiting dealers while they are in this city, but the men will pay their own fares to and from their homes. It has been arranged that the dealers will get the benefit of excursion rates.

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Kuhn Is Four-Wheel-Drive Tractor

SEATTLE, WASH., Nov. 4—The Kuhn Tractor Truck Co. has been organized here to manufacture a tractor truck, the chief feature of which is that each wheel operates independently of the other. It has a four-wheel drive and power may be applied to all wheels or to each one. There is a positive power control and some of the wheels may be buried in the mud, but the power can be applied to the free wheels alone and no slipping results. The truck is in this way pulled out of difficult positions. A four-wheel brake is another unique feature which equalizes the tension on all wheels at the same time.

127 New Accessory Exhibits

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Makes Total of 340—Every Inch of Space Taken—Car Space All Filled

NEW YORK CITY, Nov. 8—The Motor and Accessory Manufacturers, which recently allotted space in the national automobile shows to 115 members, has added 127 concerns not members of the association. With ninety-eight car exhibits, the total reaches 340. Every inch of available space for both the local and Chicago national shows has been allotted. For the first time in the history of the national shows all the space allotted to automobile exhibitors has been filled, and at the first drawing.

The new accessory exhibitors follow:

	New York	Chicago
Acieral Co. of America, New York.	X	X
Adams & Findlay, New York	X	
Adamson Mfg. Co., East Palestine, Ohio.	X	
J. Alexander Mfg. Co., New York.	X	
American Bureau of Engineering, Inc., Chicago	X	
American Express Co., New York.	X	
Armstrong Cork Co., Pittsburgh..	X	X
Asch & Co., Inc., New York	X	
Auto Gear Co., Inc., New York....	X	
Auto Gear & Parts Co., Chicago...		X
Automatic Transmission Co., Inc., New York	X	X
Barnes Foundry Co., Jersey City..	X	
Bausch Machine Tool Co., Springfield, Mass.	X	
Bay State Pump Co., Boston	X	X
Becker Bros., Inc., Chicago	X	X
Benjamin Electric Mfg. Co., Chicago		X
Bournonville Welding Co., New York.	X	
Brunswick - Balke - Collender Co., New York	X	X
Chaismith Co., Chicago	X	X
Class Journal Co., New York	X	X
Continental Motor Equipment Co., New York	X	
Corcoran Mfg. Co., Cincinnati	X	
Cox Brass Mfg. Co., Albany	X	
Craftsman Motor Corp., Chicago...	X	
Crew Levick Co., Philadelphia	X	
Culver Stearns Mfg. Co., Worcester, Mass.	X	
Curtis Pneumatic Machinery Co., St. Louis	X	X
Cutler-Hammer Mfg. Co., Milwaukee.	X	
Detroit Battery Co., Detroit	X	X
Disco Electric Starter Corp., Detroit.	X	X
Drabek Equalizer Co., Cleveland..	X	
Dunham Piston Ring Co., New York.	X	
Eastern Rubber Co., Philadelphia..	X	X
Essex Rubber Co., Trenton, N. J...	X	
Eureka Rim Compressor, Inc., Addison, N. Y.	X	
J. H. Faw, Inc., New York	X	
Fitzgerald Mfg. Co., Torrington, Conn.	X	
Peter A. Frasse & Co., New York.	X	
Fulton Co., Knoxville, Tenn	X	X
General Tire & Rubber Co., Akron.	X	
Gibson-Hollister Mfg. Co., Jamaica Plain, Mass.	X	
Gould Compensating Gear Co., Redding, Cal.	X	X
Emil Grossman Mfg. Co., Inc., Brooklyn	X	
H. & D. Co., Goodland, Ind	X	X
H. & D. Carburetor Co., New York.	X	
Hart-Bell Co., New York	X	
Hill Insulating & Mfg. Corp., New York.	X	
G. L. Holmes, New York	X	
Holt-Welles Co., Inc., New York...	X	
Hoover Spring Co., San Francisco.	X	X
Houpert Machine Co., New York..	X	
Howe Mfg. Co., Chicago	X	X
W. H. Howell Co., Geneva, Ill		X
Humboldt Machine & Stamping Co., Long Island City, N. Y.	X	X
Humphrey's Sales Corp., New York	X	
Improved Gauge Mfg. Co., Syracuse.	X	
Inland Machine Works, St. Louis..	X	X
International Coat Co., New York.	X	
Interstate Electric Co., New Orleans.	X	X
J. H. Tonneau Shield Co., New York	X	X
Juhasz Carburetor Co., New York..	X	
K-W Ignition Co., Cleveland	X	X
Kemco Electric Mfg. Co., Cleveland	X	
Lane Bros. Co., Poughkeepsie	X	X
L. Lawrence & Co., Newark, N. J.		X
Lowe Motor Supplies Co., New York.	X	
McKinnon Dash Co., Buffalo	X	
McQuay-Norris Mfg. Co., St. Louis.	X	X
Paul M. Marko, Brooklyn, N. Y...	X	
Marvel Accessories Mfg. Co., Cleveland	X	X
Master Spark Co., Chicago	X	X
Mattson Rubber Co., Lodi, N. J...	X	
S. Whyte Merritt Co., New York...	X	
Metal Specialties Mfg. Co., Chicago.	X	
Metal Stamping Co., Long Island City, N. Y.	X	X
Charles E. Miller, New York	X	
Miller Transmission Co., New York.	X	
Moreau & Pratt, Inc., New York...	X	
L. J. Mutty Co., Boston, Mass....	X	
Myle-Mayker Co., Chicago	X	X
New Era Spring & Specialty Co., Detroit.	X	X
Packer Auto Specialty Co., New York	X	
Parker Rust Proof Co. of America, Detroit.	X	X
Perkins-Campbell Co., Cincinnati..	X	
N. A. Petry Co., Philadelphia	X	
Philadelphia Storage Battery Co., Philadelphia.	X	X
Phillips Auto Seat Cover Co., New York.	X	
A. J. Picard & Co., New York	X	X
Pittsburgh Electric Specialties Co., New York	X	
Pouvailsmith Corp., Poughkeepsie.	X	X
William E. Pratt Mfg. Co., Chicago	X	X
W. E. Pruden Hardware Co., New York	X	
Reliable Auto Heater Co., Cleveland.	X	X
P. Rielly & Son, Newark, N. J....	X	
Rubber Insulated Metals Corp	X	X
W. A. Schleit Mfg. Co., Inc., Syracuse	X	X
Scully & Brandt, Inc., New York...	X	
Seaboard Industrial Products Co., New York.	X	
Sipp Machine Co., Paterson, N. J..	X	
Small & Singleton, Brooklyn, N. Y.	X	
Smith Form-A-Truck Co., New York.	X	
Spray Primer Co., Boston	X	X
John T. Stanley Co., Inc., New York.	X	
Stentor Electric Mfg. Co., New York	X	
Sternberg & Co., Chicago		X
Stevens & Co., New York	X	X
F. W. Stewart, Chicago	X	
Charles O. Tingley & Co., Rahway, N. J.	X	
Tobey Polish Co., Chicago		X
Triple Action Spring Co., New York.	X	
Triple Action Spring Co., Chicago..		X
Tuthill Spring Co., Chicago		X
United Engine Mfg. Co., Hanover, Pa.	X	X
Universal Motor Products Co., Minneapolis		X
U. S. Air Compressor Co., Cleveland	X	X
U. S. Gauge Co., New York	X	X
U. S. Metal Goods Co., Cleveland..	X	X
Van Cleef Bros., Chicago		X
Wales-Adamson Co., Chicago		X
Walker Mfg. Co., Racine	X	X
Wasson Piston Ring Co., New Brunswick, N. J.	X	
Water Gas Carburetor Co., Kansas City	X	X
Weaver Mfg. Co., Springfield, Mass.	X	X
Westfield Chemical Co., Westfield, Mass.	X	
Weston Electrical Instrument Co., Newark.	X	
C. A. Willey Co., Long Island City, N. Y.	X	
"X" Laboratories, Boston	X	X

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Brewster & Co. Joins N. A. C. C.

NEW YORK CITY, Nov. 6—Brewster & Co., Long Island City, carriage builder, and which 2 years ago began the making of a car with a Knight engine, has been admitted to membership in the National Automobile Chamber of Commerce.

Time Payment Plan for Trucks

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Guaranty Securities Corp. Method Is Similar to Passenger Car Scheme

NEW YORK CITY, Nov. 6—A time-payment plan for truck sales has just been adopted by the Guaranty Securities Corp., which about a year ago entered the field to finance the sale of passenger cars by dealers. The new plan is similar to the passenger car plan, which was described in THE AUTOMOBILE for April 6, but the percentage of cash demanded is not so great because the truck is strictly a necessity and pays for itself.

The status of the Guaranty business may be surmised from its statement that since Jan. 1 it has financed $18,000,000 of passenger car business. The truck plan has been in operation but a few days.

Collects 25% Cash

For a general understanding of the plan it may be stated that when the dealer sells a truck he collects 25 per cent cash from the customer and is paid nearly all the balance by the Guaranty corporation, which collects from the truck buyer through notes. For handling and for adequate insurance a Guaranty charge is made and is paid by the truck buyer. A small part of the sales price of the truck is retained by the Guaranty corporation until the buyer's notes are all paid, but on his deferred payment the dealer gets the prevailing rate of interest.

When a dealer sells a truck of which the f.o.b. factory list is $1,200 the dealer adds freight and the Guaranty charge in arriving at the "Buyer's Delivered Price." This Buyer's Delivered Price is the basis of figuring. It is as shown in the plan outlined in the table on page 795.

Several terms in the plan may require explanation as may also some of the steps.

Delivered Price to the truck buyer consists of the list price of the truck, including body and chassis, the freight from the factory to the dealer and the Guaranty charge. If the truck is an electric the delivered price may include the battery provided the Guaranty corporation approves of the make of battery. This, in effect, means that the battery may be included if it is supplied with the truck as shipped from the factory.

Guaranty Charges are approximately 3 per cent, but for convenience in figuring the prices of trucks have been graded in units of $250 and a flat price arrived at for each class, as is shown by the table of charges on page 795.

(*Continued on page* 795)

120,000 Cars in Canada

Ontario Leads with 50,000—100,000 Cars To Be Produced There in 1917

TORONTO, ONT., Nov. 3—Government registration returns indicate that there are approximately 120,000 cars owned in Canada to-day—an increase in round figures of 45 per cent since a year ago. Ontario with approximately 50,000 cars, maintains her position as the banner automobile province of the Dominion, as in Ontario are owned more than three times the number of cars owned in any other province, and approximately 42 per cent of all the cars in the Dominion.

This large increase in the number of cars in Canada is primarily attributable to two things. The first is, of course, national agrarian, industrial and commercial prosperity, and in the second place to the inauguration in Canada, only now getting under way, of the aggressively progressive intensive car merchandising methods long since successfully in operation in the States.

With every facility to speed this development, Canada has over 400,000,000 acres of fertile wheat land awaiting cultivation—the only great arable tract of land undeveloped in the world under salutary democratic government.

The automobile plants of Ontario will build during the coming year over 100,000 cars, according to their production schedule.

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Pennsylvania Fees for Good Roads?

PHILADELPHIA, PA., Nov. 3—Announcement was made by Governor Brumbaugh, of Pennsylvania, at the opening exercises of the new William Penn Highway at Easton, that a hill would be submitted to the next Legislature providing that all money received by the State from licenses will be turned over to the highway department for new highways. He also announced that the bill would provide for an annual contribution by the State of $5,000,000 for that purpose. The William Penn Highway which was dedicated runs from Pittsburgh to Easton.

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Canada Uses 30 per Cent More Gasoline

KINGSTON, ONT., Nov. 4—According to U. S. Consul Felix S. S. Johnson at Kingston, the consumption of American gasoline in Canada this year has been greater than ever before. To date the amount used is 25 to 30 per cent larger than last year. In the average year the consumption in Canada is about 60,000,000 gal. With an increase of 25 per cent the consumption this year will be about 75,000,000 gal. Throughout the period of high prices gasoline has been cheaper in Ontario than elsewhere.

For the purposes of comparison with Canadian prices the imperial gallon must be used as a basis. This is one-fifth larger than the wine gallon and would bring the American price to 27.6 per gal. To this must be added the duty of 2.5 cents per gallon and freight to the amount of 1.25 cents per gallon. This would bring the cost of Canadian gasoline to 31.35 cents per gallon from tank to garages. The war tax of 7½ per cent is also levied. There are indications that present war prices will go down as a result of poor weather and the increased production of crude oil.

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New Parking Law for Baltimore

BALTIMORE, MD., Nov. 4—Baltimore's new automobile parking law went into effect last week and scores of automobilists were arrested in all parts of the city.

The law requires that no vehicle of any kind be left standing on any streets during the day longer than 2 hr. at a time, nor longer than 3½ hr. at night. The biggest objection raised against the ordinance is that it affects unfrequented streets of the city as well as those on which the traffic is heavy.

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Waukesha Motor Promotes Industrial Education

WAUKESHA, WIS., Nov. 4—A unique plan for the promotion of industrial education has been evolved by the co-operative effort of the Waukesha board of industrial education and the Waukesha Motor Co., motor manufacturer, with the approval of the Wisconsin State board of industrial education. By this plan it will cost the city only a nominal sum for high class instruction, and no investment or upkeep for facilities is required. The Waukesha Motor Co. has permitted the local board to establish a school organization directly within its big plant. The school is open to any person who qualifies by being 16 years of age or over. Part of the time during each day will be devoted to actual teaching and instruction related to the general problem of gas engineering, while the remainder of the day will be devoted to the teaching of citizenship and to diversified employment within the factory itself. Enrollment is open to any young man, whether at present employed by the Waukesha Motor Co. or not, and full wages will be paid for the time devoted to schooling, the same as for employment.

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Pennsylvania License Fees $2,301,240

PHILADELPHIA, PA., Nov. 3—Up to Oct. 30, the Pennsylvania State Highway Department received $2,301,240 in license money. For the entire 12 months of 1915 the amount was $1,650,000.

Mass. Registrations Gain 31,000

113,786 Passenger Cars—17,682 Trucks—8864 Dealers' and Makers' Cars

BOSTON, MASS., Nov. 4—Registration figures in Massachusetts continue to set new records and the Highway Commission has announced that for the first 10 months of this year the relative proportion of increase has been greater than in the past 2 years. Up to Nov. 1 there were 113,786 passenger cars, 17,682 commercial vehicles and 8864 cars belonging to manufacturers and dealers. This gives a total of 140,332 machines. There were 162,046 licenses issued and the receipts have run up now to $1,537,737. These figures exceed expectations. The figures show a gain of some $300,000 in fees over the same time a year ago, and something like 31,000 more cars. The following table gives the comparative figures for the same periods for the past 3 years:

	1916	1915	1914
Automobiles ...	*181,468	†100,500	‡76,145
Manufacturers or dealers....	1,966	1,732	1,514
Licenses, operator and chauffeur ...	55,045	42,325	25,651
Operator and chauffeur renewals	107,001	85,865	70,166
Examinations .	11,179	9,693	.....
Total receipts..	$1,587,237	$1,189,010	$916,712

*Includes 17,682 commercial vehicles.
†Includes 11,564 commercial vehicles.
‡Includes 8,078 commercial vehicles.

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Automobile Telegraphic Code on Market

SAN FRANCISCO, CAL., Nov. 6—The Code Publishing Co. has placed on the market a standardized automobile telegraphic code which is the work of Robert E. Pye. The book has been endorsed by the National Assn. of Automobile Accessory Jobbers, which recommends its use. The code is divided into three divisions: Merchandise, in which is coded supplies, accessories and car models; general phrases, covering orders, shipping, prices, general communications, etc.; the third division is tables of measurements, money, transportation, etc. The book will be distributed by Commissioner W. M. Webster of the N. A. A. A. J., Chicago.

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Engel to Promote Oldsmobile Sales

LANSING, MICH., Nov. 6—J. W. Engel has been appointed manager of the sales promotion department of the Olds Motor Works. Before entering the automobile field Mr. Engel was in newspaper work and for several years filled an executive position with the U. S. Postal Service.

Para Needs More Good Roads

Gaidzik, Representing Nash in S. A., Finds Little Future Without Them

NEW YORK CITY, Nov. 4—George W. Gaidzik, South American representative of the Nash Motors Co., arrived in this city yesterday after a 10 months' business trip along the East Coast of South America, where he has been establishing agencies and demonstrating the Jeffery Quad and the Jeffery passenger car. During his recent trip Mr. Gaidzik has spent most of his time in Buenos Aires, Montevideo, Sao Paulo, Rio de Janeiro, Bahia, Pernambuco, and the two Amazon cities, Para and Manaos. Speaking of the present possibilities of automobiles in the Amazon valley, Mr. Gaidzik does not look for a big future of either of the cities of Para or Manaos. From 5 to 10 years and perhaps more may be necessary to get the road-building movement started. Para, near the mouth of the Amazon, is a city of 150,000 with 200 automobiles. Of these seventy-five are privately owned vehicles, and the remainder are in taxi service. Motor trucks have made little progress in this city, there being only five trucks most of which are used in the brewery industry. To these must be added delivery wagons used by the large stores, which are not very numerous.

As in the majority of South American cities, the streets of Para are well paved with stone block, a good surface for motor use. The trolley tracks are, however, used almost exclusively. Cars for this city should have right-hand steering, although left-hand will do. The rules of the road in Para are the same as in the U. S. A. The 56-in. tread is satisfactory.

Manaos a Rubber City

Once the streets of Para are left there are no roads with the exception of dirt trails in the immediate outskirts of the city. The country is fairly level but generally covered with forest. There being little cultivation surrounding the city there is naturally no market for cars outside of the city limits.

The city of Manaos, like Para, is essentially a rubber city, but located well up the Amazon. With a population of over 100,000 there are about 100 automobiles in the city, a quarter of which are in use. To these must be added three or four motor trucks in the service of breweries and ice companies. You can use an automobile on the streets of the city and on the outskirts but once you are beyond these, the forest begins and all use of a car ends. The city streets in Manaos are paved with stone blocks as in Para.

In both of these rubber cities of the Amazon, the odor of crude rubber is omnipresent. There is a constant teaming of it in the city from dock to warehouse. Both cities are well provided with hotel accommodations. In Para there is a five-story hotel which ranks with any in South America. It is being added to at the present time. The hotel accommodations at Manaos, while not so extensive, are quite satisfactory.

The population in both of these rubber cities is largely Portuguese. There is a good sprinkling of English. All of the poorer classes are black.

Automobile imports in these Amazon River cities, according to figures from the Brazilian government, are as follows:

Port	1910	1911	1912	1913	1914	1915
Manaos	32	31	29	24	5	0
Para	72	76	61	58	14	0

Security Co. to Finance Dealers

ST. PAUL, MINN., Nov. 2—The Security Mortgage Co., this city, has been formed with a capital of $1,000,000 to finance automobile and truck sales here. It has taken headquarters in the New York Life Building and will begin business at once. G. N. Michaud will be in charge of the office.

J. N. Storr, president of Kuhles & Stock Co. is president; A. Hirschman, vice-president of the People's Bank, is vice-president; N. P. Rogers of Rogers & Rogers, live stock dealers, is treasurer and G. N. Michaud, secretary and general manager.

Two New Jeffery Sedans

KENOSHA, WIS., Nov. 6—The Nash Motors Co., this city, has brought out two new Jeffery sedans in four- and six-cylinder seven-passenger types, the tops being removable for summer touring. The large French plate windows drop 5 in. for ventilation in warm weather, the rear window measuring 19½ by 31 in. Divided front seats eliminate the necessity of fore doors and thus do away with the need for a panel between the front window and the rear door. Upholstery is gray whipcord and there are roll curtains on the windows.

Cassidy Handling Corning Conaphore

NEW YORK CITY, Nov. 6—The Corning Glass Works, Corning, N. Y., has appointed the Edward A. Cassidy Co. as sales division for the Corning Conaphore, a new device for giving the right direction and long range to automobile headlights, and for eliminating glare. It is made in white glass and patented Noviol yellow tint glass, which eliminates the violet-blue rays, enabling the light to penetrate fog and dust and does away with back glare.

Canadian Farmers Prosperous

High Price of Wheat Stimulates Sale of Automobiles to Rural Population

TORONTO, ONT., Nov. 3—Using the wheat quotations of the week as a barometer, the automobile manufacturers who sell machines to the farmers of western Canada find the outlook most gratifying. December wheat was quoted at $1.90 last week, nearly twice the figure of some seasons. Canada's war crop of wheat is yielding handsome profits to the farmers, which leads W. P. Hinton, traffic manager of the Grand Trunk Pacific Railway, to measure prosperity in terms of automobiles owned, and cars bought, in the present year.

"Farmers are exceedingly prosperous," he states, "and their purchasing power was never so great."

"Perhaps a striking illustration of this fact," declares the railroad man, "is that approximately $2,000,000 more than in any other year has been expended by the rural population in the purchase of automobiles. In fact, the automobile seems to have become a farm necessity, and even if we are disposed to consider it an extravagance, it certainly adds to the joy of living in the agricultural districts of Canada."

Racine Tire Branch Managers Meet

RACINE, WIS., Nov. 4—The Racine Auto Tire Co., this city, which already has announced plans for a new plant involving $100,000 or more, entertained its branch managers and salesmen at a convention at the present factory for two days last week. The policies of the company and plans for the disposition of the 1917 output were discussed. Managers of the branches at Chicago, Milwaukee. Minneapolis and Des Moines were present.

Selden Division Managers in Conference

ROCHESTER, N. Y., Nov. 6—The first conference of division sales managers and prospective division managers of the Selden Truck Sales Co., this city, under the regime of Sales Director H. T. Boulden, was held Nov. 2, 3 and 4.

Mr. Boulden presided, being assisted by President Geo. C. Gordon, Vice-President Wm. C. Barry, Jr., and Secretary R. H. Salmons.

Representatives in attendance were George S. Holvey, home office sales department; E. W. Templin, Chas. N. Gillette, Southeastern representative; Chas. E. Collard, Atlantic Coast representative; Wm. C. Barry, Jr., general manager, Selden Motor Vehicle Co.; Edward F. Drew, Middle West representative; Paul B. Donaldson, Northwest representative; W. E. Dugan, factory manager; H. T. Boulden, sales director; J. E. Morse, New England representative; C. L. Du Puy, Southwestern representative; S. P. Gould, Rochester, and D. S. Everett, Pacific Coast representative.

Anderson Sales Gain 141 Per Cent

Car Shipments for 4 Months Increase 79 Per Cent Over 1915 Period

DETROIT, Nov. 4.—The Anderson Electric Car Co. had an increase in business amounting to 141 per cent during its fiscal year. Car shipments for 4 months of the current year have been 79 per cent greater than for a similar period in 1915, and it is expected that the company's business for the current year will be 100 per cent greater than last year. Directors elected are: W. C. Anderson, M. S. Towson, J. B. Book, Jr., G. M. Bacon, G. D. Fairgrieve, W. M. Locke, W. P. McFarlane, W. H. Murphy, F. E. Price. The directors elected officers as follows: W. C. Anderson, president; M. S. Towson, vice-president; G. D. Fairgrieve, vice-president and assistant treasurer; W. P. McFarlane, secretary and factory manager; W. M. Locke, treasurer; F. E. Price, assistant treasurer; Wilson Oritzer, assistant secretary.

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Studebaker Earns $8,140,420

DETROIT, Nov. 3.—The Studebaker Corp. reports net profits for the 9 months ending Sept. 30 amounting to $8,140,420. The net profits for the same period in 1915 were $7,082,479.

Practically all of the net profits this year were from domestic business, as total net profits from war orders were $154,000, as compared with $3,140,000 realized on war orders last year.

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70 Per Cent of Gasoline Pumps Tested Found Inaccurate

WASHINGTON, D. C., Nov. 6—The Bureau of Standards has in circulation report No. 81 on liquid measuring-pumps for selling gasoline. The report, in addition to a description of the different systems, gives results of some inspections having to do with the accuracy of these pumps.

Of seventy-nine measuring systems of various types chosen at random and tested in a number of different cities, fifty-five, or 70 per cent, had errors in excess of the tolerance allowable, and twenty-four, or 30 per cent, had errors within the tolerance. In addition, there were eight outfits so constructed as to be absolutely unsuited for retail liquid dispensing.

Of the fifty-five out of tolerance 80 per cent gave deliveries in deficiency and 20 per cent in excess. This tendency toward deficient measurement is worthy of careful consideration, and it is only proper to call attention to the fact that most of the causes of error in measuring-pump operation tend toward the side of deficient delivery. Among these may be mentioned leaks, retention of liquid by the hose. excessive virtual suction head, resulting in vaporization and other losses, failure to complete the full stroke and slippage.

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Templars Motors Corp. Formed

CLEVELAND, Nov. 3.—The Templars Motors Corp. has been formed, and will manufacture a four-passenger roadster at $1,250, a five-passenger touring car at $1,250, a five-passenger sedan at $1,850, and a two-passenger roadster at $1,225.

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Materials Markets Steady

NEW YORK CITY, Nov. 8—The automobile materials' market was steady last week, very few price changes taking place. Steel, copper, aluminum, and lead, remained constant. Ceylon rubber was 3 cents higher per pound, reaching 60. Tin rose to $42.33 1/3 per 100 lb., a net rise of 45 cents. Cottonseed oil declined 60 cents per barrel to $11.80. The rest of the materials were unchanged and steady, as shown in the accompanying tabulation.

It is estimated that 80 per cent of the copper production for the first 6 months of 1917 has been sold, indicating that approximately 900,000,000 lb. of copper have been placed on the producers' books for delivery during the period from Jan. 1 to June 30 next.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Week's Ch'ge.
Aluminum, lb.	.65	.65	.65	.65	.65	...
Antimony, lb.	.13	.13	.13	.13	.13	...
Beams and Channels, 100 lb.	2.96	2.96	2.96	2.96	2.96	...
Bessemer Steel, ton	50.00	50.00	50.00	50.00	50.00	...
Copper, Elec., lb.	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb.	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl.	12.40	12.35	12.22	12.10	11.80	— .60
Fish Oil, Menhaden, Brown, gal.	.60	.60	.60	.60	.60	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.25	1.25	1.25	1.25	1.25	...
Lead, 100 lb.	7.02½	7.02½	7.02½	7.02½	7.02½	...
Linseed Oil, gal.	.90	.90	.90	.90	.90	...
Open-Hearth Steel, ton	50.00	50.00	50.00	50.00	50.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb.	.83	.83	.83	.83	.83	...
Rubber, Ceylon, First Latex, lb.	.57	.57	.58	.58½	.60	+ .03
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	41.87½	41.75	41.75	42.12½	42.33⅓	+ .45
Tire Scrap, gal.	.06⅜	.06⅜	.06⅜	.06⅜	.06⅜	...

Security Prices Are Higher

Tire Issues Strong—Much Buying on Margin—Further Rise Expected

NEW YORK CITY, Nov. 8—The usual heavy buying and selling before Election Day occurred on Monday. The market was mostly bullish, the majority of buyers predicting a rise after Election Day. As a result of this heavy buying prices of many issues rose. Much pressure was brought to bear on Ajax Rubber and United Motors, which went up 3⅞ and 2 points, respectively. General Motors, Chalmers, Firestone and Kelly-Springfield Tire, were also in demand.

General Motors common rose 10 points as did Chalmers. Chalmers preferred rose 7 points, one of the features of the week. This company announced a refinancing plan last week. Firestone Tire common rose 5 points to 1150, a record price. Kelly-Springfield Tire common rose 2½ points to 77½.

—

Hayes Wheel Co. Add $500,000

JACKSON, MICH., Nov. 6—The Haynes Wheel Co., this city, has increased its capitalization from $1,000,000 to $1,500,000. The increased fund will be used for additional machinery and equipment for the manufacture of wire wheels.

—

Newell Purchasing Agent for Hood

DETROIT, MICH., Nov. 3—R. B. Newell has joined the staff of the Wallace Hood Service Bureau as the purchasing agent. Mr. Newell was formerly connected with the Briggs Detroiter Co. as service manager.

—

Bate Predicts Higher Material Prices

DALLAS, TEX., Nov. 6—That automobile makers of the North and East are expecting an advance in materials that may result in higher cost of automobiles, was the statement expressed by John W. Bate, vice-president and chief engineer of the Mitchell Motors Co., in an address before Texas Mitchell dealers at Dallas last week. The address was given at a dinner tendered by H. T. Hays, district representative for the Mitchell company at the Adolphus Hotel. Other factory representatives who spoke at the meeting were: George W. Hipple, general merchandising counsel and F. W. Pelton, advertising manager.

—

Avery Tractor Maker's Capital $2,300,000

LOUISVILLE, KY., Nov. 3—B. F. Avery & Sons, manufacturers of gasoline trac-

tors in this city, have filed amended articles of incorporation fixing the capital stock at $2,300,000, against the old capitalization of $1,500,000. The $200,000 of 7 per cent series A preferred will be retired and a series known as A1 preferred, consisting of 7000 shares at $100, bearing 7 per cent, will be issued; another series of $600,000 preferred, paying 6 per cent, will be put out. There is a similar issue outstanding. There will be 10,000 shares of common of $100 each, as compared with 700,000 authorized at present.

—

S. R. B. Earnings Halt Reorganization

PHILADELPHIA, PA., Nov. 3—The earnings of the Standard Roller Bearing Co. during the past year have shown so much improvement that the proposed reorganization of the company, it is stated, has been practically abandoned. Net earnings for the year ended Sept. 30 last were $747,546.

There are outstanding $2,725,850 common, $572,750 7 per cent cumulative preferred of authorized issues of $4,000,000 common, $3,000,000 first preferred and $1,000,000 second preferred stock.

—

Fisk Ratifies Increase of Capital

CHICOPEE FALLS, MASS., Nov. 1—The Fisk Rubber Co., this city, has approved the increase in capital from $19,400,000 to $39,500,000 and extension of time for conversion of second preferred to common stock from Nov. 1, 1917 to Nov. 1, 1932.

Packard Continues Expansion

Many New Buildings—Numerous Machines Installed —Sociological Work

DETROIT, MICH., Oct. 27—Fourteen months ago the Packard Motor Car Co. ordered a bird's-eye view made of its plant. When it was finished it was found to be old compared with the number of buildings added after the photograph was taken. The company has endeavored three times since to secure a bird's-eye view, but always with the same result. The building construction has been so rapid and vast that each view is always one or two stories or buildings behind. It is quite likely that the view shown here, though finished as the story is written, will not include the structures that have been started or completed in the past few days. Demands for increased productive facilities have been so urgent that construction of new buildings cannot catch up with it.

During the past year, 6.6 acres of floorspace have been completed while 4 acres are under course of construction, making a total space of 58.2 acres of floorspace that the company will utilize for the manufacture of its products. The buildings completed recently cost $1,000,000 and those in the course of erection amount to $350,000. The company will have a total of sixty-six buildings when all plans for immediate construction are finished. Those r completed and under course of con tion include a traffic garage, 54.9 b 103 ft., two six-story additions to the stock room building, each 103 by 200 ft., a power house addition four stories high, 65 by 140 ft., two four-story additions, each 60 by 396 ft., a lumber storage shed 50 by 140 ft., a truck storage building, 36 by 272 ft., and a heat treating plant four stories high and 60 by 130 ft. There will be a total of 2,553,272 sq. ft. of floorspace when all structures in course of erection are completed, divided into four divisions: main division, 1,792,061 sq. ft., service division, 216,087 sq. ft., truck division, 346,292 sq. ft., and the forge and foundry division which serves both trucks and pleasure cars and will have 198,380 sq. ft.

5530 Major Machines

There are 5530 pieces of major machinery in the factory of which 550 were recently installed including the following among the more important:

Toledo press, cost $8,000, which has a pressure capacity of 250 tons and is used to stamp sheet metal into running boards, bonnet sides, fenders, etc., and which is almost as large as one side of the building it occupies.

A flywheel machine that performs all finishing operations on the raw flywheel casting in 11 min.

Two worm bevel gear wheels and worm bevel pinion cutters that cut to 0.001 in., and which cost $3,000 each.

A milling machine, cost $6,275, that mills the rough off the cylinder blocks

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co.	70	73	+3⅞
J. I. Case T. M. Co. pfd.	83	85	—3
Chalmers Motor Co. com.	125	140	+10
Chalmers Motor Co. pfd.	105	115	+7
*Chandler Motor Car Co.	105	105½	+1
Chevrolet Motor Co.	186	190	..
Fisher Body Corp.	39	42	+1
Fisk Rubber Co. com.	..	93	..
Fisk Rubber Co. 1st pfd.	109	113	+1
Fisk Rubber Co. 2d pfd.	95	105	—5
Firestone Tire & Rubber Co. com.	1150	1170	+5
Firestone Tire & Rubber Co. pfd.	104	106	—6
*General Motors Co. com.	810	875	+10
*General Motors Co. pfd.	124	126	—2
*B. F. Goodrich Co. com.	71¾	71⅞	—1⅛
*B. F. Goodrich Co. pfd.	112	114	..
Goodyear Tire & Rubber Co. com.	293	296	—3
Goodyear Tire Rubber Co. pfd.	108¾	109½	+ ¼
Grant Motor Car Corp.	8	10	..
Hupp Motor Car Corp. com.	5¼	6	..
Hupp Motor Car Corp. pfd.	92	100	..
International Motor Co. com.	4	8	—1
International Motor Co. pfd.	20	30	..
*Kelly-Springfield Tire Co. com.	77½	78	+2½
*Kelly-Springfield Tire Co. 1st pfd.	97	100	..
*Lee Rubber & Tire Corp.	41½	41½	+1
*Maxwell Motor Co. com.	84½	84⅞	—1
*Maxwell Motor Co. 1st pfd.	85	86	— ½
*Maxwell Motor Co. 2d pfd.	54	54½	—1
Miller Rubber Co. com.	240	260	..
Miller Rubber Co. pfd.	105	107	..
Packard Motor Car Co. com.	..	175	..
Packard Motor Car Co. pfd.	93	99	—1
Paige-Detroit Motor Car Co.	38	39	—4
Peerless Truck & Motor Corp.	23	25	+1
Portage Rubber Co. com.	170	173	..
Portage Rubber Co. pfd.	170	173	..
Regal Motor Car Co. pfd.	20	30	+3
†Reo Motor Car Co.	46	48	..
Saxon Motor Car Corp.	77	79	— ½
Springfield Body Corp. com.	95	100	..
Springfield Body Corp. pfd.	120	130	..
Standard Motor Construction Co.	7	9	— ½
Stewart Warner Speed. Corp. com.	110½	112½	—1
Stewart Warner Speed. Corp. pfd.	..	..	..
*Studebaker Corp. com.	128⅛	129	+1½
*Studebaker Corp. pfd.	111½	112	+1
Swinehart Tire & Rubber Co.	90	92	..
United Motors Corp.	64½	64¾	+2
*U. S. Rubber Co. com.	60¾	61⅛	+1¾
*U. S. Rubber Co. pfd.	110	111	..
White Motor Co.	55¼	56	+1¼
*Willys-Overland Co. com.	42½	42¾	+ ¼
*Willys-Overland Co. pfd.	103	104	+ ½

*At close Nov. 4, 1916; listed New York Stock Exchange. †Par value $10; others $100.

Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

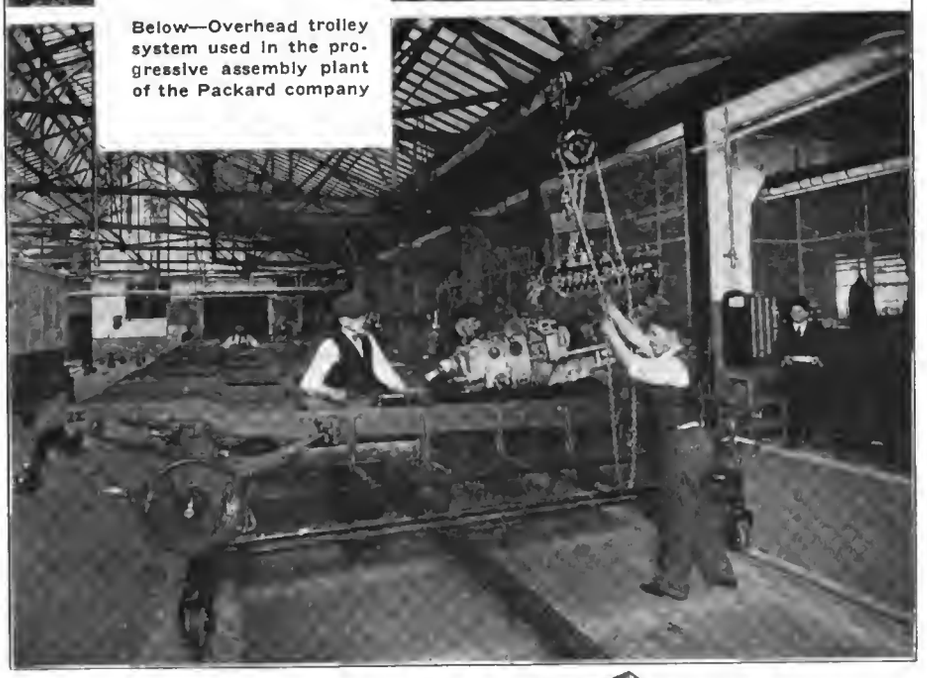
	Bid	Asked	Net Ch'ge
Auto Body Co.	42½	44½	— ¼
Chalmers Motor Co. com.	124	130	+4
Chalmers Motor Co. pfd.	..	..	..
Continental Motor Co. com.	37½	38½	— ¾
Continental Motor Co. pfd.	9½	10¼	..
Ford Motor Co. of Canada	..	300	..
General Motors Co. com.	790	850	—10
General Motors Co. pfd.	124	127	— ½
Maxwell Motor Co. com.	83½	86	—3½
Maxwell Motor Co. 1st pfd.	84	86½	—1½
Maxwell Motor Co. 2nd pfd.	52½	55½	—1½
Packard Motor Car Co. com.	..	170	..
Packard Motor Car Co. pfd.	100	102	..
Paige-Detroit Motor Car Co.	38	40	—3
W. K. Prudden Co.	49¼	50½	+ ¼
Reo Motor Car Co.	45½	46¾	— ½
Studebaker Corp. com.	126½	129½	—5½
Studebaker Corp. pfd.	109	..	..
C. M. Hall Lamp Co.	..	31	..

INACTIVE STOCKS

Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd.	20	..	+2

Above—Showing the constant building in which the Packard company is now engaged

Below—Overhead trolley system used in the progressive assembly plant of the Packard company



Two of the recent additions used for progressive assembly work

and reams it in consecutive operations in 6.7 min.

Two smaller milling machines of the same nature as the one above.

A cylinder boring machine that bores out rough cylinder blocks, and mills it by a progressive revolving operation.

Eight multiple drills costing $3,000 each and capable of drilling 156 different holes in the crankcase and cylinder blocks in 28 min.

One multiple drill that bores forty-seven holes in the transmission case in one operation.

Two hydraulic presses that force the rear axle housing onto the tube and have a pressure of 20 tons to the square inch. Each of these machines takes a floor-space 10 by 30 ft.

Two special Packard machines that dome the inside of cylinder blocks and which were designed, invented and built in the Packard factory.

Progressive Assembly

The plant operates upon the progressive assembly and manufacturing system based upon six divisions arranged as:

(*a*) Progressive machinery.
(*b*) Progressive stock conveying.
(*c*) Progressive chassis erection.
(*d*) Progressive motor assembly.
(*e*) Progressive enameling.
(*f*) Progressive final assembly.

The stock conveying mechanism was recently finished for the assembly of rear axles and transmissions at a cost of $35,000.

The final assembly is conducted in one of the new buildings that parallels the stockrooms and is so situated that the bins can be loaded with fifty car lots of various stocks at one time and the workers are never forced to move more than 7 ft. from the stock supply. Both floor and overhead trolley conveyors are in use. The bodies are lowered on to the chassis by means of the overhead system.

New ovens, 126 ft. long, have been installed in the enameling rooms and are capable of 400 to 500 deg. of heat. Two huge tanks holding 1860 gal. are utilized to clarify the enamel and a mechanical washing machine was recently added that contains 250 bbl. of water and is used to secure and cleanse all parts before they are enameled.

12,000 Employees

The company employs 12,000 men and plans to use 15,000 when the buildings now being erected are completed. It does much for its employees to uplift them in their homes, business and social life and has commenced several schools besides erecting a clubhouse and baseball ground.

The school includes courses for salesmen, truck manufacture and motor work, and also the teaching of English to foreigners.

Guaranty Securities Corp. To Finance Truck Sales

(*Continued from page* 789)

There are two charges, Charge A and Charge B. Charge A applies to all trucks below $1,500 and Charge B must be applied to all above $1,500. Charge B may be applied to those below $1,500. Charge B is the addition of a flat $30.50 to Charge A to cover collision insurance, and in case the service is such that collision is at all probable the dealer may insist upon the buyer paying Charge B where Charge A might otherwise prevail.

Above $1,500 the Charge B is 5 per cent of the delivered price.

These two charges are made because the collision risk is considered greater on the heavier trucks. Rather than base the charge on weights it was deemed more satisfactory to base the dividing line on price, the corporation believing that $1,500 is a good mark between heavy and lighter vehicles.

In case trucks are going into such a rush-and-hurry service as mail delivery, and if the price is below $1,500, the collision risk is greater, and in that case Charge B would apply below $1,500.

Charge A, as does Charge B, includes the usual fire and theft insurance and covers the cost of handling the deal. The insurance becomes effective as soon as the contract is signed and the truck delivered.

The dealer determines whether Charge A or B is to be made.

In case the dealer takes a car or truck in trade the allowance made must be included in the 25 per cent cash payment that he secures when the new truck is delivered. The Guaranty corporation will not finance the sale of used trucks.

If a buyer wishes he may pay more than 25 per cent down and may make the term of payment less than one year—but not more. Dealers are encouraged to get as much down as possible and as short a payment term as possible.

The interest on the notes and the Deferred Certificate must not exceed the prevailing legal rate. In most States this is 6 per cent, wherefore 6 per cent has been used in the table at the beginning of this story.

After the dealer has secured the 25 per cent cash payment he enters into a conditional sale contract with the buyer. This form is laid out in a very simple way. Under each blank space to be filled in is a small number. On the first page of the contract is told what these numbers mean, so that the dealer may always know just how to make out the contract. For instance, under one blank space it says "7." The first page of the contract says: "7, the amount of the note." So, where it says "7" the dealer writes in the amount of the note.

Handling the note is made simple. The note is attached to the first page of the contract. All the dealer has to do is fill in the blank space as explained by the numbers, there even being directions as to where the buyer's name shall go. It is difficult for a dealer to go wrong in filling out this contract and note.

Having the contract and note signed, the dealer forwards them to the Guaranty Securities Corp. and in a few days receives 90 per cent of the face of the note in cash. He then has 25 per cent of the whole and 90 per cent of the 75 per cent balance, which amounts to 92½ per cent of the whole price of the truck, including freight.

For the remaining 7½ per cent the dealer has to wait until the buyer makes the last payment, but this is represented by a Deferred Certificate, upon which he receives interest at the same rate the note itself carries.

The dealer has nothing whatever to do with making collections, and the buyer deals only with the securities corporation. Local banks are not involved.

One other little job the dealer has to do is have the buyer fill out a Purchaser's Statement. Statement A is used in case the buyer is worth more than $5,000 and Statement B if he is worth less.

Matters are still further simplified for the dealer by the attachment to the contracts, which are in duplicate, of a printed letter form. This is filled out by the dealer and mailed with the note and contract to the Guaranty corporation.

Advantages to the dealer are: He can

Extend his business without increasing his capital.

Secure sales where cash-buying might stand in the way.

Get all his cost and nearly all his profit at the time of sale.

The buyer:

Gets his truck at once and pays for it while he is using it.

Does not have to have credit handled through local bank.

Notes are held in trust, not hawked about.

THE DEALER'S PART.

1—Collects 25 per cent of $1,312 in cash, which includes the $67.50 that goes to the Guaranty Securities Corporation	$328.00
2—Sends to Guaranty Securities Corporation note for the balance of 75 per cent	984.00
3—Receives at once 90 per cent of face of note, deducting $67.50, which was received by dealer for Guaranty Securities Corporation's charge	818.10
4—Dealer has received in cash at once	$1,146.10
5—Receives Deferred Certificate for 10 per cent of $984, bearing interest at 6 per cent...$98.40	
6—When last payment is made he gets the $98.40	98.40
List price of truck plus freight	$1,244.50
7—Dealer also receives 6 per cent interest on the $98.40 Deferred Certificate	5.90
Dealer actually receives for truck	$1,250.40

THE BUYER'S PART.

1—Pays cash 25 per cent of $1,312	$328.00
2—Signs conditional sale contract and note for balance of $984.00	
3—Pays $82 monthly for 1 year	984.00
Delivered price of truck	$1,312.00
4—Also pays interest on the note	31.98
Buyer actually pays for truck	$1,343.98
Price of truck plus freight	1,244.50
Cost of accommodation	99.48
Cost of accommodation per month	8.29
" " " per week	1.91
" " " per day	.33

GUARANTY SECURITIES CORPORATION'S PART.

1—Accepts from dealer the buyer's note for	$984.00
2—Advances to dealer at once 90 per cent of $984 minus the $67.50 Guaranty charge	818.10
3—Collects $984 from buyer in 12 monthly payments.	
4—When last payment is collected pays dealer Deferred Certificate of $98.40, plus interest at 6 per cent.	104.30
5—Company realizes as follows:	
a—Guaranty charge $67.50	
b—Interest from buyer 31.98	
Total	$99.48

Guaranty Plan for Selling Trucks on Time

Illustrating by a truck listing at $1,200 and on which the freight is $44.50. The interest rate is assumed to be 6%. The plan is based upon the Delivered Price, which is arrived at as follows:

Factory list price, f.o.b., chassis and body	$1200.00
Freight	44.50
Price the dealer must get for himself	1244.50
Guaranty Securities Corporation's charge	67.50
CUSTOMER'S DELIVERED PRICE. What the buyer must pay	1312.00

CHARGE A

May apply up to $1,500 Job. Includes incidentals and usual fire and theft insurance for one full year.

CHARGE B

May apply up to $1,500 Job—Required on trucks selling for more than $1,500. Includes incidentals and usual fire, theft and collision insurance for one full year.

GUARANTY CHARGES

$14.50	On all trucks between	$500	and less	$45.00		
22.00	"	"	"	501	"	$750 52.50
29.50	"	"	"	751	"	1,000 60.00
37.00	"	"	"	1,001	"	1,250 67.50
44.50	"	"	"	1,251	"	1,500 75.00

Must pay CHARGE B on all trucks..... 1,501 or more 5% of delivered price

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Engine Development

POWER plant improvement is a major development in the industry. Every demand made upon the car is reflected in the engine. The automobile-buying public has been educated to the point where the engine demands are in excess of what the nature of the fuel would suggest as being feasible, and the matter has developed itself into a contest between the possibilities of the fuel and of superdevelopment in the methods of vaporizing it and burning it.

The path for future progress is fairly clear. There is little doubt regarding the way in which design must travel if it is to continue to progress. Better vaporization of the heavier fuel, increased volumetric efficiency, or in a word, the increase of mean effective pressures by improvements in design which will tend to get the gas into the cylinder in a condition best suited for rapid combustion and with the least possible friction due to restrictions and bends in the ports.

Lighter reciprocating parts are a necessary development due to other improvements which have permitted higher speeds. With the power plants of a few years ago where the maximum piston speed was 1000 ft. per min. for passenger vehicles, it was not necessary to be so very careful regarding reciprocating weights and balanced crankshafts.

With many manufacturers recommending a piston speed of 2000 ft. per min. for passenger cars, these things become necessary. Furthermore, the gas speeds have increased, and it is necessary that ports be smoother, that the fuel be better vaporized (even though it is heavier), and that the volume of the cylinder is better filled at each stroke.

The small high-efficiency power plant is surely going to increase. To-day there are engines on the drafting boards which should be capable of maintaining 3000 r.p.m. steadily and without vibration of over-stressing of the parts. The high-speed engine provides the answer to the 4-to-50-mile-an-hour flexibility, and it is along these lines that the development of the next 2 years is likely to occur.

Detachable Heads

ENGINES with detachable heads are on the increase and have proved successful with very few exceptions. There are certain precautions to be observed in the design which when followed give a unit that is accessible and easily taken care of.

Where the detachable head has failed it is generally because insufficient water was carried into the head because of improper passages leading from the cylinder casting to the head casting. If these passages are arranged correctly there will be no difficulty in getting the water around the head.

It will be impossible to use anything but a good quality copper-asbestos gasket between the cylinder and the head. If a plain paper gasket is used there will be trouble as soon as a renewal is attempted and a leakage will occur. The copper-asbestos gasket is more expensive, but that expense is justified, and seems necessary.

The benefits to be gained from the removable head are many both from a manufacturing and maintenance standpoint: They are an aid to accurate cylinder grinding and are valuable in that they assist the manufacturer to maintain a very narrow limit of variation on combustion chamber size. To the user they are a great boon when it comes to cleaning out the cylinders, removing carbon or in grinding valves.

The Tractor Engine

ENGINES for tractors must be able to battle successfully with the dust cloud. There are two ways of doing it: First by keeping everything tightly closed so the dust cannot enter and second by making the parts of such materials that they are not damaged by dust. The designer of a tractor motor must do both.

The two important entry points for dust are the breather and the carbureter. A washing arrangement for the carbureter air will prevent the grit from entering. On the breather there is plenty of room for ingenuity to keep the dust out and each manufacturer has a pet method of his own.

In the way of materials, the parts must be hard so that the little diamond-like grains will not cut them, and furthermore, they must be large and stiff to withstand the racking stresses of a tractor.

Engines for 1917 a Culmination of Refinement

Few New Designs But Great Improvements in Detail Result in Higher Thermal and Mechanical Efficiencies—Longer Life and More Economical Manufacture Part of Year's Progress

Part I—The Trends in General

By J. Edward Schipper

THERMALLY, mechanically and economically, the American gasoline engine has received a great forward impulse during 1916. If all the progress made by our individual master builders could be concentrated into a single engine, that power plant would give back more power and useful work from a given quantity of fuel, more energy for a given size, travel farther on a gallon, be less expensive to manufacture, easier to maintain and have a longer life than the product of a year ago.

At this very moment we are in the midst of a period of engine development which makes almost certain the prediction that during the next 12 months a longer stride in the direction of perfection will be taken than the combined steps of the past decade. The latest products of our power plant specialists are capable of a performance as stock jobs that far surpasses the special engines of even 3 years back. And the most significant fact in connection with the development is that nowhere can be found a radical revision of design. What has been accomplished has been done by steady and patient digging into details.

Our engines for 1917 are more efficient thermally, principally because they are more efficient from a volumetric standpoint. The development of the high-speed engine has worked against the development of higher volumetric efficiencies and yet the improvements in detail of design have actually brought forth a net gain in that respect. It will be interesting to note, in going through this story of improvement, how minor changes in the valve action in some instances, the port design in others, and in some cases the rearrangement of very small details have added as much as 20 per cent more power to a power plant.

Mechanical Efficiency Increased

Mechanical efficiency has been increased largely through the carrying out of trends that were clearly expressed a year ago, and chief of these is the reduced weight of reciprocating parts. Next in order comes the balance of rotating masses, and third the better arrangement and individual design of the lubricating system insofar as the placing of the oil bath at points where it is most needed and in the proper quantity is concerned. Mechanical efficiency of an engine is the ratio of the brake to the indicated horsepower, expressed mathematically. It is a measure of the approach towards the ultimate in any given motor size, and when it is stated that the engine of 1917 has a better mechanical efficiency than its predecessor, it means that better performance is being secured from engines of equal displacement. Here again it will be highly interesting to note how the alterations in detail have brought about this important result.

Accessibility and Life

Coming to another broad highway of progress, that of longer life, it is found that the general methods for securing this have been in the reduction of stresses on parts through better design. Put in another way, it means higher factors of safety secured through better arrangement of parts, better materials, safer dimensions in a few instances and indirectly through a very important development in the way of accessibility. The two qualities of accessibility and life are bound very closely together.

The qualities demanded by the automobile buyer have forced this progress. A buyer of to-day demands a car that will have a speed range averaging from 4 to 50 m.p.h. on high gear. He demands a large power-to-weight ratio to give acceleration and hill-climbing ability and silence. Smoothness, economy and low price are among some of the other requirements that are made and insisted upon. To meet this demand with an engine that has for its working medium a fuel which is ever presenting greater difficulties in the way of vaporization, has taxed the ingenuity of the engineers as never before.

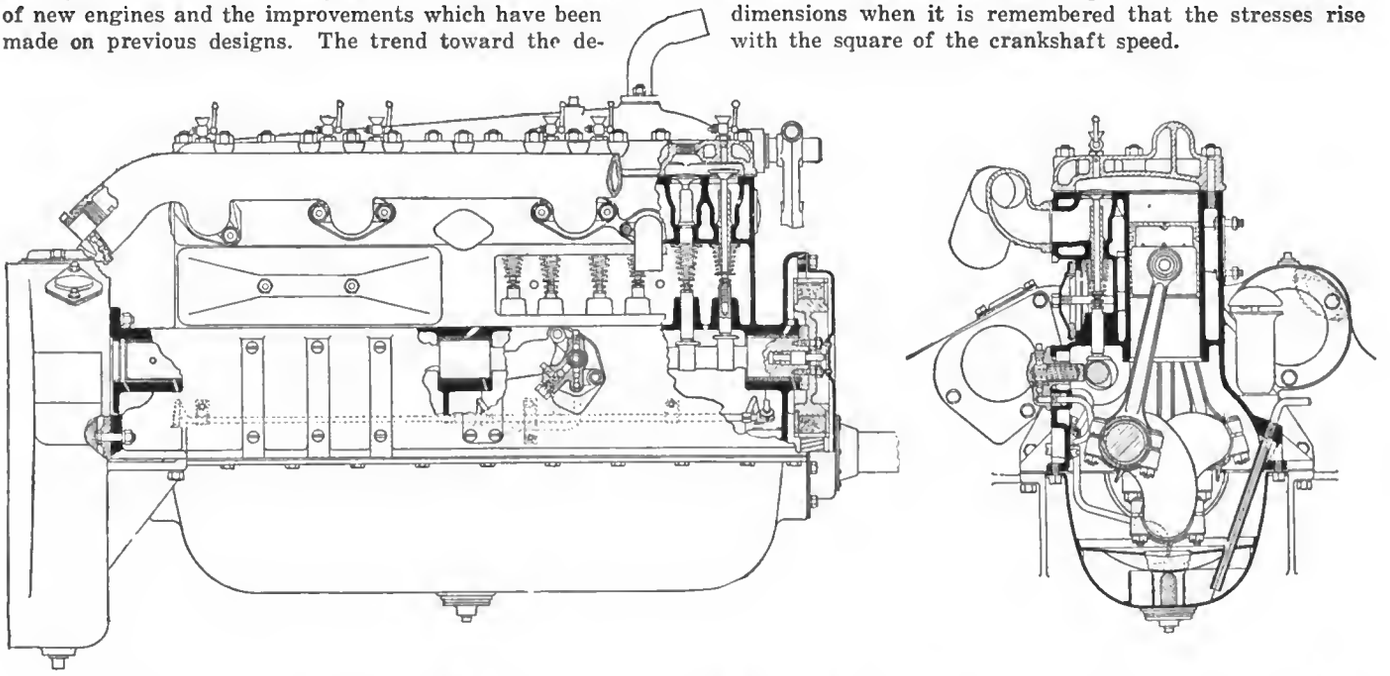
One of the greatest factors this year has been in the matter of material prices. Tungsten valves, aluminum pistons and cylinders, aluminum crankcases, alloy steel crankshafts and gears have been

particularly affected by the rises. One result is that no attempt has been made to go beyond experiments particularly in the direction of the aluminum motor, during this year.

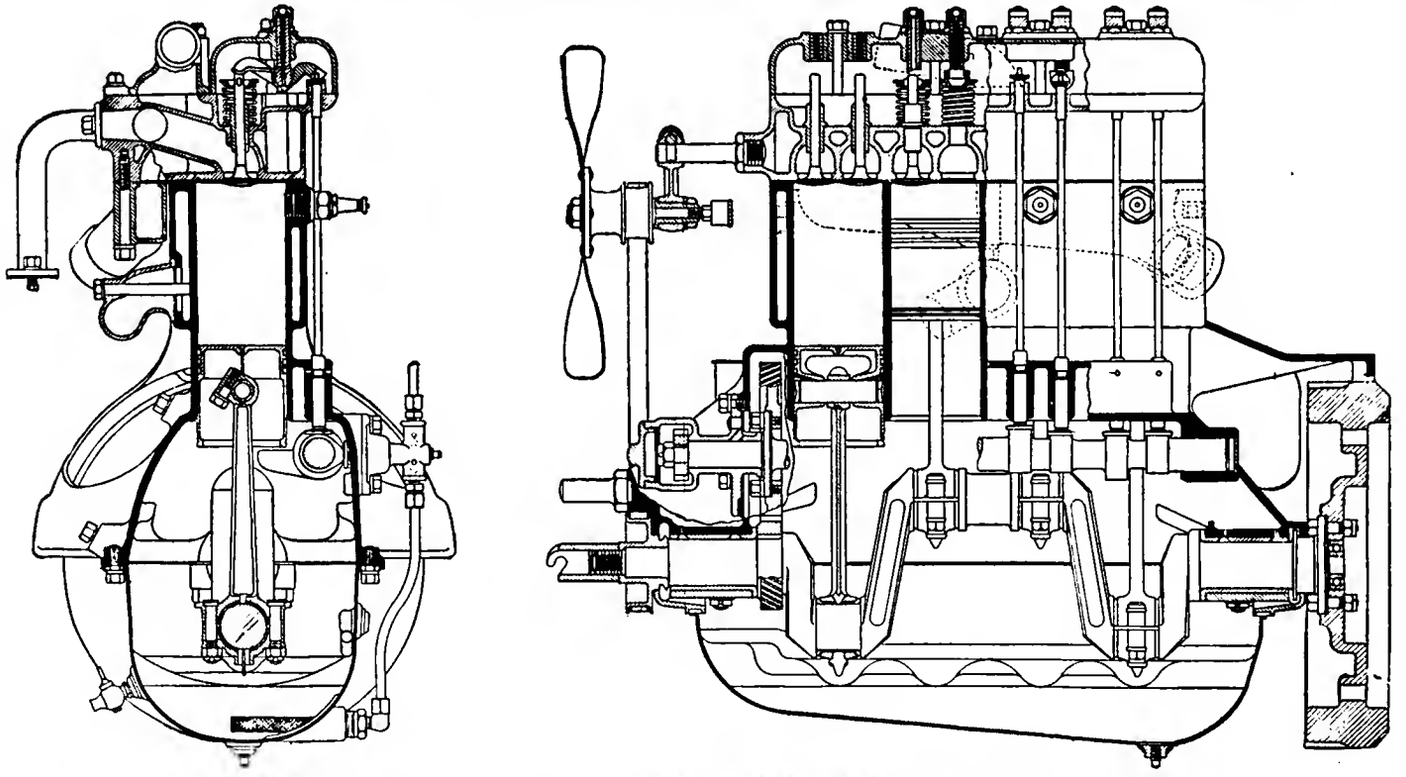
On the other hand, the improvement of machining and casting work has continued at about the same rate as in previous years and much of the credit belongs to these tool room designers who have enabled the motor manufacturer to produce economically and at a profit even in the face of the higher cost of materials.

In the general make-up of the engine, the trend toward the overhead valve seems to have struck its level, and there has been no falling off or increase during the year that is worthy of note. In fact the year is notable for the scarcity of new engines and the improvements which have been made on previous designs. The trend toward the detachable head continues. There has been one concern which has dropped the design, but others have added it so that the scale still shows a balance toward the detachable head.

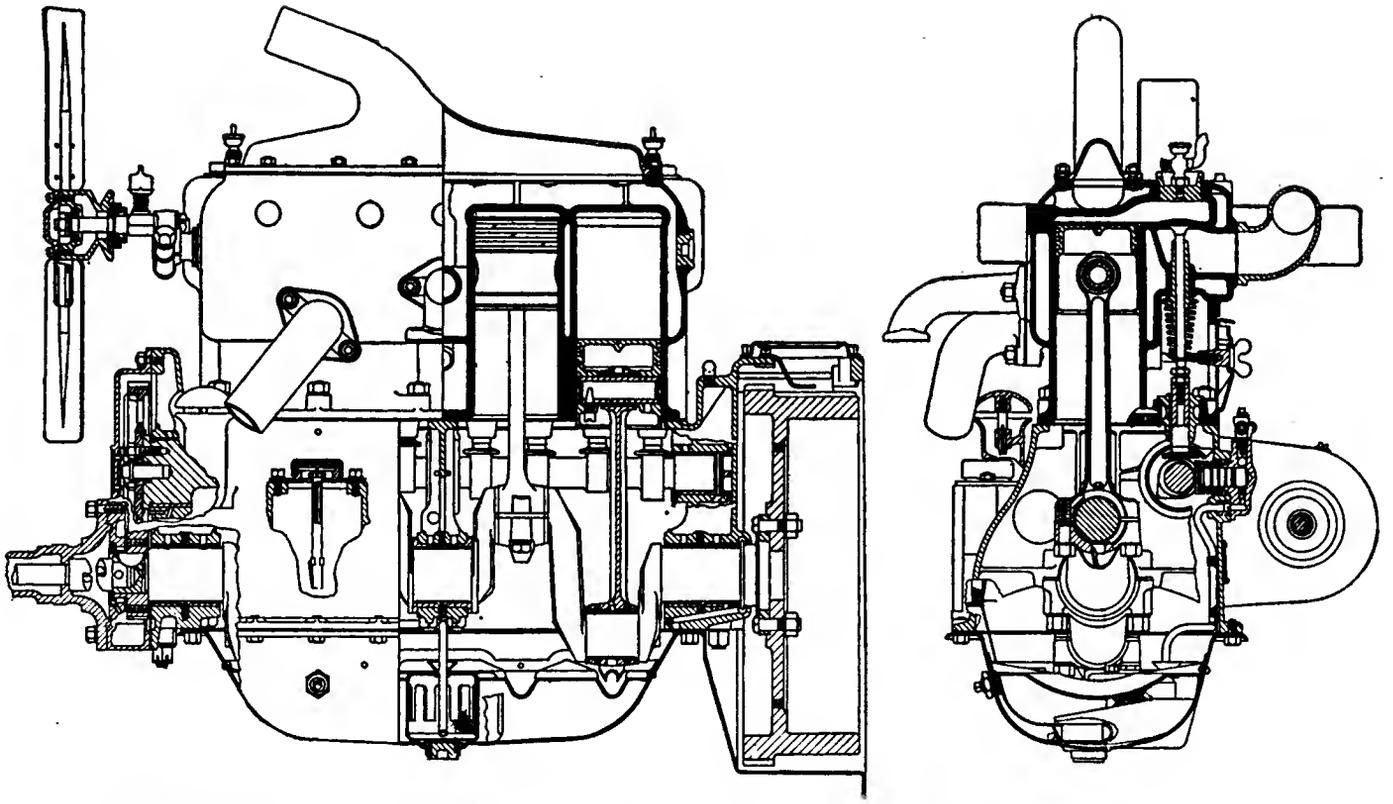
Crankshaft balance has been made more or less of a fad by the exploitation of some new designs through various sales mediums. As a matter of fact no new problems have been encountered by the engineer, beyond those which are natural with the higher speed of rotating and reciprocating parts. Piston speeds have been climbing up to the point where engine designers believe that the best practice for passenger car work is around 2000 ft. per minute piston speed. This is approaching quite close to 3000 r.p.m. and naturally the question of balance assumes proportions of considerable dimensions when it is remembered that the stresses rise with the square of the crankshaft speed.



L-head Continental engine with integrally-cast iron crankcase and detachable head. The end section at the right shows the moon-shaped throws on the crankshaft for balancing purposes. Crankshaft balance has received marked attention this season



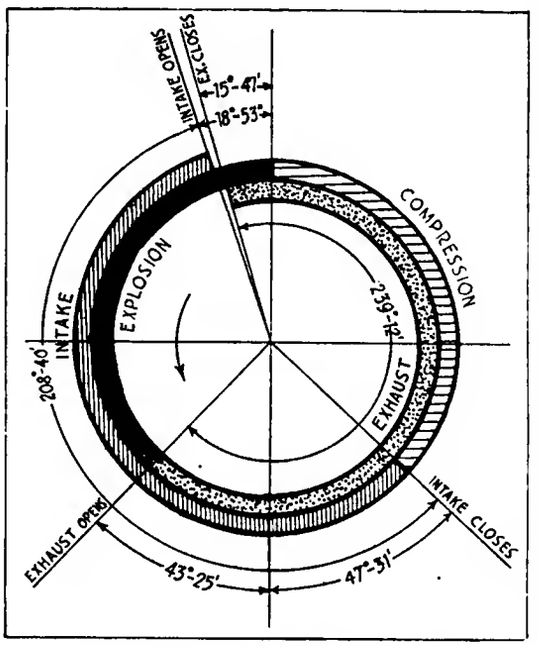
Sterling four-cylinder valve-in-head design for light passenger cars. It has a detachable cylinder head with the spark plugs in the side and the fan direct driven from the crankshaft acting as a vibration damper



Longitudinal and transverse sections through a typical Continental four-cylinder unit which can be successfully applied to trucks. The cylinders are cast in a single block, but the crankcase and oilpan are separate

The curved-cheek crankshaft is in the majority and instances of elaborate systems of counterweighting are practically unknown among the engine specialists. Perhaps the most interesting case of counterweighting is in an engine developed for gasoline-electric purposes by the Milwaukee Machine Tool Co., in which the counterweights are carried practically into the plane of rotation of the crank. The weights are brought as closely as possible to this vertical transverse plane while maintaining a pathway for the connecting-rod. This is a very small displacement engine, four-cylinder 2½ by 3½ in. designed to run continuously at close to 3000 r.p.m. and all parts are designed for such conditions.

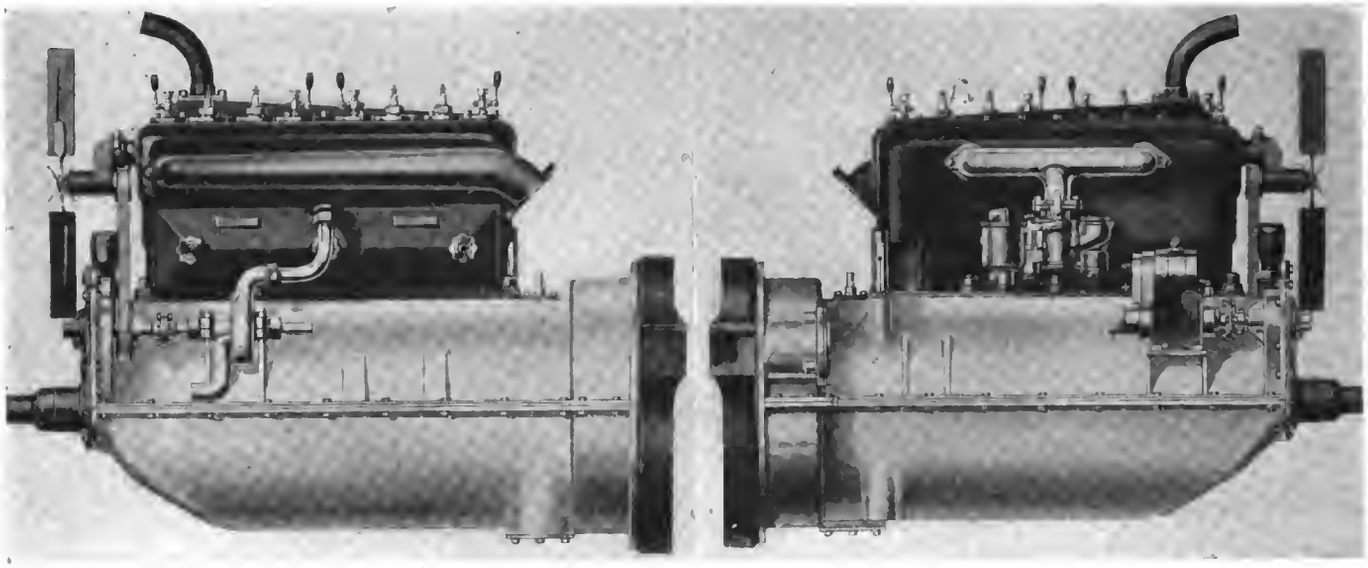
Another high-spot in gasoline engine development is in the provisions made to aid in the vaporization of the fuel. The day is past when the engine builder puts the entire question up to the carbureter maker. Almost every manufacturer of engines has devised some method of preheating the charge, and this in the face of the struggle for higher volumetric efficiencies. Yet it is a matter of necessity now. The day has arrived when the gasoline engine really can burn kerosene, and not a few of them are doing it. The tractor engine is the connecting link where kerosene and gasoline are both being used, and the cored-in intake manifold or the unit intake and exhaust manifold have become very prominent this year. The Waukesha motors have a very nicely worked-out double manifold and the Golden, Belknap and Swartz engine also has a new development in this respect. The Falls intake manifold is now incorporated in the removable head of the engine. These are good examples of what everyone is doing or has done on the newest models.



Valve-timing diagram of model 20 Sterling engine, looking at the front of the flywheel

Before going into the details of motor improvement it should be remarked that power plants are not, taking them as a grand average, lighter than last year because the use of aluminum has dropped off in crankcase work to some extent. They are more powerful for their weight, however, and this is really what counts as long as the weight is not excessive. Individual parts of the engine which promote efficiency through being light have been reduced in weight.

Aluminum pistons are still in the balance. Personal talks with practically every engineer in the motor manufacturing business still give the general impression that they have neither become accepted nor condemned for general practice. It is not so much a matter of price, although in the opinion of one engineer it costs $6 more per motor to use the aluminum with present prices. A year ago though, it seemed as if the aluminum piston would become the standard in all motors within a year. At the present time there is no doubt but that the opinion of the majority of the engineers is that the real lightweight piston has not as yet been developed. On the other hand, it does not lack its firm supporters, so the matter is still on the fence with experimenting actively being carried on all over the country. One interesting fact is worthy of comment and that is, the aluminum piston has found greater favor among the automobile engineers than among the motor manufacturers who build for the trade. Where the aluminum piston has fallen



Both sides of the Wisconsin 4 by 6-in. power plant. This is a four-cylinder unit which is capable of handling large sized trucks. It has considerable flexibility, its stroke-to-bore ratio being 1.5

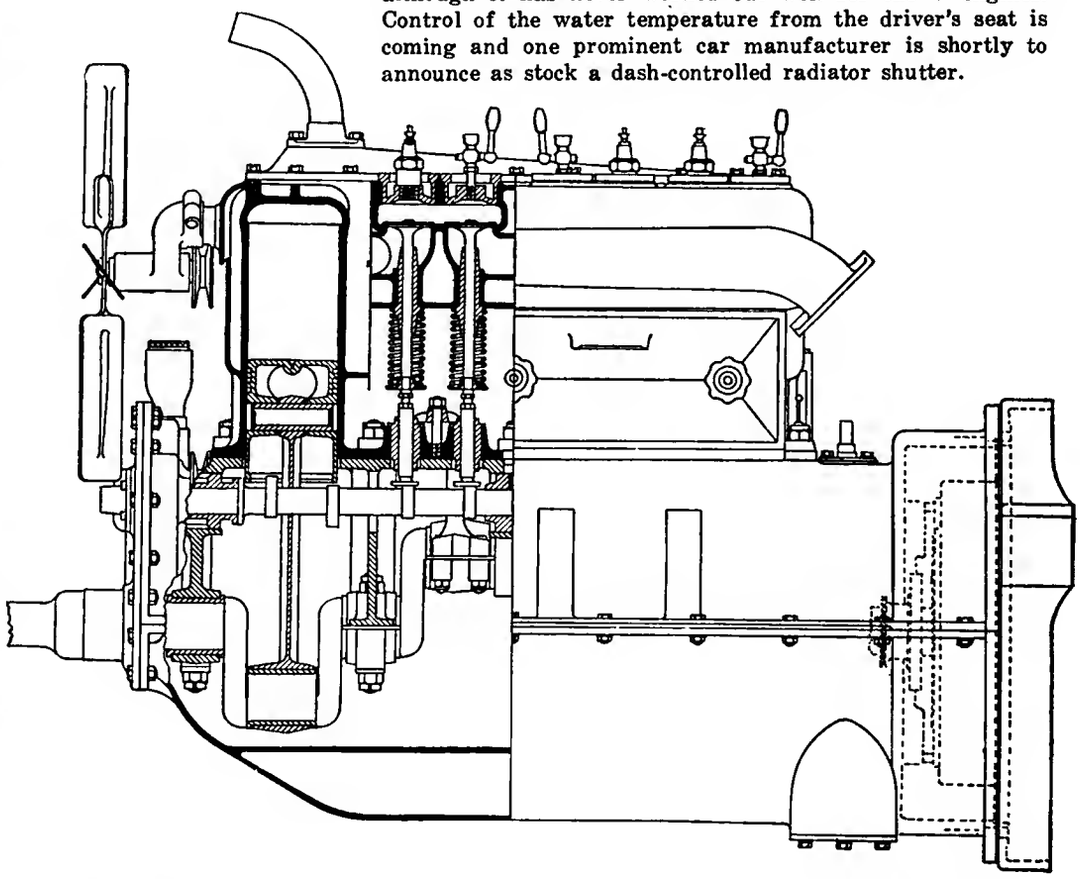
down, particularly in one instance where several cars were called in and changed over to iron pistons, it is because the pistons were made too short and secondly because the workmanship necessary to keep the clearances accurate could not be secured commercially in that particular installation.

The Eight and Twelve

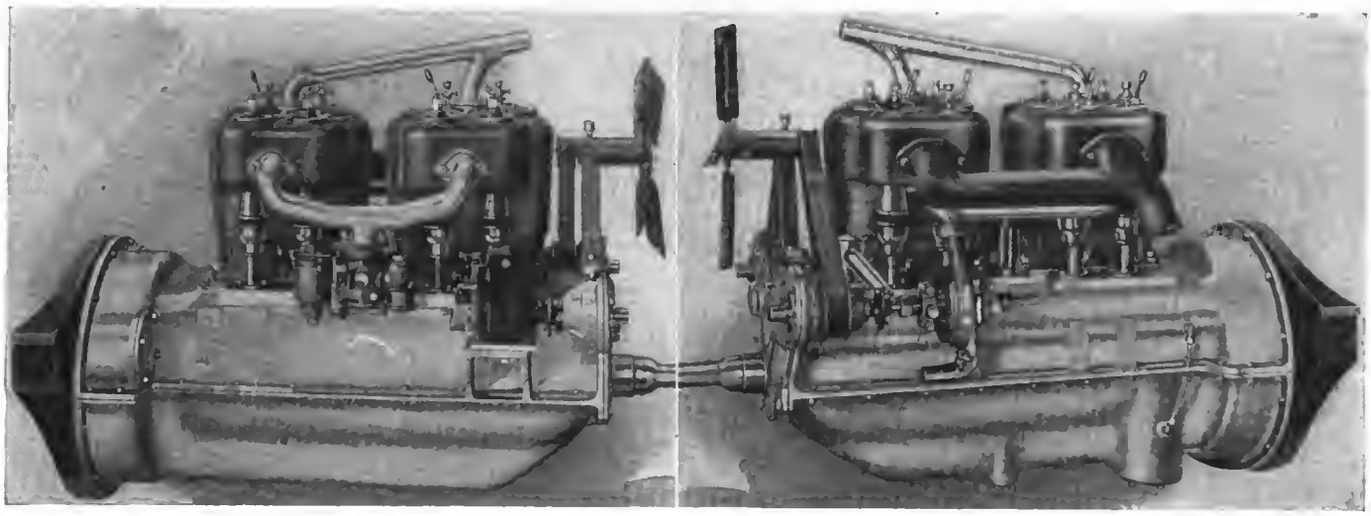
The V-engine cannot be overlooked in touching on the big points in engine practice. All doubt seems to have passed regarding its fitness. It is a question of cost versus performance. The question that each engineer must ask himself in deciding upon the building of a V-motor is whether he can get the same performance from an eight that he can from the six at the same price. The answer is both no and yes, because some have discarded the V, because they have felt that the six gives the better performance-cost answer, while with others it has been the other way around. Examples can be given on both sides so they mutually offset each other and show the point to be one that is open for debate, and since debate is stimulating and is really the key to progress, the V engine, besides having proved its fitness for the work, now stands as a champion of one type of design as opposed to the straight line variety. The shorter, stiffer shafts in the V are offset with the maintenance questions and altogether the question has various ramifications which are carried down to the limits of personal choice. During the year we have had practical demonstrations which have shown both types satisfactory.

Oiling has not changed greatly except that there is a tendency to keep the valve drive submerged so that it cannot become noisy. The details of this will be considered separately but in taking up the main trends it may be stated that oiling by circulating combination pressure and splash is typical. The oil pressure has gone up along with the speeds and now it is not uncommon to send the oil to the rubbing surfaces under a pressure of 40 lb. per square inch.

Cooling favors the pump-circulation among the motor builders. The proportion is about 66 per cent by pump and 34 per cent by thermo-syphon. The latter type of feed has been gaining for the past 3 years among the smaller engines although it has never worked out well for the V engines. Control of the water temperature from the driver's seat is coming and one prominent car manufacturer is shortly to announce as stock a dash-controlled radiator shutter.



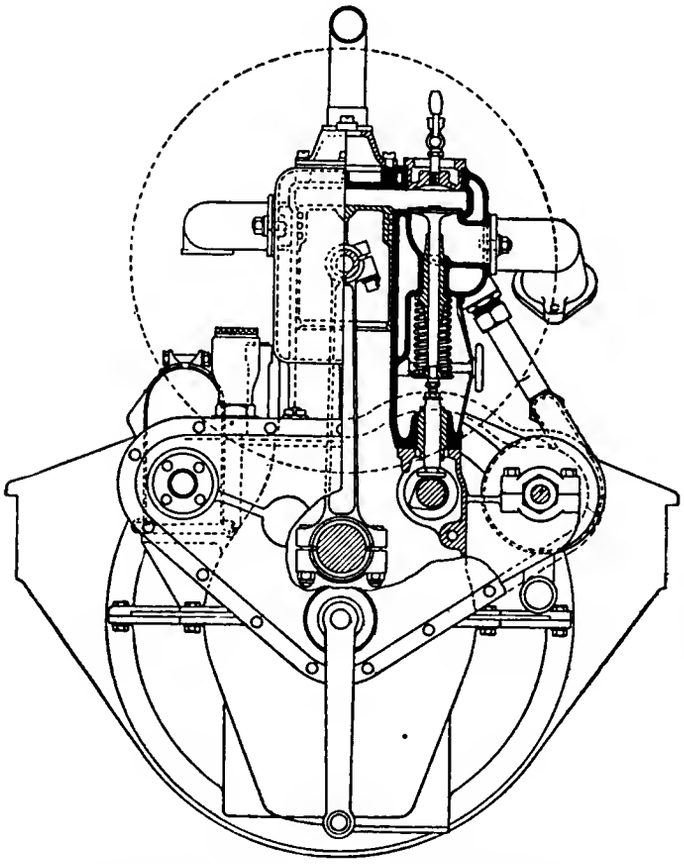
Wisconsin four-cylinder 4 by 6-in. engine which is used extensively for commercial vehicles



Wisconsin T-head engine which is known for its hard-pulling qualities. This model is a development extending over several years and has a bore and stroke of 4¾ by 5½

Part II—Mechanical and Thermal Efficiency Increased

Reduced Friction in Gas Ports, Higher Compressions and Greater Mean Effective Pressure Responsible—Maximum Piston Speeds Vary Through Wide Range



Transverse section through the Wisconsin 4 by 6 in. truck motor

THERMAL efficiency is a measure of the power secured from a given quantity of fuel. Mechanical efficiency is a measure of the power secured from a given size of engine. The two are closely related but still are independent. In increasing each of these factors, the use of a number of detailed improvements has been made which has had a marked effect on engines as a whole.

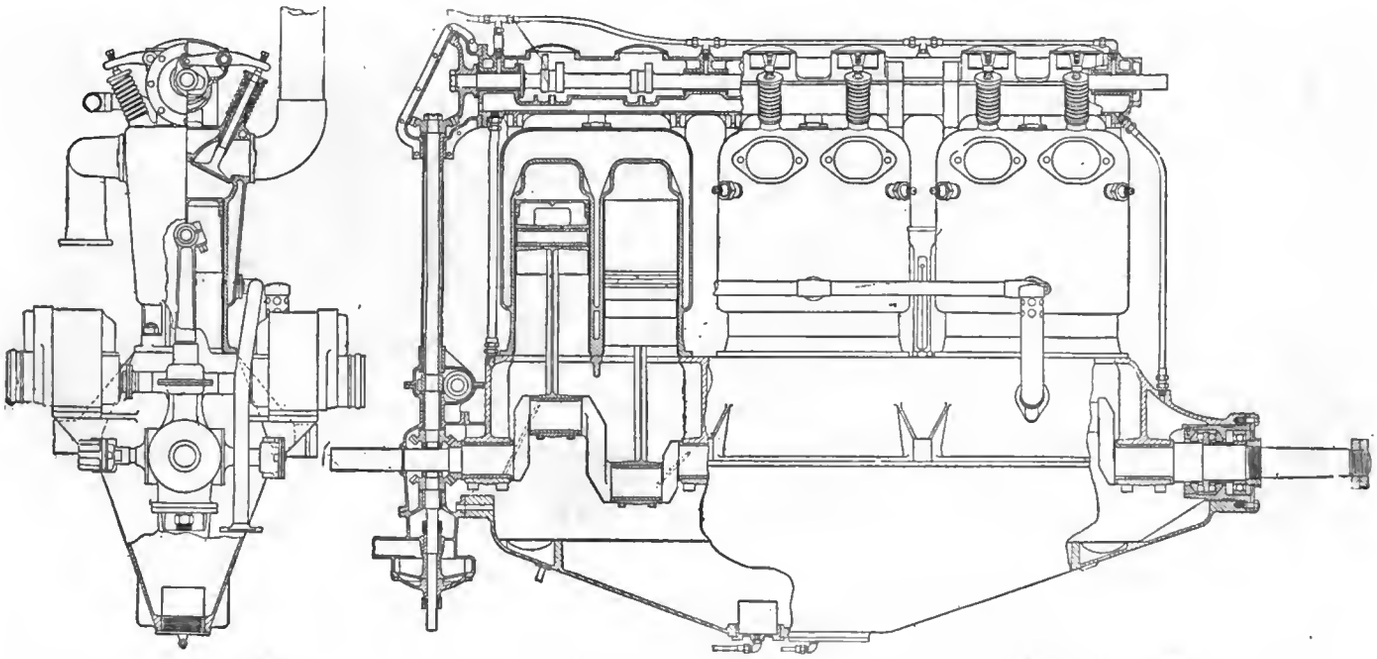
No other factor has had such attention this year as the increase in volumetric efficiency. This relationship between the volume of gas drawn into the cylinder and the volume of displacement is highly important because it is a direct measure of the relationship between the volume used and the volume wasted in an engine.

A number of factors have worked against the betterment of the volumetric efficiency, the two greatest of these being the higher speeds at which engines are operated and the second is the necessity for heating the heavier grade of fuel which is now being sold. The higher speeds have forced the engine builder to keep increasing the size of the valves year by year until in 1915 the limit was reached. It has been impossible to go any higher and consequently there has been very little alteration in this respect.

It has been discovered, though, that all the restriction of gas flow has not been in the valve but in the approach to the valve, and consequently there has been a universal house-cleaning of intake passages. The Sterling company has even given this volumetric efficiency matter such close attention that its engines have larger intake than exhaust valves.

Integral Manifolds

The use of the cored-in manifold has eliminated some of the bends in the passages, and has permitted of the direct connection between the carbureter and cylinder block. This trend is of about 4 years standing and is still on the increase.



Wisconsin six-cylinder aviation engine which has a valve action quite similar to that used on the Stutz racing cars. The camshaft is carried overhead

No notable change has been made by any of the companies in valve timing. In the overhead valve design there has been one tendency which has worked out very well and that is in the use of the offset rocker arm. In place of having the rocker with the fulcrum at the center it is off center so that the lift of the valve is magnified. The ratio then, instead of being 1 to 1, as it has been in practically every installation up to the last year, is now on a great many 1 to 2 or 3 to 5. The Falls Motor Co., which specializes on a valve-in-head design, has not adopted this practice on the ground that it would complicate replacements which would more than offset any gain.

The advantages claimed for the offset construction is that it eliminates a certain amount of inertia, owing to the smaller travel of the valve parts. This gives the effect of silencing the drive to some extent and further permits the follower to ride the cam better because of the lesser rise on the cam face. Besides this the leverage of the valve spring on the rocker arm, being greater, the spring can be reduced in tension, thereby compensating for the difference in the linkage.

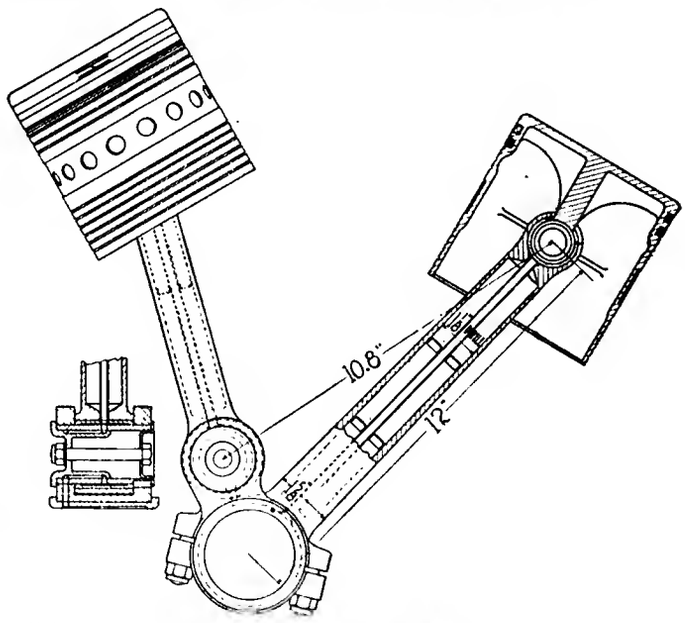
Another feature of the differential rocker is that it allows of a longer dwell of the valve, due to the quicker lift. This certainly reflects in the direction of higher volumetric efficiency as the time of maximum opening of the valve is increased and therefore a longer period is allowed for the gases to make their way into the cylinders.

Compressions are higher than they were a year ago. They vary to such an extent that it is impossible to draw a general trend. In truck motors the combustion space is quite often around 35 per cent of the piston displacement, while in motors like the Continental little six, which is a high-speed passenger car type, this percentage is about 30 or about 85 lb. absolute. The little Falls overhead job with a piston displacement of 180 in. for its six-cylinders has a compression space of 26.5 per cent of the displacement, which would give a compression average of over 90 lb. absolute.

Higher Mechanical Efficiency

The reduction in the size of the combustion space and the reduction of friction in the intake passages has more than offset the expansion of the charge due to preheating. The latter has been necessitated by the lower grade fuel, but does not seem to affect the power of the engine. Possibly combustion is more complete with the preheated and gasified charge. On a small engine being developed at the Milwaukee Machine Co. plant a novel scheme is being tried in shaping the passage below the valve in venturi fashion so that there is no break in direction of flow at the valve, but instead it gets the continuous flow effect imparted by the venturi. The throat of the venturi is just below the valve opening.

The increase in mechanical efficiency is largely wrapped up in the same matters as thermal efficiency. The higher compression has resulted in higher mean effective pressures, which in turn means a greater horsepower output from a given displacement. In the reduction of vibration due to the mechanical refinements, particularly in the crankshaft and reciprocating weights, there lies another one of the reasons for the increase in mechanical efficiency. Lower bearing friction will tend to bring this up, but it is to be doubted if this is being secured owing to the higher speeds and larger diameter shafts which have carried the linear bearing speeds close to the limit. When these rise over 1000 ft. per minute they are getting close to the limit for standard cars.



Pistons and connecting-rods of twelve-cylinder Wisconsin aviation engine

Part III—Refinements in Structure and Manufacture

Part-by-Part Study of Motors Shows That Every Detail Has Been Carefully Refined During the Year

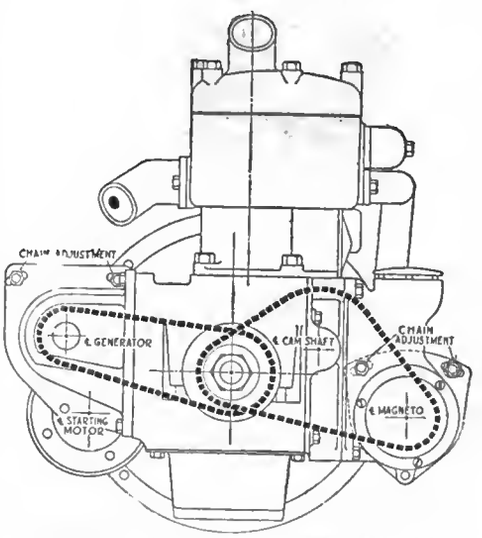
TAKING the engine part by part, it will be discovered that there is some sort of refinement in every detail. This may be in the line of economical manufacture, lighter weight or in some other direction, but there is no part of the engine which has been left untouched. In some parts the line of deviation between passenger and commercial or tractor practice becomes highly marked. In others it has been possible to cut the cost of manufacture while at the same time the efficiency of the resulting engine may actually have been increased.

Gray iron, or what is known as 15 per cent semi-steel, is the king of metals for cylinder use. The aluminum cylinder has not gained this year and will not until aluminum drops from its present price level. In manufacture the ground cylinder is favored over the reamed-in small bores, while above 3 in. there is a leaning toward the reamed finish. One or two manufacturers believe the best results are obtained by rolling. Taking engine manufacture as a whole, it may be said that reaming and grinding are about equally divided. The consensus of opinion on this subject is that the reamed finish is excellent for wearing into a finish fit, while it is easier to grind the surface of the cylinder commercially, within the desired limits.

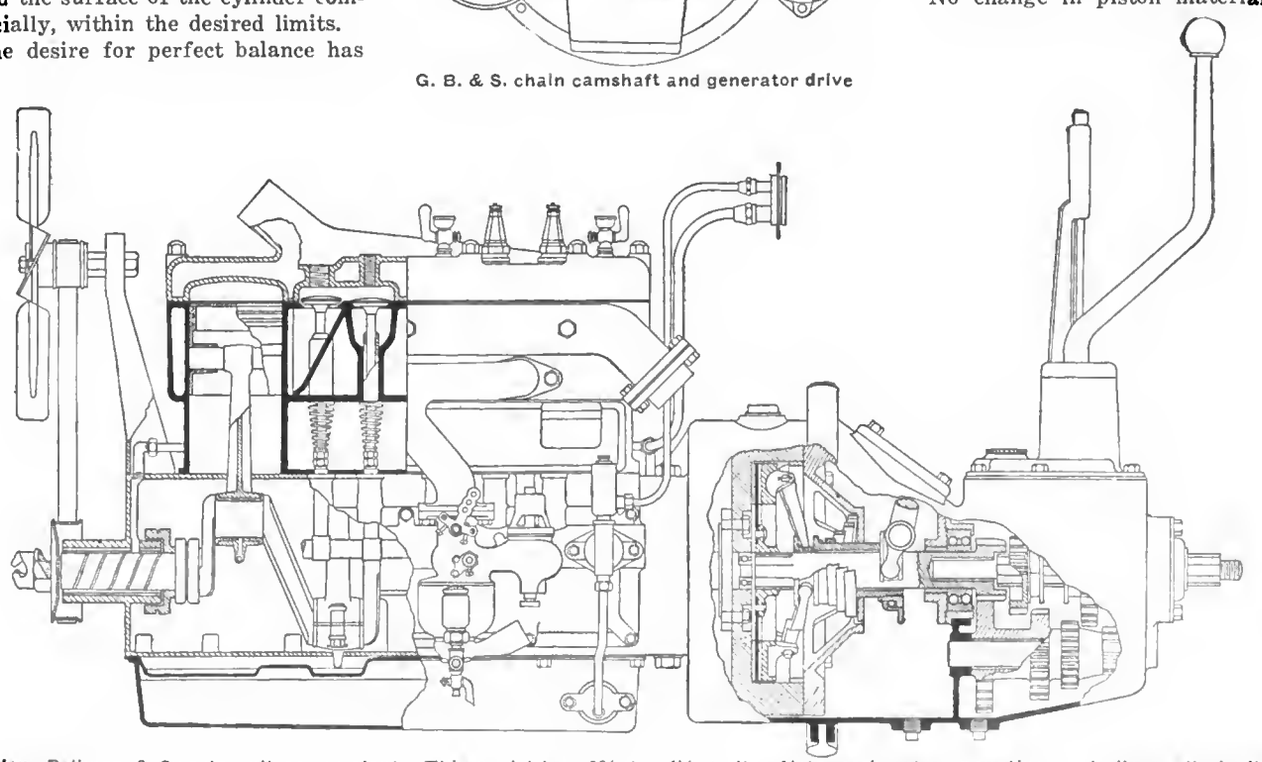
The desire for perfect balance has made the manufacture of equal combustion chamber volumes imperative. One of the Le Roi engines intended for high speed work is checked so that all combustion chambers must be accurate within 3 c.c. for volume. If desired that explosion pressures be equal on all pistons this must be done.

Another important feature in cylinder design is the question of how low the jackets should be carried. There has been a tendency all along the line to increase the water space, and jackets are universally larger. On the latest Falls motor, the waterjackets have been extended clear down to the crankcase line. In detachable head jobs, the passages for water from the main cylinder casting to the head have to be watched particularly. The Golden, Belknap and Swartz company has discontinued the detachable head because of a desire to secure better cooling in the upper part of the combustion space. This is the only instance, however, of where a detachable head has been dropped and the trend may be said to be in the opposite direction. A copper-asbestos gasket is necessary between the head and the cylinder, and any attempt to use a simple paper gasket at this point will be sure to end in failure as soon as a replacement is attempted.

No change in piston material can



G. B. & S. chain camshaft and generator drive



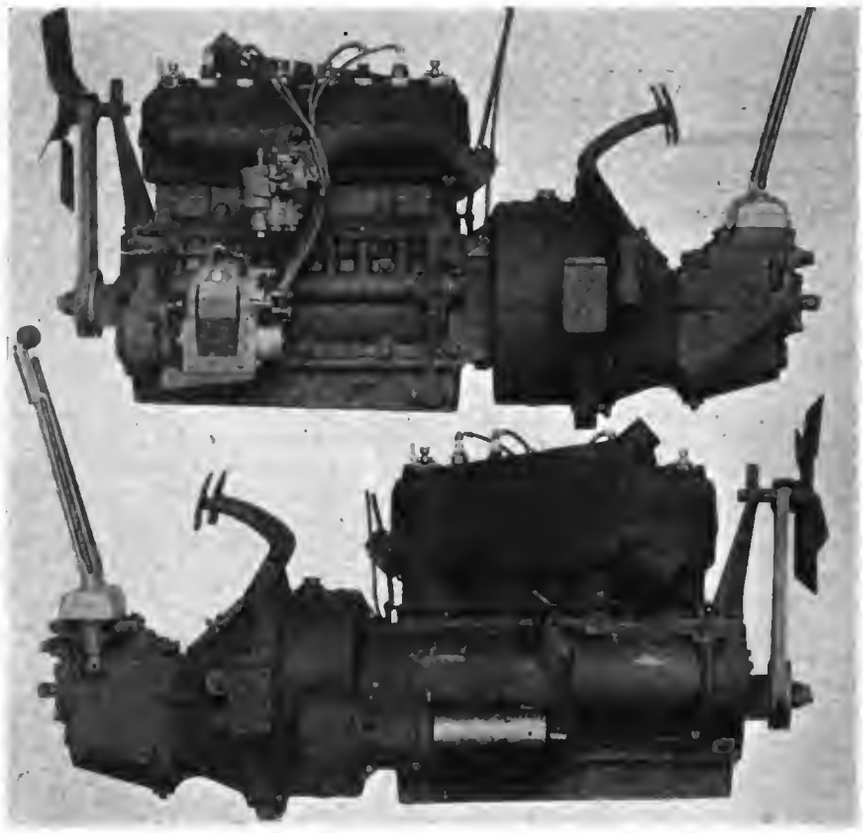
Golden, Belknap & Swartz unit power plant. This model is a 3¾ by 4¼ unit. Note carbureter mounting and diagonally-inclined intake manifold. Clutch and gearset details are shown at the right. End view of the engine appears above

be noted during the year, except possibly a slight backward movement toward iron where aluminum was tried a year ago. As stated, though, the aluminum question has not been settled yet. Gray iron, the same as used for the cylinders, remains far in the ascendancy.

Three rings, all above the piston pin, are practically standard, although one manufacturer, the Falls company, has changed to two rings and will place one of the patent leak-preventers in the top of each unit. For very high speeds two rings are enough, for the lower speeds it requires three eccentric rings to do the work.

Clearances on passenger car pistons have not changed during the year. On tractor work where the engine operates in a cloud of dust that cannot be altogether excluded, the larger clearances have been found necessary. On the Waukesha tractor motor, for example, with the 4¾-in. bore there is a piston clearance at the top of 0.018 in., which is more than double that of the corresponding passenger car engine with iron pistons.

Although cast iron remains as the chief piston metal, pistons have been made very much lighter all along the line. The skirts are thinner and the piston pin boss is not taking so much metal. The pistons are being carefully lapped to the cylinders by many, and in the Continental factory there is an interesting special machine which laps the cylinder by means of a dummy piston. On the little high-speed Le Roi engine the piston skirt is drilled all over with large holes for lightness.



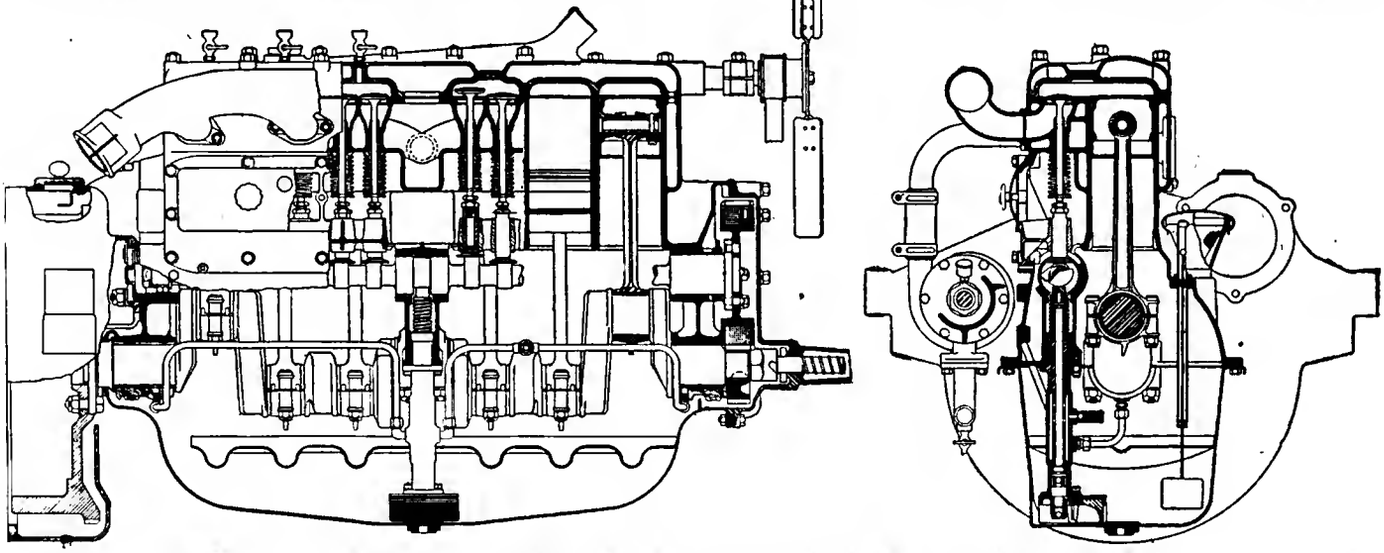
Golden, Belknap & Swartz unit power plant with L-head cylinders for small vehicles

On the Falls motor the piston pin has been lowered slightly and the difference has been taken off the connecting-rod length. A little piston kink that is used by some with good results is to taper off the top of the piston so that the oil instead of gathering on the head of the piston will gather in the space around the outside diameter, thus tending to feed itself between the piston and the wall.

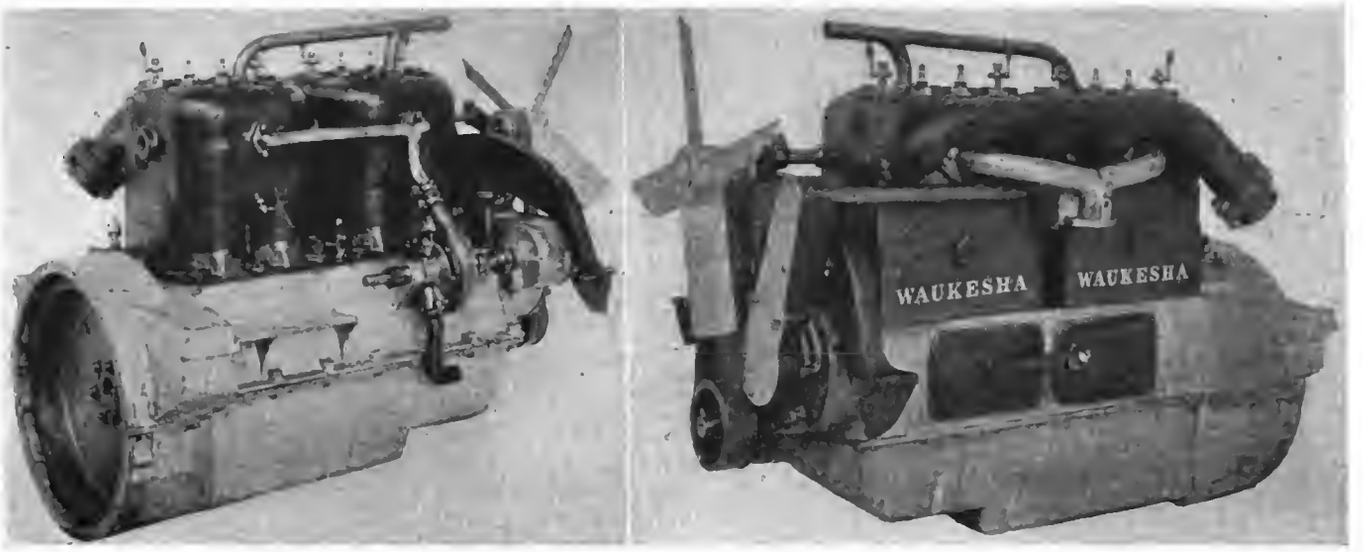
On all motors it is a desirable thing to be able to remove the pistons by pulling them out through the bottom past the crankshaft. This saves taking down the entire motor to replace a piston ring, for example, and is especially demanded for truck and tractor work, where time is invaluable. The majority of motors are being designed in this way, and no doubt others will rapidly fall into line. A slight difference in tractor practice, as compared with passenger cars, is that it is generally thought desirable to put the upper rod bearing in the piston boss with a solid connection to the rod. This is on account of a gain in bearing area. This practice is not universal, however.

Connecting-Rods

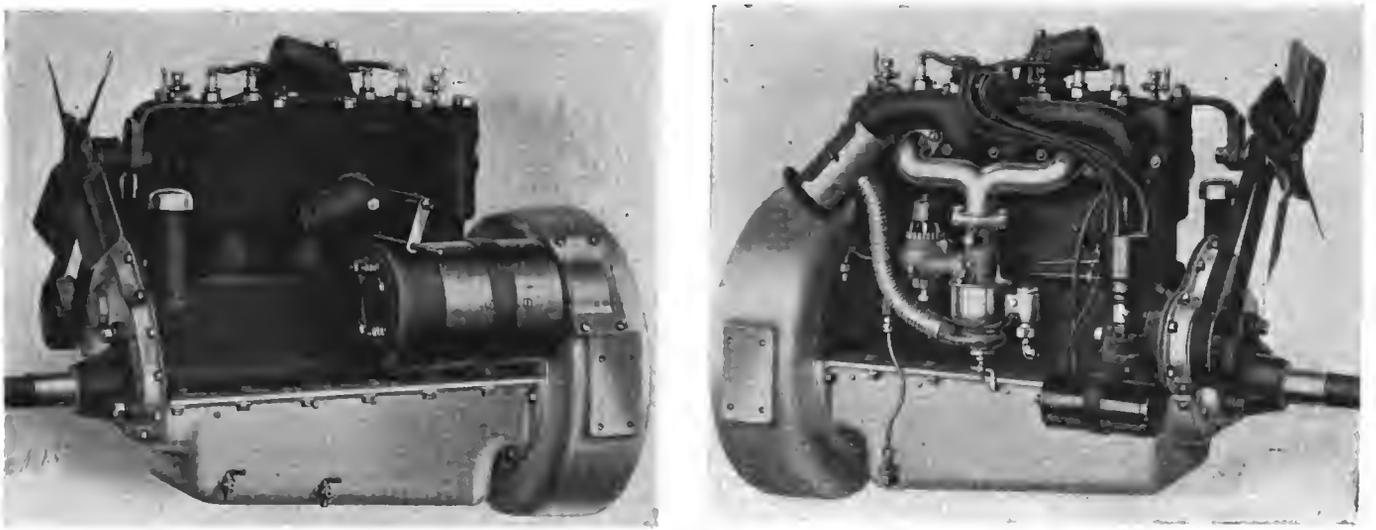
Little change will be found in rod practice. The straight I-beam is used almost universally and the material most employed is carbon steel, drop-forged and heat-treated. The tubular rod has not gained during the year, although in aeronautical practice it is coming in very strongly. The Wis-



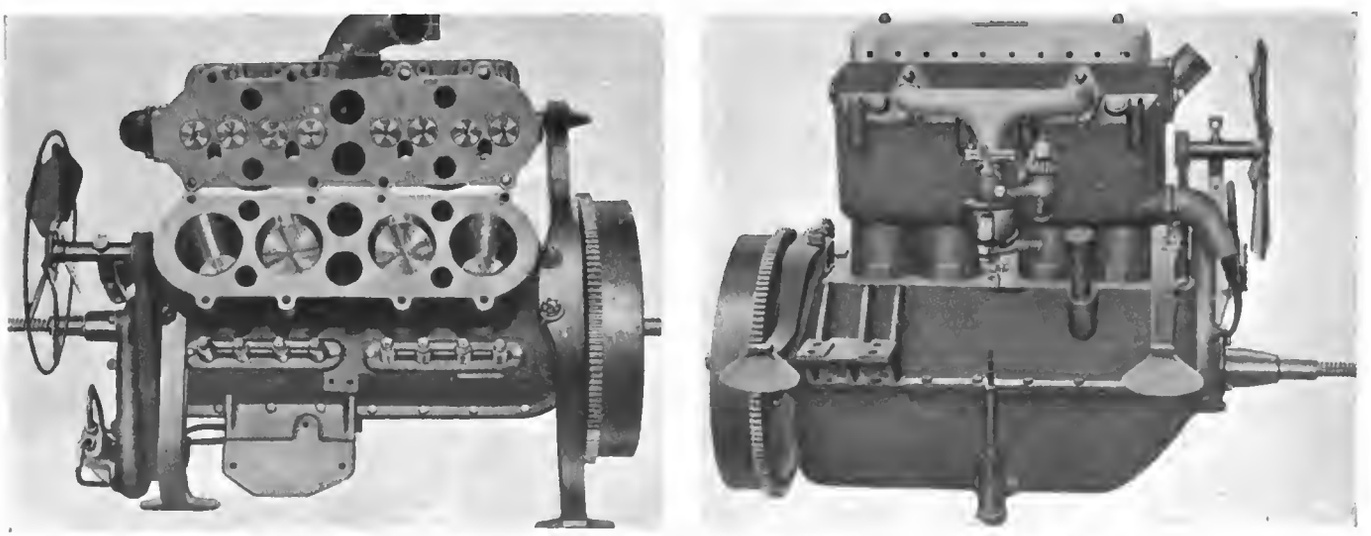
Rutenber model 25, which has a bore of 3⅛ and a stroke of 5 in. This model has been improved by the use of a stiffer crankshaft and is larger in bore than its predecessor, giving altogether a more powerful and efficient design



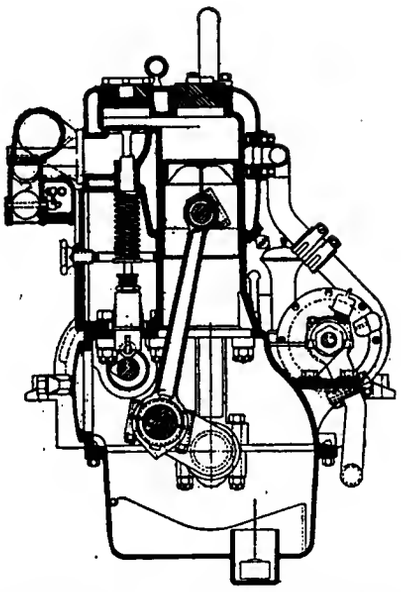
Both sides of a Waukesha engine which is used extensively on tractors. Note how carefully all the moving parts are inclosed to guard against the abrasive action of the gritty dust in which tractors are generally compelled to work



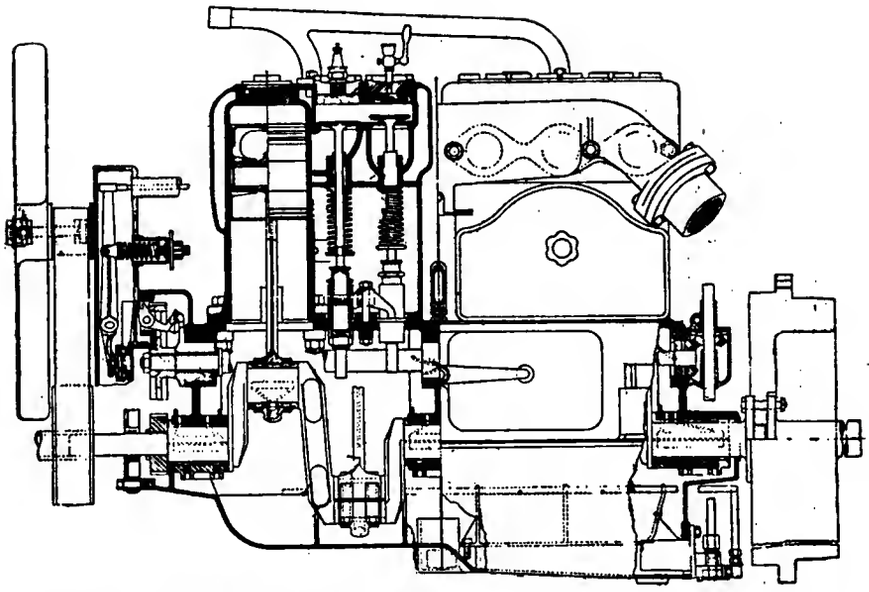
Both sides of the 3⅛ by 4½-in. four-cylinder Le Roi engine, which is designed for light commercial or passenger car work. Note mounting of electrical units and arrangement of manifolds



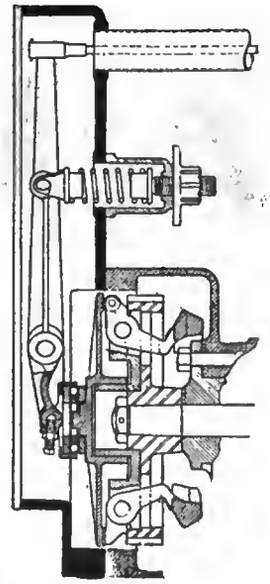
Two views of the four-cylinder Beaver model M L which has a bore of 3½ and a stroke of 5 in. A feature of this design is the detachable cylinder head, the illustration at the left giving an idea of the accessibility of the combustion chamber with this arrangement, while the one at the right shows the intake side of the engine



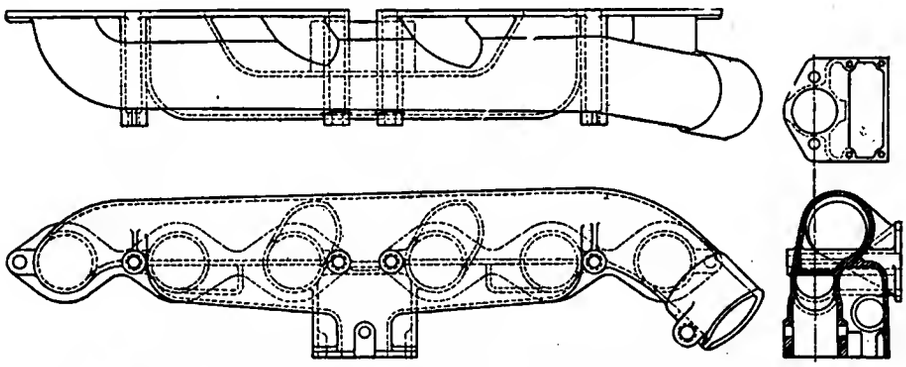
End section through the Waukesha 4½ by 6¾-in. engine, showing the valve and piston assembly details



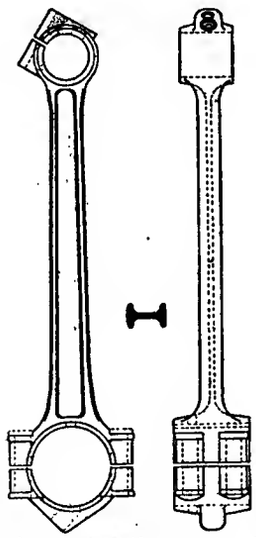
Longitudinal part section of 4½ by 6¾-in. four-cylinder Waukesha, showing mounting of governor behind the fan. Note combined intake and exhaust manifold



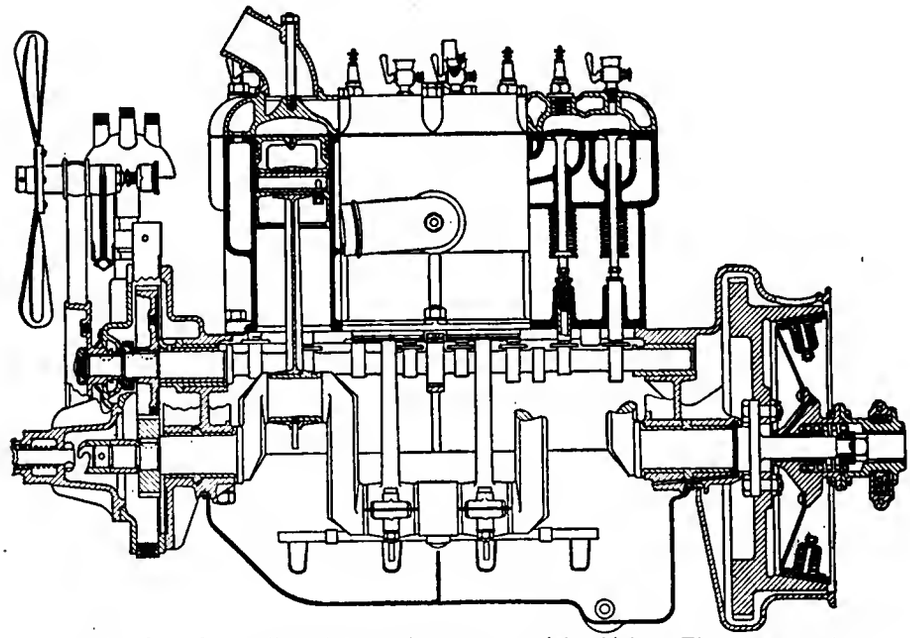
Enlarged view of governor on 4½ by 6-in. Waukesha model



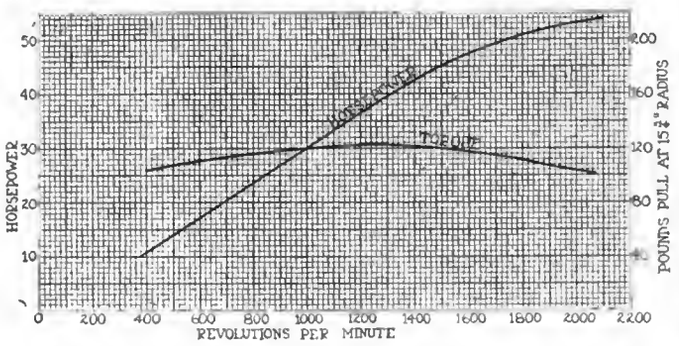
Combined intake and exhaust manifold which is a feature of the 4½ by 6-in. Waukesha, aiding in the vaporization of heavy fuel



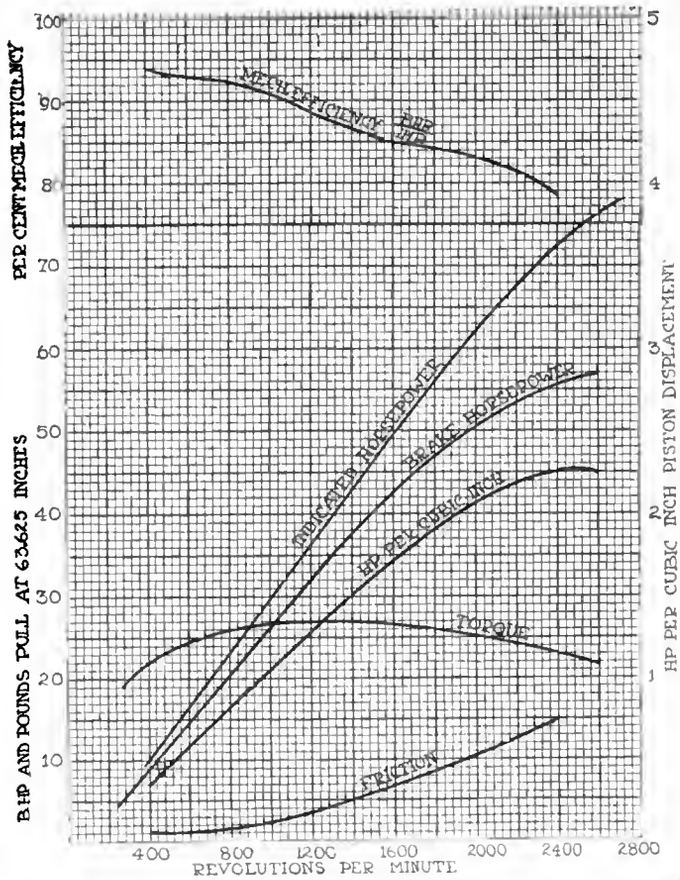
Waukesha connecting-rod showing light H-section



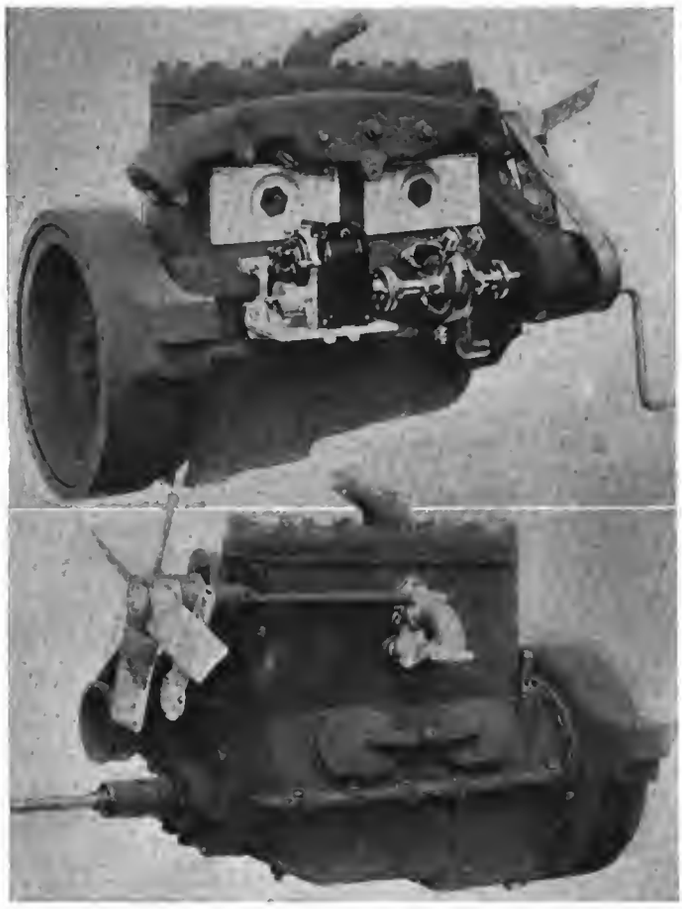
Lycoming four, for medium duty work on commercial vehicles. The generous size of the gas ports and the water passages surrounding the valves is indicative of present trends in this direction



Horsepower and torque curves of 3½ by 5⅛-in., six-cylinder Buda motor fitted with 1¼-in. carbureter



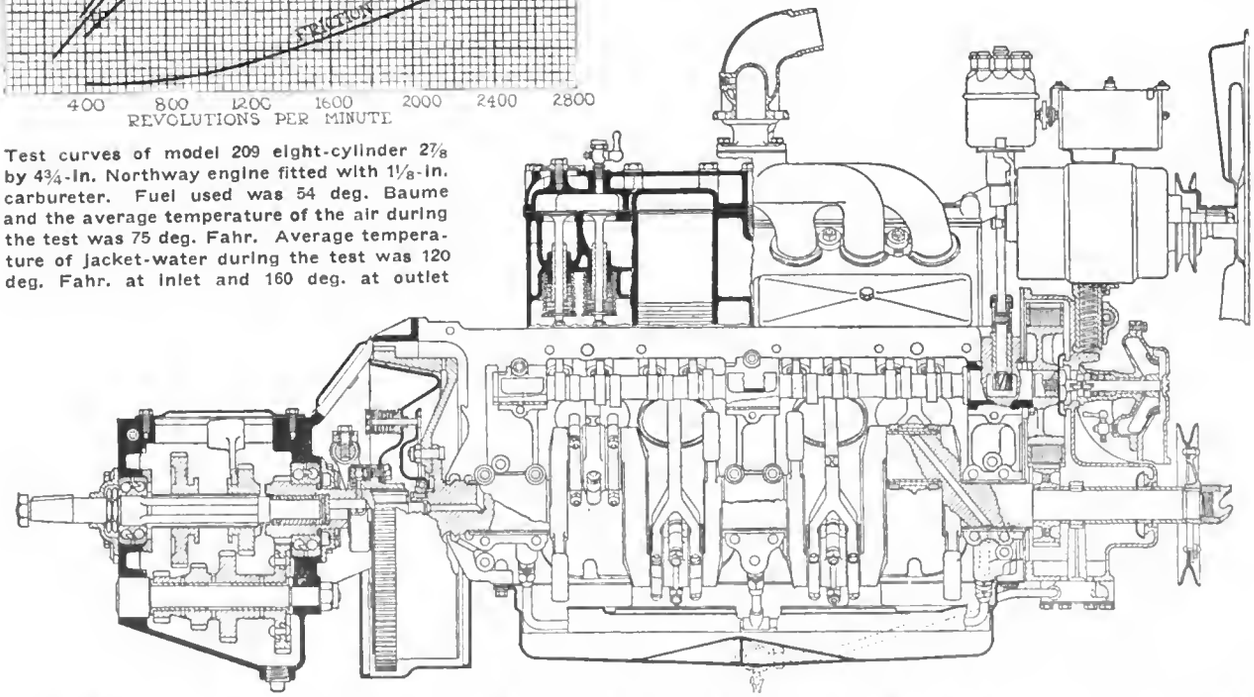
Test curves of model 209 eight-cylinder 2⅞ by 4¾-in. Northway engine fitted with 1⅛-in. carbureter. Fuel used was 54 deg. Baume and the average temperature of the air during the test was 75 deg. Fahr. Average temperature of jacket-water during the test was 120 deg. Fahr. at inlet and 160 deg. at outlet



Waukesha motor intended for tractor service. Combined intake and exhaust manifold aids vaporization of kerosene

consin aeronautical motor has the rods made from solid billet steel. Needless to say this practice is far beyond automobile work except for special cases such as racing.

The shorter rod of the Falls motor, due to the dropping of the piston pin, is the only example where rod lengths have been changed.



Northway eight. Note the single three-bearing, sixteen-cam shaft and the use of the forked rods. Both of these points have been much discussed in eight-cylinder practice and this engine is typical of this class of motor

Where manufacturers take the pains to mill off the flash from the drop forged rod they make a gain in the direction of lightness, but it is a time-consuming operation which must be done carefully. In carrying out the balancing operation, all the makers of engines weigh the rods in sets and equalize each set of rods and at the same time keep the centers of mass at corresponding points on each rod, within very narrow limits.

Crankshafts

Crankshafts are still growing stiffer. They are larger in diameter and at the same time shorter. Rutenber has a 2-in. shaft in place of a 1¾ on its standard model 25, and this is typical. This is one of the points in which passenger car and tractor practice approach each other for entirely different reasons. In the passenger car the stiffness is needed to take care of the higher speeds. In tractor work the stiffness is needed to take care of the constant racking of the engine on account of the rough work at constant maximum torque. Tractor engines must stand up. Two days may mean thousands of dollars in crop loss to a large farmer and he must have tractor engines that will work right along indefinitely.

Furthermore, on tractor work the ever-present grit and dust problem enters. It cannot be kept out in spite of washing apparatus on the carbureter and double filters in the breather pipe. It will get into the engine, and the only thing to do is to make the shaft so hard that it cannot be cut by the grit. The Waukesha motor, for example, uses a heavy chrome nickel steel shaft in which the tensile strength is carried up to 140,000 lb. per sq. in. and of a scleroscope test that almost equals tools steel.

Valve Actions and Drives

Silent chain drive has not gone ahead in the last 2 years for camshaft drives. The wide-faced helical gear seems to be about the most popular, and the use of Fabroil, Micarta and other compressed materials is looked upon favorably by a great many. The Waukesha is using a drop-forged gear, which the company believes to be best for the rough work of tractors, especially in that non-resonance is not such a great necessity. In passenger car practice, on the other hand, silence is greatly to be desired, and hence wider faces,

Specifications of 54 Stock Engine Models for 1917 Produced

MAKE AND MODEL	No. of Cylinders	Piston Displacement, Cu. In.	Bore and Stroke in In.	Cylinders Cast	Valves Placed	Valve Diameter in In.	Exhaust Valve Lift	Piston Length in In.	No. of Piston Rings	Weight of Piston in Oz.	Weight Connecting-Rod in Oz.	Length of Connecting-Rod in In.	Width Wristpin Bearing in In.	Diameter Wristpin Bearing in In.
Beaver.....ML	4	192.40	3½x5	block	head	1 7/16	5/16	.....	3	.....	.....	.....	1¼	½
Buda.....HU	4	312.00	4¼x5½	block	right	1½	½	5¼	8	71¼	96½	12½	2¼	1½
Buda.....IU	4	276.50	4 x5½	block	right	1½	½	5¼	3	.....	96½	12½	2¼	1½
Buda.....RU	4	197.23	3½x5½	block	right	1½	½	5	3	46	57½	11½	1¾	1 7/16
Buda.....YU	4	381.70	4½x6	block	right	2½	½	6½	3	98½	119½	18½	2½	1½
Buda.....LSU	6	303.10	3½x5½	block	right	1½	½	5	3	46	57½	11½	1¾	1 7/16
Buda.....SSU	6	364.48	3½x5½	block	right	1 11/16	½	5	3	55½	66½	12½	2	1
Continental.....N	4	192.40	3½x5	block	right	1 47/64	10/27	3¼	3	.....	50	10½	1¾	1 11/32
Continental.....C-4	4	280.60	4½x5½	block	left	2	15/49	5½	3	.....	.....	11	1¾	1 8/37
Continental.....E-4	4	349.90	4½x5½	pairs	left	1 31/32	18/49	5½	3	.....	.....	12	.....	1¾
Continental.....7-W	6	224.00	3½x4½	block	right	1 5/16	9/32	3	3	30	25	8½	1¾	½
Continental.....7-N	6	303.10	3½x5½	block	right	1 11/16	20/59	3¼	3	.....	50	10½	2 7/16	1 11/32
Davis.....SD	4	113.10	8 x4	block	right	1½	7/32	3	3	28	29½	8	1 1/16	1 1/16
Falls.....I-T	6	180.20	3 x4½	block	head	1½	9/32	3¼	3	28	28	8½	¾	37/50
Falls.....J	6	180.20	3 x4½	block	head	1½	9/32	3¼	3	28	28	8½	¾	37/50
Ferro.....9	8	198.00	3 x3½	block	head	1½	5/16	3 3/16	3	.....	.....	7	1¼	¾
Ferro.....8	8	265.00	3½x4	block	head	1¾	5/16	3 7/16	3	.....	.....	8	1½	1
Ferro.....13	8	162.00	2¾x3¼	block	head	1 7/16	3/11	3	3	.....	.....	7	1¼	37/50
Hercules.....C-2	4	226.40	3¾x5½	block	left	.....	.....	.....	5	.....	.....	.....	.....	.....
Hercules.....C	4	197.20	3½x5½	block	right	.....	.....	.....	5	.....	.....	.....	.....	.....
Hercules.....M	4	276.50	4 x5½	block	left	.....	.....	.....	5	.....	.....	.....	.....	.....
Hercules.....M-2	4	312.00	4¼x5½	block	right	.....	.....	.....	5	.....	.....	.....	.....	.....
Le Rei.....C	4	138.40	3½x4½	block	.....	1¾	.....	.....	.....	.....	.....	.....	.....	¾
Light.....H	4	149.30	3½x4½	block	right	1¾	5/16	4	3	28	39	9	1¼	¾
Lycoming.....DU	4	165.90	3½x5	block	right	1¾	15/49	4	3	34	46	9½	1 7/16	¾
Lycoming.....U	4	165.90	3½x5	block	right	1¾	15/49	4	3	34	46	9½	1 7/16	¾
Lycoming.....DXU	4	192.40	3½x5	block	right	1¾	15/49	4	3	40	46	9½	1 7/16	¾
Northway.....108	6	177.00	2 13/16x4½	block	bead	1½	5/16	3 7/16	3	51	22	9	1½	¾
Northway.....289	8	246.70	2½x4½	block	right*	1½	5/16	3½	4	†63 3/20	†28 3/20	9½	1½	¾
Northway.....309	8	346.30	3½x4½	block	left*	1½	5/16	4¼	4	†77	†41	9½	1½	6/7
Northway.....306	8	346.30	3½x4½	block	left*	1½	5/16	4¼	4	†80	†35	9½	1½	6/7
Rutenber.....T	4	192.40	3½x5	block	head	1¾	5/16	3 13/16	3	40	31½	9½	1¼	¾
Rutenber.....38	4	294.00	4½x5½	pairs	right	1½	5/16	5	3	67	67	12	2	1
Rutenber.....25	6	230.00	3½x5	block	right	1 7/16	5/16	3½	3	27½	81½	9½	1½	¾
Sterling.....20	4	120.20	3 x4½	block	bead	1½	5/16	3¼	3	24	24	7½	1½	37/50
Tester.....H	6	230.10	3½x5	block	right	1¾	5/16	3 7/16	4	27	47	9½	1	1
Tester.....T17	6	572.50	4½x6	block	opp	2 7/16	5/16	5	4	58	58	12½	1½	1
Waukesha.....TU4	4	202.00	3½x5½	block	right	1¾	5/16	3¾	3	41	66	10½	2	1
Waukesha.....B	4	231.90	3½x5½	block	right	1¾	5/16	3¾	3	46	90	11½	2	1
Waukesha.....R	4	327.00	4½x5½	pairs	right	2	5/16	5½	3	80	76	11½	2½	1½
Waukesha.....M	4	430.00	4½x6½	pairs	right	2½	5/16	5½	3	90	94	12½	2½	1½
Weidely 4.....D	4	211.60	3½x5½	block	head	1¾	5/16	4¼	3	38½	73	11	2	¾
Weidely 12.....C	12	390.00	2½x5	threes	bead	1 7/16	¼	3½	3	22	41½	10	1¼	¾
Wisconsin.....J	4	449.60	5 1/10x5½	pairs	opp	2½	¼	6	3	103	106	12	3	1 7/16
Wisconsin.....JU	4	449.60	5 1/10x5½	pairs	opp	2½	¼	6	3	103	106	12	3	1 7/16
Wisconsin.....A	4	389.90	4½x5½	pairs	opp	2½	¼	6	3	96	106	12	2½	1 7/16
Wisconsin.....AU	4	389.90	4½x5½	pairs	opp	2½	¼	6	3	96	106	12	2½	1 7/16
Wisconsin.....QU	4	166.00	3½x5	block	left	1¾	5/16	3¾	2	34	44	10	2½	¾
Wisconsin.....TU	4	302.00	4 x6	block	left	2	5/16	5½	3	59	85	12	2½	1 7/16
Wisconsin.....UU	4	341.00	4½x6	block	left	2	5/16	5½	3	80	85	12	2½	1 7/16
Wisconsin.....D	4	606.00	5½x7	pairs	opp	2½	¼	7	4	128	148	14	3½	1 7/16
Wisconsin.....M	4	727.00	5½x7	pairs	opp	2½	¼	7	4	156	148	14	4	1 7/16
Wisconsin.....K	6	909.00	5½x7	pairs	opp	2½	¼	7	4	128	148	14	3½	1 7/16
Wisconsin.....P	6	1090.00	5½x7	pairs	opp	2½	¼	7	4	156	148	14	4	1 7/16

*Optional. †With forked rod-blade rod lighter. ABBREVIATIONS: Opp, *opposite;* ext-man, *external manifold;* int-pas, *internal passage;* Cent

compressed fabric gears, the helical pitch and occasionally silent chain drive.

Camshafts have not been altered materially. In fact timing and cam contours have not changed much in the last 3 years. Where the offset rocker has been adopted it has, of course, necessitated a change in the cam, but the average timing will not be found to be much altered. There is a surprisingly small difference between commercial and passenger car work, the latter being slightly more advanced for the higher speed. Exhaust valve opening at 45 deg. before lower center is about the average, while for a few passenger cars it will run nearer 55 deg.

In construction, the valve operating parts have been made lighter. There is quite a trend towards hollow push rods. Waukesha, Northway and Falls have all adopted them this year. The high speeds of the valves have called for a reduction in the inertia of the moving parts through decreased weight. If this inertia is not decreased the followers will not cling to the cams. Steel tubing is used for the push rod, and this is fastened by welding or expanding to the solid steel-hardened follower.

Followers of the mushroom type are growing rapidly and the roller design seems to be falling off among the motor specialists. There is generally an offset on the follower to distribute cam wear. This is secured through the simple means of making no accurate determination of the push rod axial center, so the variations in the casting will give the offset.

Valves

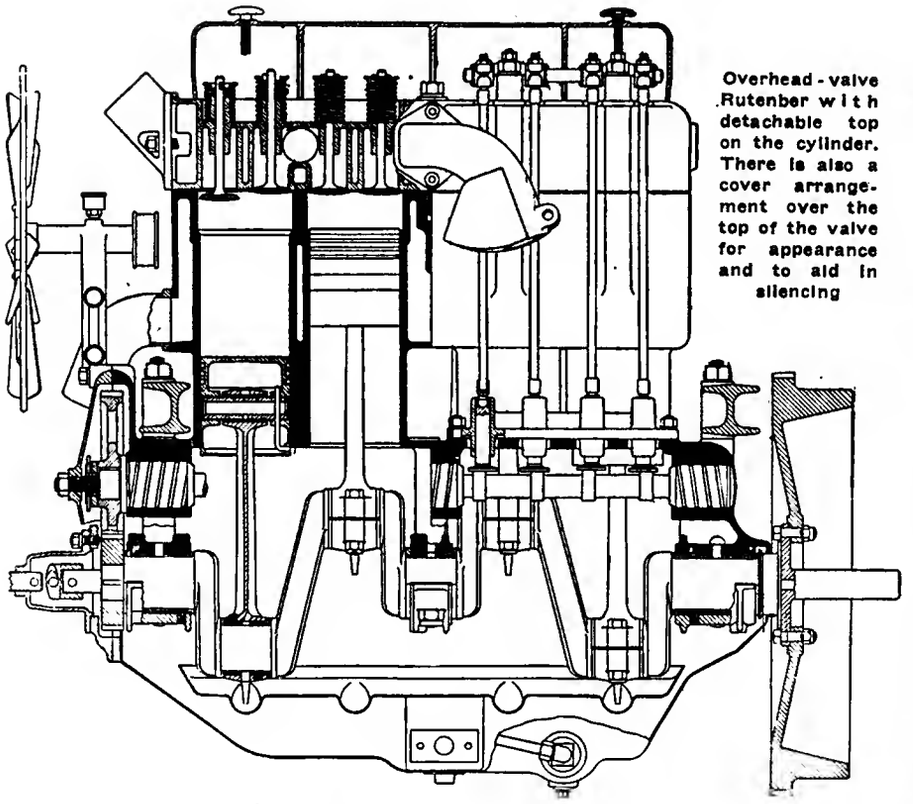
Valve sizes, as stated before, have not changed much. There are quite a number of theories on the subject. For instance, one engineer will say that in truck motors the gas velocities have to be higher in order to take care of the lower grade fuel now on the market. Another truck motor engineer will state that the truck engine valves have to be larger in order to secure the higher volumetric efficiencies at lower speeds. As a matter of fact, practically everyone is going just as large as he believes safe in valve sizes.

Tungsten for valves is rather high in price. The natural result is experiments with other alloys. Wisconsin is using tungsten, and so is Northway, while Waukesha has found 3½

by 17 Manufacturers, Including Principal Dimensions

Width Connecting-Rod Lower End Bearing in In.	Diameter Connecting-Rod Lower End Searing in In.	Diameter Crankahaft	No. Crankahaft Bearinga	LENGTH OF CRANKSHAFT SEARINGS				Intake	Water Circulation	Motor Lubrication	Material of Crankcaae	Material Cylindera	Material Piaton	MAKE AND MODEL
				Front	1st Inter.	2nd Inter.	Rear							
2	1⅞	2	3	2⅞	2	.....	3⅜	ext-man	thermo*	circ-spl	.....	iron	iron	Seaver ML
2⅛	2⅛	.....	3	3⅛	2⅜	.....	4	int-pas	cent	pres	iron	iron	iron	Suda HU
2⅛	2⅛	.....	3	3⅛	2⅜	.....	4	int-pas	cent	pres	iron	iron	iron	Suda IU
2	1⅞	.....	3	2⅞	2⅛	.....	3⅛	int-pas	thermo	circ-spl	alum*	iron	iron	Suda RU
3	2⅛	.....	3	3⅛	3⅛	.....	4⅛	int-pas	cent	pres	iron	iron	iron	Suda YU
2	1⅞	.....	4	2⅞	2⅛	2⅛	3⅛	int-pas	cent	circ-spl	alum*	iron	.....	Buda LSU
2	2	.....	4	3⅛	2⅛	2⅛	4	ext man	cent	circ-spl	alum	iron	iron	Suda SSU
2 3/16	1⅞	1⅞	3	3⅛	2⅛	.....	3 9/32	int-pas	cent*	sp-pres	alum	iron	iron	Continental N
2 10/37	2	2	3	2⅞	3	.....	4 9/32	int-pas	cent*	circ-spl	alum	iron	iron	Continental C-4
3	2⅛	2⅛	3	3 1/16	3⅛	.....	4 13/32	int-pas	.....	circ-spl	alum	iron	iron	Continental E-4
2	1⅝	1⅝	3	2 14/25	3	.....	3 9/32	int-pas	cent	sp-pres	iron	iron	iron	Continental 7-W
2 3/16	2⅛	2⅛	3	2⅞	2⅛	.....	3 9/32	int-pas	cent	sp-pres	alum	iron	iron	Continental 7-N
1½	1¾	1¾	2	2	.....	.....	2 13/16	int-pas	thermo	circ-spl	iron	iron	iron	Davis SD
1⅜	1 9/16	1 9/16	3	2 5/16	2	.....	3	int-pas	thermo	sp-pres	iron	iron	iron	Falla I-T
1⅜	1 9/16	1 9/16	3	2 5/16	2	.....	3	int-pas	thermo	sp-pres	iron	iron	iron	Falls J
2	1⅜	1⅜	3	2⅜	2⅛	.....	3	ext-man	thermo	pres	iron	iron	iron	Ferro 9
2⅛	1⅞	1⅞	3	2⅞	2⅛	.....	3⅛	ext-man	thermo	pres	iron	iron	iron	Ferro 8
1	1⅛	1⅛	2	2 10/19	.....	.....	2⅜	ext-man	thermo	pres	iron	iron	iron	Ferro 13
.....	.....	.....	5	.....	.....	.....	.....	ext man*	gear	pres	iron*	iron	iron	Herculea C-2
.....	.....	.....	5	.....	.....	.....	.....	ext-man*	gear	pres	alum*	iron	iron	Hercules C
.....	.....	.....	5	.....	.....	.....	.....	ext-man*	cent	pres	iron*	iron	iron	Hercules M
.....	.....	.....	5	.....	.....	.....	.....	ext-man*	cent	pres	iron*	iron	iron	Hercules M-2
.....	.....	.....	.....	.....	.....	.....	.....	ext-mnn	thermo	circ-spl	alum	.....	.....	Le Roi C
2	1⅞	1⅞	2	2⅜	.....	.....	2⅞	int-pas	thermo	.....	.....	.....	.....	Light H
2⅜	1⅞	1⅞	2	3⅛	.....	.....	3 1/16	int-pas	thermo	circ-spl	iron	iron	iron	Lycoming DU
2⅜	1⅞	1⅞	2	3⅛	.....	.....	3 1/16	int-pas	thermo	circ-spl	iron	iron	iron	Lycoming U
2⅜	1¾	1¾	2	3⅛	.....	.....	3 1/16	int-pas	thermo	circ spl	iron	iron	iron	Lycoming DXU
1⅞	1⅝	1⅝	3	2⅜	1⅞	.....	2 13/16	ext-man	cent	circ-spl	iron	iron	iron	Northway 108
2 5/39	2⅛	2⅛	2	3⅛	.....	.....	3⅛	ext-man	cent	pres	iron	iron	iron	Northway 209
2⅛	2⅛	2⅛	3	3⅛	3	.....	3 5/8	ext-man	cent	pres	iron	iron	alum	Northway 309
2⅛	2⅛	2⅛	3	3⅛	3	.....	3 1/16	ext-man	cent	pres	iron	iron	alum	Northway 308
2	1⅞	2	3	2⅞	2	.....	3 5/16	ext-man	thermo	circ-spl	iron	iron	iron	Rutenber T
2⅛	2⅛	2⅛	3	3⅛	3	.....	4⅛	ext-man	cent	pres	iron	iron	iron	Rutenber 38
1⅞	2	2	3	2⅞	2⅞	.....	3⅜	int-pas	cent	sp-pres	iron	iron	iron	Rutenber 25
1½	1 9/16	1 9/16	2	3	.....	.....	3	ext-man	thermo	circ-sp	iron	iron	alum*	Sterling 20
1 11/16	1⅞	2	3	2⅛	2⅛	.....	3	int-pas	cent	sp-pres	iron	iron	iron	Teetor H
1⅞	1⅞	2	4	4	1⅞	1¼	4	int-pas	cent	sp-pres	alum	iron	iron	Teetor T17
2⅛	2	2	3	2⅛	2⅛	.....	3	int-pas	thermo*	circ-spl	iron	iron	iron	Waukesha TU4
2⅛	2	2	3	2⅛	2⅛	.....	3	int-pas	cent*	circ-spl	alum	iron	iron	Waukesha S
2⅛	2	2	3	2 7/16	3⅛	.....	3⅛	ext-man	cent	circ-spl	alum	iron	iron	Waukesha R
3	2	2	3	3⅛	4⅛	.....	4⅛	ext-man	cent	circ-spl	alum	iron	iron	Waukesha M
2⅛	2	2⅛	3	2⅛	2⅛	.....	4	ext-man*	cent	sp-pres	iron	iron	iron	Weidely 4 D
1 7/16	2	2⅛	3	2⅛	2⅛	.....	4	int-pas	cent	sp-pres	alum	iron	iron	Weidely-12 C
3⅛	2	2	3	3⅛	3⅛	.....	4	ext-man	cent	pres	alum	iron	iron	Wisconsin J
3⅛	2	2	3	3⅛	3⅛	.....	4	ext-man	cent	pres	alum	iron	iron	Wisconsin JU
3⅛	2	2	3	3⅛	3⅛	.....	4	ext-man	cent	pres	alum	iron	iron	Wisconsin A
3⅛	2	2	3	3⅛	3⅛	.....	4	ext-man	cent	pres	alum	iron	iron	Wisconsin AU
2	2	2	2	3	.....	.....	3⅛	int-pas	thermo	circ-spl	iron	iron	iron	Wisconsin QU
3	2	2	4	2⅛	2⅛	2⅛	3⅛	ext-man*	cent	pres	alum	iron	iron	Wisconsin TU
3	2	2	4	2⅛	2⅛	2⅛	3⅛	ext-man*	cent	pres	alum	iron	iron	Wisconsin UU
3⅛	2⅜	2⅜	3	4	4	.....	6	ext-man	cent	pres	alum	iron	iron	Wisconsin D
3⅛	2⅜	2⅜	3	4	4	.....	6	ext-man	cent	pres	alum	iron	iron	Wisconsin M
3⅛	2⅜	2⅜	4	4	4	4	6	ext-man	cent	pres	alum	iron	iron	Wisconsin K
3⅛	2⅜	2⅜	4	4	4	4	6	ext-man	cent	pres	alum	iron	iron	Wisconsin P

centrifugal pump; thermo, *thermo-syphon;* circ. spl, *circulating splash;* pres, *pressure;* spl pres, *splash pressure;* alum, *aluminum;* gear, *gear pump.*



Overhead-valve Rutenber with detachable top on the cylinder. There is also a cover arrangement over the top of the valve for appearance and to aid in silencing

per cent nickel steel very satisfactory. Another concern is experimenting with chrome nickel, and a few who cannot secure the material at commercial prices are trying other alloys. There is also a strong contingent in favor of the cast iron valve.

Oiling Systems

Higher pressures are used in oiling to compensate for the higher speeds. In the engines made by passenger car manufacturers there has been a tendency towards full pressure feed. This has been followed to some extent by the motor manufacturers. The Buda oil pump delivers a pressure of 40 lb. at 1000 r.p.m. of the crankshaft, and this is typical of other practice.

In oil pump practice there has been a little uneasy shifting around, both in the pump and in the drive. The Waukesha changed to a plunger pump a year ago, but came back to the gear device. Rutenber, on the other hand, has changed over from a vein pump to a plunger. The gear pump is in the majority, with the drive taken off the end of the camshaft. Oil leads are larger and as a rule are confined within the limits of the motor.

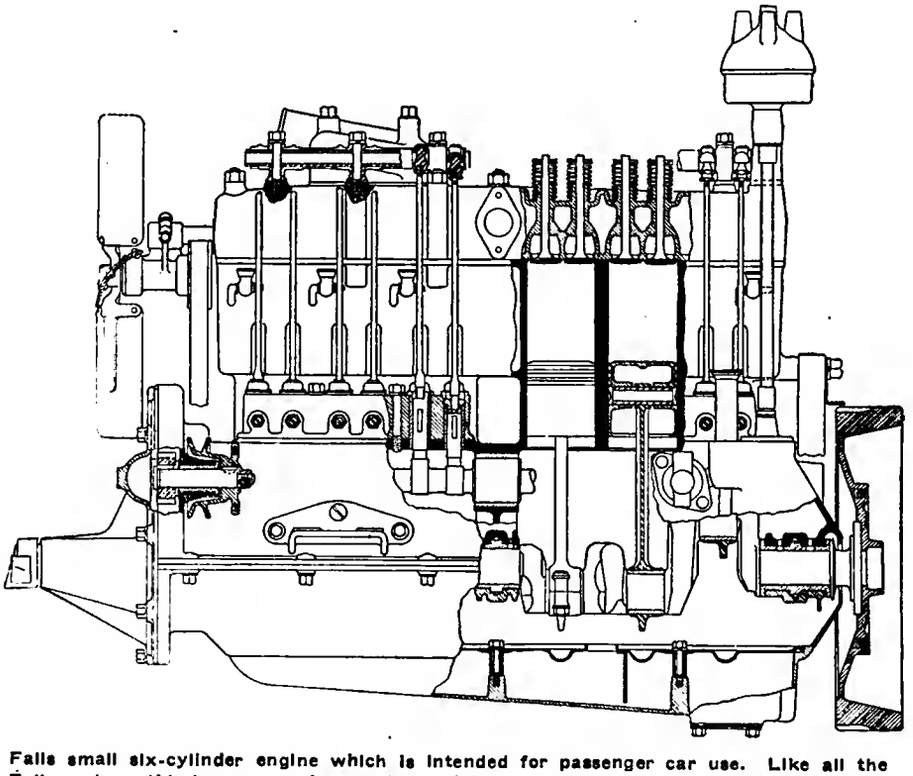
Some of the companies have simplified the oiling system to the extent of making it entirely self-contained. This has been a tendency for three years or more. The Wisconsin pump can be removed by taking four studs out of the bottom of the case. The Falls company has removed the external pipes this year and made the system self-contained. In the Le Roi engine there is a compartment surrounding the camshaft, which acts as a secondary oil chamber. It is 8 in. above the crankshaft and consequently gives that much hydraulic head for continually maintaining a supply in the splash troughs.

The matter of maintaining the oil in the splash troughs becomes very important in tractor work where a machine may be forced to operate on the side of a hill or constantly up-grade while it is running some stationary installation or, on the other hand, down hill. Waukesha has solved the problem of rectangular troughs, in which the scoop dips at the center or diagonal intersection of the rectangle. The scoop has been designed to give sufficient dip at any possible inclination.

Dust filters must be used in the oiling system of the tractor engine. Particularly is this true in the breather. One engine uses two screens in the breather pipe, the top removable and the other stationary. The continual cloud of gritty dust that surrounds the tractor is its worst enemy, and although the grit cannot be altogether kept out, every precaution must be taken. Tractor motors must be entirely inclosed for this reason.

Aeronautical

All through the motor industry there is a feeling of preparedness in the direction of aeronautical work, Although motors are in such demand that prospective automobile manufacturers have gone from factory to factory begging for production, enough time has been snatched to give the aeronautical side of the question a little attention. Wisconsin,

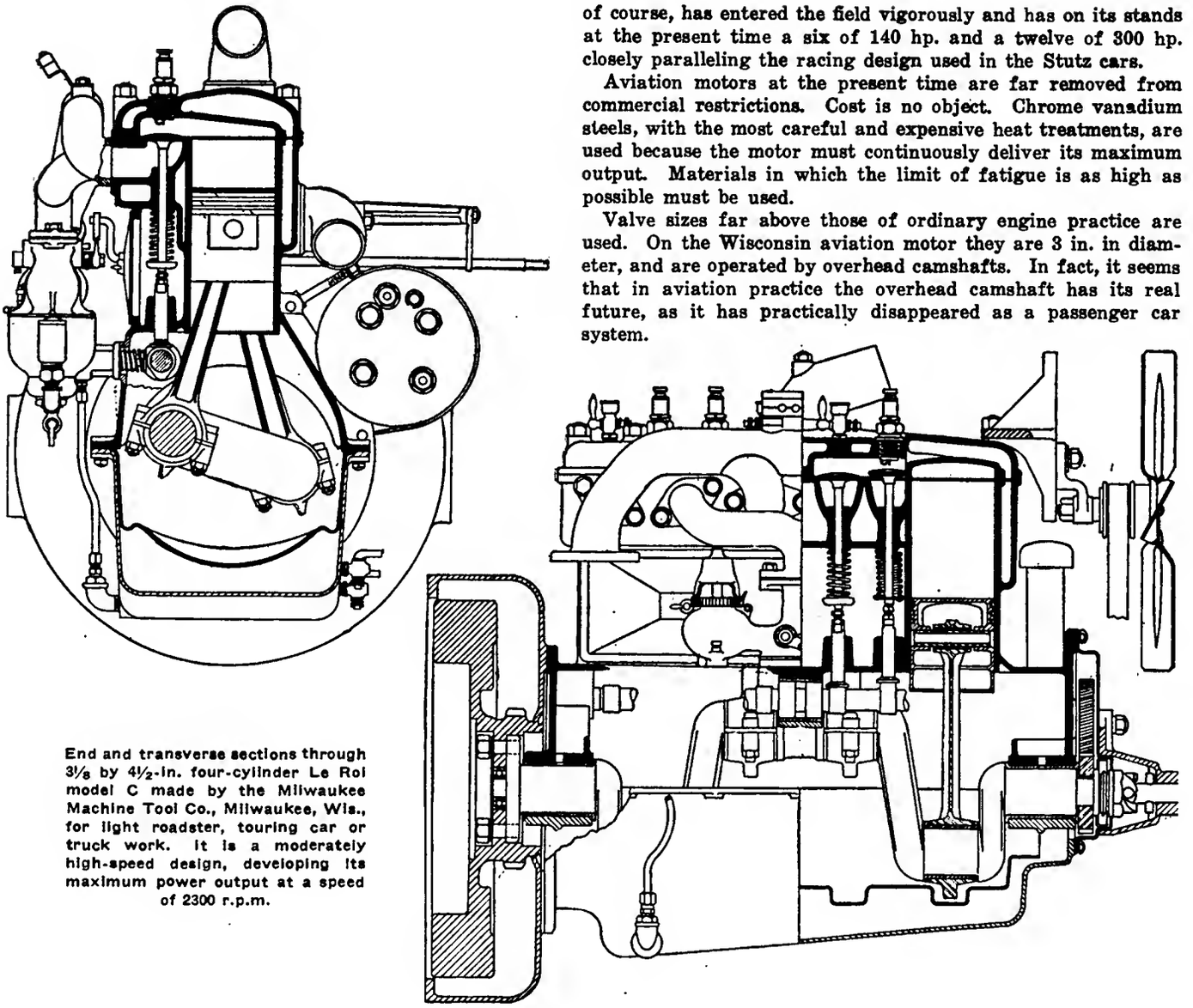


Falls small six-cylinder engine which is intended for passenger car use. Like all the Falls motors, this has an overhead valve action and a very efficient form of combustion chamber which is clearly shown in the end cylinder

of course, has entered the field vigorously and has on its stands at the present time a six of 140 hp. and a twelve of 300 hp. closely paralleling the racing design used in the Stutz cars.

Aviation motors at the present time are far removed from commercial restrictions. Cost is no object. Chrome vanadium steels, with the most careful and expensive heat treatments, are used because the motor must continuously deliver its maximum output. Materials in which the limit of fatigue is as high as possible must be used.

Valve sizes far above those of ordinary engine practice are used. On the Wisconsin aviation motor they are 3 in. in diameter, and are operated by overhead camshafts. In fact, it seems that in aviation practice the overhead camshaft has its real future, as it has practically disappeared as a passenger car system.



End and transverse sections through 3⅛ by 4½-in. four-cylinder Le Roi model C made by the Milwaukee Machine Tool Co., Milwaukee, Wis., for light roadster, touring car or truck work. It is a moderately high-speed design, developing its maximum power output at a speed of 2300 r.p.m.

Schoenrock Uses Two-Diameter Piston and Two Sets of Valves

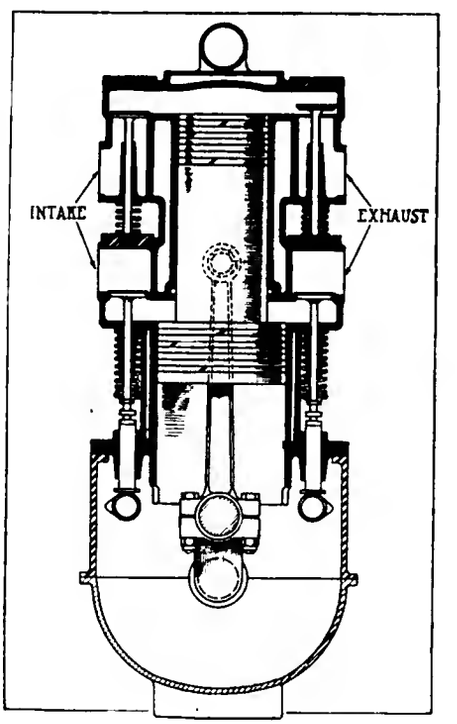
THE section at the right of the page illustrates the Schoenrock engine, which incorporates a novel adaptation of the four-cycle principle. The object of the engine is to secure the benefits of four-cycle practice with twice the number of expansion strokes. As will be seen, there is no great difference between this engine and any other except that it has a two-diameter piston, the smaller diameter being at the top and acting as the seal for the expansion chamber while the larger piston is at the bottom and is merely a factor in the scavenging of the engine.

Piston a Unit

There are two sets of valves, the upper left and lower left being intake and both right valves exhaust. The double piston is a unit so that as the gases are expanded they act upon the same rod, transmitting the power to the crankshaft. On exhaust the flow is very much the same as on the ordinary four-cycle engine.

May Be Rotary

In operation, as already stated, the engine has twice the number of expansion strokes, this being gained by the fact that while the small piston is compressing the gas the larger piston is exhausting the burnt gases. Although this drawing shows the engine with poppet valves it may be constructed with rotary or any other type. The intake valves are at the left of the cylinder block and the exhaust valves at the right, as indicated in the illustration. The connecting-rod mounting is also shown in the drawing.



War Develops German Industry

Necessity for Economy in Metals Makes Chassis Design Simpler, Stronger and Lighter—Lack of Rubber and Other Materials Brings Out Synthetic Product for Tires

By E. A. Langdon

GERMANY'S automobile industry has played a part of the utmost importance in enabling that country to withstand the assaults of its enemies since the beginning of the war. Needless to point out, this industry has not escaped the influences and effects of the great conflict and these results of the abnormal conditions created have been of both a detrimental and a beneficial character. For example, most of the cars which were drafted for service at the beginning of the war have long since been consigned to the army's great clearing houses for material, where they have been dissected and their various units used for other purposes or in repair work, or the rusty skeletons of their chassis, plucked bare of every detachable part and accessory, are gradually disintegrating in the mire of a thousand battlefields.

Chassis Are Simpler

Chassis construction has undergone a marked change, both in design and materials employed. Chassis are stronger and lighter, due to the elimination of many special parts formerly used, but now discarded for reasons of economy, and also because of the marked increase in the use of aluminum, not only for crankcases, gearboxes, etc., but also for such parts as valves, shafts, cylinder castings and other units for which an immense amount of copper, steel and iron was formerly required. A number of aluminum alloys of great strength has made this wide use of the metal possible, one of these alloys closely resembling the qualities of steel.

Gas from Coal for Fuel

An ingenious method of supplying automobile fuel has enabled the Germans to solve the gasoline shortage problem, which has at times remotely threatened to become serious since the beginning of the war, in spite of the enormous quantities of the fuel which Roumania practically made a compulsory condition to the purchase of wheat by Germany. Gas distilled from coal, and somewhat resembling illuminating gas in a liquefied or highly compressed state, is carried in steel tanks and fed to the engine through reduction valves.

One of the most important developments directly due to the war is claimed by the Germans to be the perfection of the manufacture of tires and other articles in which rubber was formerly used by synthetic processes. They also state that this product will compete successfully in quantity and quality with natural rubber in the world's markets following the termination of hostilities.

Industry Is Concentrating

German automobile, parts and accessory manufacturers, as well as the truck builders, are being fused into a powerful, compact unit of industry and are counting on their co-operative abilities to overcome trade barriers existing against their products at the end of the European struggle. It is even possible that agricultural and commercial motor trucks and tractors will represent a majority of the products of the industry for two reasons. One of these reasons is the large demand for these machines due to the scarcity of horses caused by the war, and the other is the economical advantage of standardized production.

Army Cars Different Now

The automobiles used by the army, at the present time, differ considerably from those used at first. Needless to state, there is hardly a car left which was drafted for service at the beginning of the war, except a few luxurious private cars used by the officers of the general staff and German princes. The supply of machines, however, must be replenished, and it is remarkable how, under the stress of necessity, German engineers have given up more and more special parts which went to make the machines as nearly perfect as their builders could conceive them; hence the cars are approaching an ideal of strength and simplicity, both in regard to design and materials used.

Aluminum Widely Used

The most striking feature, perhaps, is the immensely extensive use of aluminum, not only for crank and gear cases, but for valves, shafts, cylinder heads and jackets, supplanting a great deal of copper, iron and steel used before. The reason for the usefulness of aluminum is that the Germans have developed a number of very strong alloys, one of which is said to closely resemble the qualities of steel. The economic side of the matter is that the Germans mine coal belonging to France and to a considerable extent by French labor, and this coal enables them to manufacture tremendous quantities of aluminum cheaply by the electrical process.

This cheap production on a very large scale of coal has also aided the Germans to cope with their shortage of gasoline, as the gas obtained by distillation of the coal is used very largely to replace gasoline in stationary engines, marine engines, etc. This gas, which resembles liquefied or highly compressed illuminating gas in many respects, is transported in steel tanks from which it is drawn through suitable reduction valves. The reason for using this gas instead of industrial alcohol, which was used so widely in the early months of the war, is the necessity of economizing in potatoes, the chief staple food of the German people.

Synthetic Rubber for Tires

Rubber, the Germans say, will rapidly become a matter of the past after the war. All the tires used on German cars, as well as all the other rubber articles required by the Central Powers, are now made artificially, or rather synthetically. The Germans promise quite seriously that in the future their product will equal in quality and compete very successfully with Para and Ceylon rubber, and they never grow tired of repeating, with grim sarcasm, the fact that they are obliged to their enemies for forcing them to develop rapidly an invention which otherwise might have come along slowly in the course of years.

It has been stated above, and in some earlier article as well, that the Germans are organizing their industries more

and more on the "American," that is, the centralized, concentrated plan, and that by this means they intend to overcome whatever barriers they might have to break down in the market of the world when the war is over. This applies to the automobile industry as well, and in all likelihood, it will, after the war, face the world market as a solid combination, or "Kartell," as they call it in Germany—which is very little different from a trust. On the other hand, it is not at all impossible that the whole German automobile industry will devote itself to just one class of work, or chiefly so, namely, the building of trucks for agricultural and commercial uses.

The Need for Trucks

That the need for commercial motor vehicles will be even greater than for pleasure cars, after the war, follows simply from the fact that the stock of horses, with the exception of the breeding specimens, will be practically killed off by the time the war is over. Besides, the farming population, and especially the smaller ground holder, will be very much dependent on government support in every form, and as the subsidy policy for automobile trucks will doubtless be continued with even greater vigor than it was begun before the war, the incentive for buying efficient modern equipment will be correspondingly increased.

While the beginning of the war, or, let us say, the first 12 months, saw the introduction of many new devices and processes of warfare, such as movable siege guns, asphyxiating gases, liquid fire, electric barbed-wire entanglements and so forth, the number of innovations in war technique since the end of the first year have been rather small. The reason for this is not quite easy to understand, but, as several officers of the engineering branch of the German army have put it, is just about this:

Trying Out the New Things

"Germans, Austrians, French, and, in spite of their denials, British, have for years preceding the war invested an immense quantity of study and labor in the possibilities of the present war, and according to their ideas of the problems it would present, have worked out different schemes to overcome the difficulties they assumed they would have to face. Consequently, as the different ideas of warfare were given reality by the war's first year, the different inventions and discoveries and methods, either perfect or made so during that period, were brought into action. This introductory period being past, and the gravity of the struggle centering upon the Western field, methods had to conform to the situation given there. What is this situation? You may liken it to a game of chess on an immense scale, a game in which each player according to known ways of playing is capable of checkmating his opponent at the latter's first grave mistake. Hence the endless feeling-out and experimenting on both sides. Now and then, one or the other player believes to have found a new solution, but upon attempting to put it into practice finds, sooner or later, that he has not gaged the situation correctly. It is simply the impossibility of solving a problem of strategy by tactics. Therefore, whatever technical improvements one side or the other may bring out now, can be of but little bearing on the result. Both sides realize this, but the difference is that we are ready to express our understanding of the situation."

These words are almost verbatim what the writer learned from a high "genie" officer, now retired because of injuries. The interview took place in September, and the writer having obtained some English papers in Holland a few days before, asked the colonel above quoted: "How about the new British 'tanks'?"

The British Tanks

The officer stroked his long mustachio, and answered slowly: "It is quite a novel development, and its full efficacy cannot as yet be approximated. But if you want my opinion of the 'tanks,' let me tell you that on the Western front, two things count, men and explosives. Other devices are entirely minor. The men being required to serve the machinery of war, the rest consists in blasting to bits as much as possible of the enemy's position. Whatever is not an explosive is subject to destruction by explosives; and all we can tell after a few days' experience, so to speak, with the 'tanks', is that this maxim holds good in their case. They move slowly, at hardly more than 5 miles an hour, and that makes them splendid artillery targets."

I requested the colonel for a description of the "tanks."

"Mind you, this is far from being exact. Well: they are about 65 ft. long, almost 10 ft. high and not much narrower. The most striking feature is propulsion by endless steel lattices, engaged in the manner of chains by a set of driving wheels arranged on each of the axles. Steering is by a central pair of wheels placed like that of the old-time tricycles and arranged back of the machine. The power plant is situated close to this third wheel, entirely out of view from in front, and I conclude that the driver is guided by a sort of periscope eye placed in a well shielded position at the front of the machine. I doubt whether this engine weighs less than a 4:4:2 type of locomotive, and therefore would easily require 400 to 600 hp. for driving it. I know that Allied journals state the machine is like a railroad engine and carries its own rails along. But this is not so. These 'rails' are continually being laid over the most torn up ground imaginable, and the simile would be more correct if they would say that traction is by means of a pair of wheels, one on each side, with a theoretical spoke length of several hundred feet, but so actuated as to overcome the difficulty which this radius would cause if power were applied at the geometric center of the wheel. We have not as yet captured a 'tank', chiefly because when—as it happened in several cases—a 'tank' gets beyond control, it is blown to smithereens by the army of which it is part, so as to keep us from capturing it. Hence, you understand, all these statements are, so far as the construction is concerned, a matter of deduction. I should not be surprised, however, if these huge machines were driven, instead of by gasoline motors, by Diesel engines. By the way, isn't there a similar tractor made in the States?"

An American Prototype?

I failed to recall at the moment. The colonel gave me a merry look, like a schoolboy finding that there is one thing he knows and the teacher does not, and opened a drawer of his office desk. After a few seconds he handed to me a catalog of the Holt tractor factory! There was an illustration of what no doubt served as the original type for the "tanks," the caterpillar drive used on an American agricultural tractor.

The privates, "Kanenenfutter," who return from the trenches for a brief furlough to the "hinterland," are less easy about the new fighting machines. They maintain that when the "tanks" were first introduced, they made quite a terrible impression on the soldiers in the trenches, and it took quite a while until the suitable artillery could be got into readiness. But now the "tanks" are said to be a normal feature of the fighting like poisonous gases, and the soldiers with their marvelous faith in the ability of the army's rank feel certain that very shortly their effects will be quite checked and possibly beaten by a counter-invention. But there, the words of the engineering officer will probably prove true.

Friendly Toward America

A remarkable feature of the situation at present is the feeling toward America. The antagonistic sentiment which existed about a year ago has very much subsided, and the ideas then prevalent, about "*révanche*" toward America, for

supplying the enemy with ammunition and for restricting the submarine warfare, have almost disappeared, and by the intelligent Germans are passed over with a slight embarrassment. When you ask them about it, they say that they are so certain of their success in the end, that they will need their energies for something else than hitting back, after the war, at who might have harmed them during the war. The fact is, they realize that they will need very much raw material when the seas are open once more, and that it is no use antagonizing the people from whom you will have to buy most of it and who will find customers aplenty.

Big Tariffs in Europe After War

Of course, trade, like everything else, will be very different after the war. New methods will have to be used, both in buying and selling, and especially will the matter of credit and payment be altered. After the war, especially where such articles as automobiles, and particularly trucks, are concerned, a considerable part if not most of the business will be done on a basis of instalment payments from the consumer. In other words, American exporters here will meet a similar condition to that prevailing in South America, where payments are on long terms. It is not improbable that the same condition will apply to all of Europe, at least the Continent; and hence, exporting will call for more capital than it did before the war. Add to this the likelihood that every one of the European States or groups of States will surround itself by a tariff wall, and it follows that business with Europe after the war will be, although big, yet not an easy matter to transact, nor will it present any opportunities for the get-rich-quick type of business man.

Preparation Is Imperative

It would be well for the American automobile manufacturer who is at present reaping handsome profits to look into the future, organize his plant in the most efficient and economical manner imaginable, study the past methods required in trading with different European countries and educate their working, selling and advertising forces with a view to taking up the hard work of exporting when opportunity will present itself. In this regard, the parable of the wise and foolish virgins will once more prove significant, as it has proved so many times in the past.

Merchant Marine a Necessity

In closing, the writer would like to add one more thing which, though not of immediate automobile nature, should make American manufacturers think. American business men, not only in Germany and Austria, but also in Holland, Switzerland and Scandinavia are continually bemoaning the fact that there is so little of an American merchant marine with ships plying between the old and new world. They fail to see why their business, often enough in merchandise which cannot in any way be construed to be contraband, should be paralyzed and, as it was in many cases, destroyed, because nations other than their own are at war, and things seem to have come to the point where the belligerents force neutrals to look out for every one's interests except their own.

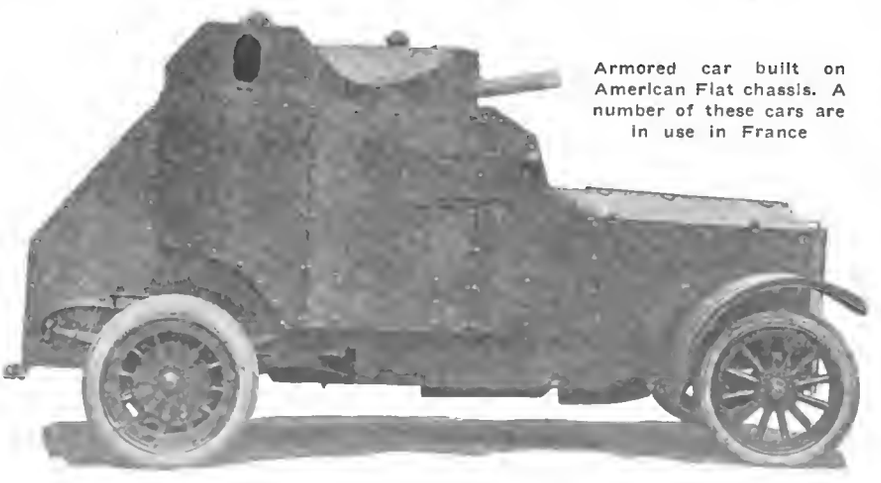
Fiat Armored Trucks in Battle Service

AMERICAN automobile chassis are numerous on the battlefields of France, both as the conventional passenger car and covered with armor plate. These armored cars are built both on motor truck and passenger car chassis, depending upon the character of the service for which they are intended. Thus massive, heavy chassis are used for field work where thick, weighty armor plate is a necessity, due to possible exposure to heavy fire and where speed is a secondary consideration. For swift, light armored types powerful passenger car chassis are frequently utilized, the plating not being as heavy since these cars are usually employed for scout work and quick dashes, so that they are not called upon to sustain heavy rifle or artillery fire for any length of time.

A number of the armored cars now in service in the Somme district and around Verdun are built on Fiat chassis produced in the American factory of the Fiat Co. at Poughkeepsie, N. Y. The illustration shows one of these Fiat armored cars. The motor is a 55-hp. type; wheelbase is 128 in.; transmission four-speed; and clutch multiple disk. In fact, the chassis with the exception of heavier springs, dual rear wheels, and the double steering controls, is identical with the model 55 passenger car chassis which the Fiat company is producing as its regular standard car. The chassis is equipped with the regular forward steering, so that the front driver operates the car as under ordinary conditions. There is a rear steering arrangement, so that the second operator facing backward at the rear end of the car can steer the car backward and have the car under the same control as the front operator—the advantages being that the armored car can run up as close to the firing line as desired, use the turret guns, and immediately back straightaway without having to turn around and subject the car to broadside firing from the opposing lines.

The radiator at the front of the car is armored with a V-shaped plate, so that any bullets striking will be deflected, without doing any damage.

On the chassis are mounted two rapid-fire guns in revolving turrets. Both the front and rear operator are protected by shields over the slits in the armor plate, through which they may look while under fire. The front operator has an opening, which is kept open when not in danger, but which can be closed down to the minutest point when approaching the firing line, giving almost perfect protection.



Armored car built on American Fiat chassis. A number of these cars are in use in France

The chassis is equipped with dual wheels rear, single wheels front. No air is used in the tires, so that puncture is not as serious as with air-filled types, the regular casing being filled with a special filler material adopted by the English government, although these tires are mounted on demountable rims for quick changing if necessary.

More News Is Wanted in Advertising

Value of a Good Name Considerable—Important That Price Be Stated—Foolish Catch Words Usually Disliked by Buyers

THE difference between American and British advertising is generally accounted for by the statement that the latter is "English," which explanation is given for anything and everything that the Briton does in his own way. But that the English ad reader is just as keen as his American cousin for attractive advertising and for ads that "tell him what the thing can do" and what it costs is indicated in a letter to *The Motor*, England, from one of its readers.

He advances the very modern thought that there is not enough sympathy between the advertiser and the prospective buyer, a criticism that is not necessarily confined to the British Isles. "One often wonders," he says, "whether the advertisers can regard their efforts from the standpoint of the buyer.

"The commercial value of advertising cannot be too highly esteemed. To be known is essential, and since first impressions have a peculiar adhesiveness, much—very much—depends upon one's introduction to some new commodity placed upon the market. Makers vie one with another to outdo in attractiveness, to excel in superior claims, to show their goods in the fairest light, and thereby eclipse the less-dazzling efforts of their rivals.

"Apart altogether from any commercial or speculative purpose, the scanning of the advertisement pages of such a paper as *The Motor* is full of interest, and one often wonders whether the advertisers can regard their efforts from the standpoint of the buyer, and whether they fully appreciate the effect upon the general mind. Sometimes one feels convinced that there is an absolute want of sympathy between advertiser and purchaser.

Must Attract Attention

"To attract attention to an article is the primary intention, and this may be accomplished in various ways. At the one extreme is the depicting of the absurdly ludicrous, freak forms and figures and faces, distorted and grotesquely abnormal features; but the effect of these, though at first they may succeed in drawing attention, is to repel; and probably every motorist could name a list of good and useful articles which are studiously avoided simply because of the advertiser's design which offended the sense of propriety.

"Just now, too, the figure of a man of good stature and military age at once arouses the thought that he ought to be at the Front and not soliciting a purchase of his goods. To rescue old gods from the backwaters of mythology and equip them in extremely modern guise adds no fascination to the goods they are supposed to adorn. It is always a risk to insert a face as a winning feature of an advertisement, unless that face have some peculiar charm or virtue. Some advertisers, not necessarily in the motor line, have ruined their chances of success by publishing abroad their own likeness. We often enjoy more fully goods, as also literary or poetic work, when we have not seen and do not know the manufacturer or author. Some geniuses in the factory and at the desk are insignificant to the eye. Nature, at times sparing in her natural and physical gifts, has bestowed vast stores of mental ability upon her unbeautiful children.

"An advertisement may be both attractive and pleasing. There are some we have turned to again and again simply because the illustration took pleasurable hold upon us, and, unconsciously, we became favorably disposed toward the thing itself. High art has been enlisted in this work of advertising, and a sense of gratitude toward the advertiser has led to the use of his—possibly—inferior goods to the complete exclusion of better things unhappily proclaimed.

"There are firms who cling to the idea that antiquity is still a virtue in the market, and largely declare their goods "The Original," even going to the extent of naming the date of birth or the age of the thing described; and the public, knowing that it is experience which teaches the most useful lessons of all, and that a hundred minds are ever busy in a more or less successful effort to improve upon any commodity which has attained to favor, prefer goods of the same kind whose making has no marks of antiquity.

"What's in a name?" is a stereotyped question; but there is more in the naming of an article than some makers think. It would not be a difficult task to draw up a fairly long list of articles which one would not care to ask for simply because their names are awkward or foolish. Give a thing a simple, straightforward, harmonious name and the battle is at least partly won. When people are uncertain how a word is to be pronounced, they hesitate to use it; and if that word be a foreign word, whose mispronunciation would be a mark of lack of education, educated people will shun it, even though it mean inconvenience and disadvantage to themselves, for fear of a slip.

"A man's own name is not by any means necessarily suitable for his goods. Who would not hesitate to inquire about the "Mary Ann carbureter" or the "Simple Simon tire?" The failure to appreciate things aright—a failure which is disastrous from the sale point of view—is shown in such nomenclature as the "Little Nell motor clog" or the "Tiny Tim differential grease." These may be fantastic exaggerations, but they have their counterpart in the advertisement pages of some journals.

"What the buyer really wants to know is the need that the goods will meet, claims that have borne the test, while one is also willing to accept with the usual scepticism the ambitious expectations of the makers. These have, however, been carried to such an extreme that the inquiry columns of many papers are full of requests for the experiences of disinterested users as to whether the advertised commodities actually fulfill the promise or claim of the advertisement.

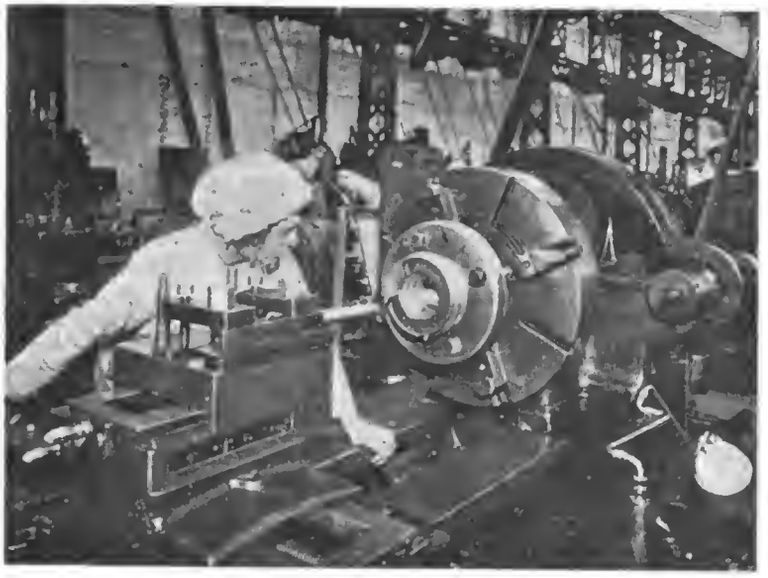
State the Price

"One thing more, and that is the price. Why cannot advertisers state the price of their goods? The withholding of this all-important factor is undoubtedly detrimental to the salesman. It creates suspicion. It is said that many shop windows show no prices on their goods because the sellers vary the price according to the apparent spending ability of the customer, or because the instructions are to ask at first too much in order to secure custom by reduction. These methods will not do to-day. We want to know exactly what a thing is to cost; we shall then know whether it will be worth our while to buy. The bartering of the Eastern fair is not according to the genius of the Western buyer. Advertisements count, advertising largely controls the market; but, after all, it is worth that wins, and the advertiser who gains a large sale by fraud or deception will suffer for it in the end."

Should Use More Female Labor

Automobile Manufacture Comprises Many Operations Which Can Be Performed Equally as Well as by Men —Hours Should be Shorter and Pay a Little Lower

By H. W. Allingham*



Cutting a large square thread

THERE are, in automobile manufacturing, many lighter jobs which could be done quite as well by women as by men. Such work should be paid for at a higher rate than it has been the practice to pay for woman labor, but at a slightly lower rate than men would expect for the same work, and the woman's hours should be a little shorter, perhaps 44 hr. a week where the men work 48 hr.

In showing how the above decisions have been arrived at it will not be possible to avoid repeating much which has already been published in the daily press and in weekly and monthly magazines. It is, also, not proposed to attempt to argue that the automobile industry is more suited to the employment of female labor than any of the other industries at present employing male labor almost exclusively. In fact, all the arguments which may be put forward in favor of the employment of women in the automobile industry, apply with equal force to a large proportion of the world's industries.

Until the European war forced upon the European nations a careful consideration of the possibilities of employing women, it had been the custom there, as it is at the present time here, to assume that certain classes of work were "men's work," simply because men had been customarily employed on such work since its inception.

A consideration of the question as to whether such an assumption is based on any logical reasoning shows that in the majority of instances it is not. Whether work is suitable for female labor or not is dependent on two main considerations.

(1) The manual effort required.

(2) The skill required.

Consideration of 1 needs no amplification. 2 should be analyzed further. In general it has been found that the more skilled manual work of the world must be planned on the assumption that male labor will do it. The reasons for this are as follows:

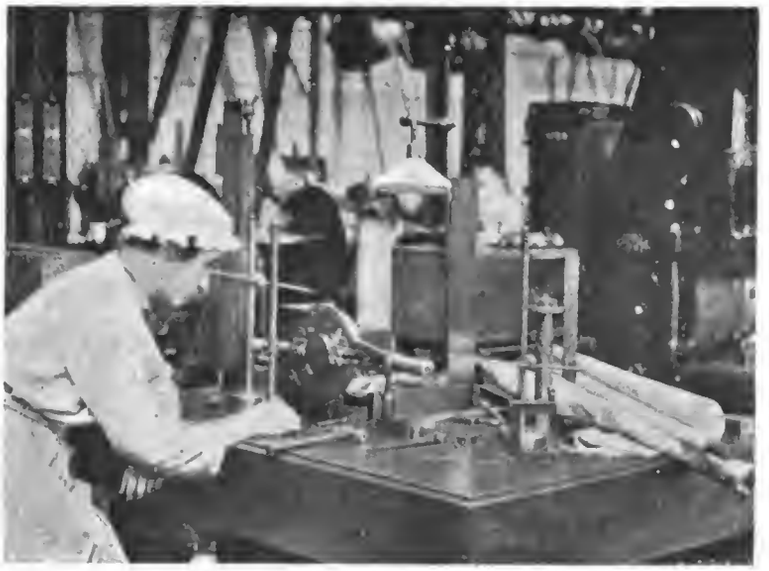
a. By virtue of the skill required, a more or less lengthy period of apprenticeship is required, during with the worker is an expense rather than a dividend-earner. It therefore follows that it is desirable to employ such people on skilled work as may be reasonably expected to remain active producers for a large part of their lives. This rules out women in general, because of the belief that they are more uncertain than men, practically never working after they marry.

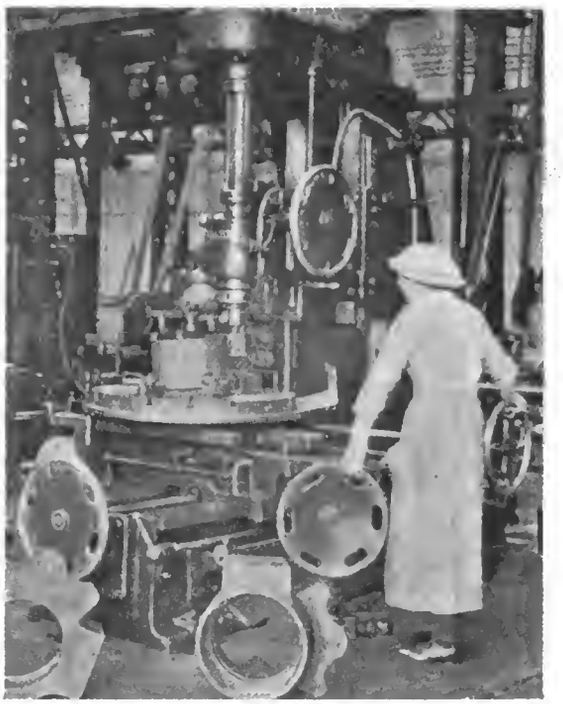
b. Ever since the inception of the "factory" systems less than 100 years ago men have banded themselves into unions which have tended to limit the employment of women, and of unskilled or semi-skilled men.

Mechanical engineering, covering foundry, machine shops, etc., has, in the past, almost without exception been looked upon as work suitable for men, although in the specialized industries, more particularly in the higher branches, women have been employed regularly for many years. Examples of this are light brass-finishing, core making, etc., while in the electrical trades much of the light work is now looked upon as women's work. The real difficulty is to determine how far it can be extended. For example, there can be no two opinions as to the fact that the machining of a 6-in. shell weighing 140 lb. is not suitable work for women, from the point of view of manual effort required, although it may be from the point of view of skill.

Performing surface grinding operation

*Mr. Allingham is a consulting production engineer with a very wide experience both in Europe and in America. He is especially well acquainted with the automobile factories of America and of England, while he has been able to study at first hand much of the work now being done by women in Europe.





Extremes of work. Above, the operator is illustrated engaged in marking off, and at the right in handling heavy parts

Again the operation of high-speed-steel hardening furnaces, or relieving lathes, can scarcely be expected to be sufficiently standardized, except in occasional instances, to be suitable for female labor. Nevertheless the writer in his own factories has been agreeably surprised to find women handled all the above work with every success, after careful teaching. The strictly logical line to follow would appear to be, firstly to determine what may be considered the limit for a woman in regard to manual labor, and then it becomes a question of balancing up the objections of trades unions and the difficulties of teaching.

Overcoming Objections

As an example of how male workers may be handled in this connection, I will give an instance which occurred in a factory where I was production engineer some 5 years ago. The department in question was the manufacturing milling department, and the labor regularly employed was of the semi-skilled or "machine operator" variety. Some of the work had increased in volume very greatly, and we had put in jigs holding, say, fifty small pieces, one jig being filled while the other was cutting. The work was light, and labor was scarce. Realizing that to start girls on these machines would be an innovation at that particular shop, and likely to cause trouble, I called a meeting of all the men involved, and asked them what their objections would be. They had all the usual objections and, of course, said they would not work if women were introduced. I went in detail into the orders in the department and through the capacities of the machines as shown by stop-watch time-studies (already this practice for setting rates was accepted by the men) and gave them one week to bring in their male friends to man the machines. If they could not give us the output required then, we should have the right to start women, *giving the preference to the men's sisters and friends.* The result was twelve women out of forty workers within a month, the women's work being carefully selected so as not to clash with the men's. No trouble was experienced and the men could not be rude or rough to their own relatives.

The average results of this and dozens of similar experiences can be set out briefly as helping to point the way to future developments. 1. Women will handle small delicate work of a repetition nature more quickly than men, giving a larger output per hour.

2. Women should work shorter hours than men. In general 8 hr. are quite enough, and a 44-hr. week, with Saturday a half day is my present ideal, just as the 48-hr. week is long enough for men working at an efficient speed.

3. The task per hour for women on light work should be as high as for men.

4. Rather heavier work can be tackled by women at a rather lower speed per hour.

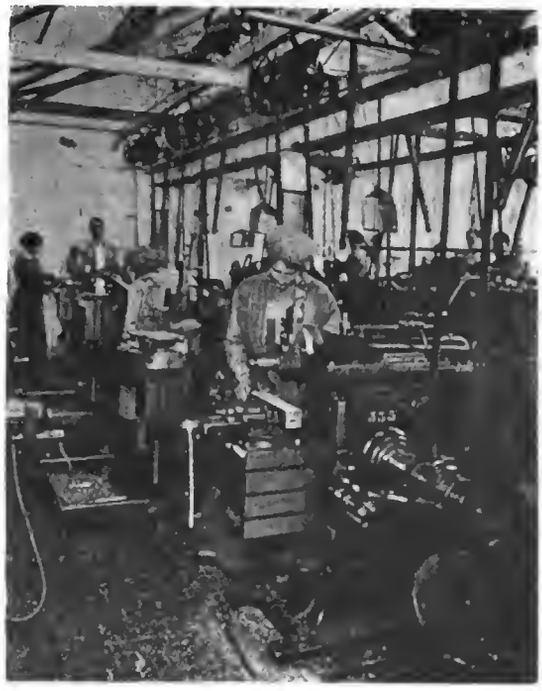
It is doubtful, however, whether the need for women to undertake what I describe as rather heavier work would arise if they were regularly employed on light work. There is so much light work in the world at present done by men that this, at any rate, merits the first consideration. For instance, the custom in some countries of using women for snagging and fettling castings while men are doing plain light engine-lathe work in the same factory, seems to be quite wrong. The great increase in quantity production in the automobile trade has caused a splitting up of operations, and a state of standardization of small operations has been reached in many factories to such an extent that workers entirely unfamiliar with factory methods can learn to perform the operations quickly and skillfully in a very short time. When these operations are light and do not involve much strength, there would seem to be no logical reason why men should be employed in preference to women. Such operations include almost all the light machining operations on such parts for instance as valves, aluminum pistons, etc., and light assembling operations on units.

Light Machine Work Suitable

The classes of machines capable of being efficiently operated by women are the lighter varieties of drills, milling machines, plain lathes, punch presses, special continuous operation machines and hand screw machines; automatics are not among those recommended to be considered at first.

In regard to assembling, much of the electrical work and top making is now being done by women, and the extension of women to the other components would appear a logical step. For example, the assembling of the connecting rod and piston, of pumps, of carbureters, even of the differential gear and steering gear, would not on the face of it appear to afford any difficulties.

The question of the reduction of wages paid is an economic one, but must be mentioned here, as it will be one of the great



Women operators doing what was formerly men's work, shaping small parts and grinding in valves of truck engines

causes of objection to women labor on the part of the labor unions. The fact that women have received lower hourly wages in the past has been due to the fact that so large a proportion of female workers have not been entirely dependent on their wages, and also that a very much smaller percentage of women than of men have dependents on them. Thus a girl of 18, one of a family, goes out to work. She is living at home, and a wage of $7 a week is almost all pocket money to her and she would not trouble to join a union if there was one. From the above, many people argue that it is quite logical that women should receive lower wages than men, because wages are dependent on supply and demand.

It is this same supply and demand which has caused the writing of the present article. The supply of male labor is unable to meet the demand. This has caused the wages offered to increase out of proportion to the increase in the cost of living, but still we have the alternatives:

(A) Curtail output

(B) Employ women

(a) is unsound from every economic standpoint because it is tantamount to limiting the production of wealth. We are therefore driven to adopt (b).

Now comes the question: Is it best for the country at large that where male labor is replaced by female labor, the wages, or piece work prices, shall be the same as previously, in which case the costs will remain the same, or shall the wages be in accordance with wages paid to women doing work requiring similar physical and mental ability in other trades? If we pay the same wages as men, we may embarrass all the other industries employing women, while if we pay wages similar to those in other industries we cause dissatisfaction to the men previously doing the work.

Must Compromise

The writer's belief is that a compromise will be effected. The wages paid at present for semi-skilled or un-skilled work are proportionately higher than those paid for the highly skilled tool-makers, for example. The reason for this is that the semi-skilled work has been increasing at such a rate that operators could not be obtained without offering big rates. If the semi-skilled work be now subdivided into light and heavy, we can leave the rates for heavy as they are now, and the light work should be logically somewhat lower-priced. In addition, the total wages earned by a woman are reduced, if she works shorter hours than a man, as she should do.

On the other hand, I believe wages paid to women in the past have been lower than they should be, and the widow who has been compelled to try and keep her family on the wages she could earn has been in an almost impossible position.

To sum up; automobile manufacture has expanded so much of late that there is a distinct tendency to a shortage of semi-skilled labor. There are many branches of the work at present done by men which could just as well be handled by women. Women should work shorter hours than the men previously employed on the work. Wages should be slightly lower than those received by men, but not so low as were customary before the war. Finally, present war wages should not be taken as a criterion, although the shortage of male labor will continue after the war.

Women employed in an English factory fitting crankcases of large aviation engines. They are very successful at work of this character

Committees Manage Perfection Spring Co.

System Eliminates Individual Management of Departments—Administrative Committee Supervises the Other Twelve—Each Committee Meets at Least Once a Month—Duties Outlined

THE Perfection Spring Co., Cleveland, one of the largest spring producers, is operating its institution under a form of committee management installed during the past year as briefly mentioned in THE AUTOMOBILE several weeks ago. The system aims to eliminate individual management of each separate department and to substitute for it a supervision of the various departments by means of committees composed of officers and employees and arranged and controlled by the administration.

The administrative committee includes Christian Girl, president and general manager; W. E. Perrine, assistant general manager; P. A. Connolly, secretary; T. E. Borton, treasurer, and H. H. Newsom, works manager, and is the supervising committee over all, determining the other committees, their responsibility, range of supervision and the departments directly under their control.

There are in all thirteen committees which are classified as administrative, finance, sales, manufacturing, engineering, standard engineering, purchasing, safety, welfare and employment, patent, salaries, sport and recreation, and cost and efficiency. Their range of duties and composition are:

Administrative Committee—

Officers of company—Supervision of all committees.

Committee on Sales—

Sales department and road engineering department—reports directly to the president or assistant general manager.

Chairman—the president.

Committee on Manufacturing—

President, assistant, general manager and works manager—supervises standard manufacturing and new process and development work and reports directly to president or assistant general manager.

Detail prints and schedules for manufacturing shall be given the manufacturing department by the order department. This department shall have charge of the cost department with the chief cost clerk as its present head. Stock room and receiving department are under the direction of the manufacturing department. It shall handle all stock and tools entering into the production of springs.

Chairman—the works manager.

Committees on Engineering—

Research committee, standard engineering committee.

Research committee includes designing and analysis—consists of the head of the laboratory, head of the experimental spring department and others that the chairman might desire.

Standard engineering committee has as its duties the active work of designing springs in process of manufacture—consists of chief engineer, road engineers and inside engineers and reports directly to J. G. Utz, chief engineer.

Chairman—the chief engineer.

Committee on Purchases—

Composed of assistant general manager, secretary and works manager. Has as duties the purchasing and directions of all purchases. The purchasing department is in charge of Mr. Homan who is directly responsible to the committee. The department has one man assigned to the purchase of factory supplies and tools for the manufacturing department.

Chairman—Assistant general manager.

Committee on Safety, Welfare and Employment—

Composed of the secretary, assistant general manager and works manager.

It is the duty of the committee to take such action as will safeguard employees and eliminate or reduce accidents to a minimum.

The committee on welfare will assist and look after the welfare of employees and their families.

Employment committee shall pass upon and handle such employment problems as come outside the scope of the regular employment agent.

Chairman—The secretary of the company.

Committee on Patents—

Composed of officers of company and engineers.

Its duties are the supervision of the application and prosecution of matters referring to patents and the investigation of all patents submitted from outside sources to the company with the power to recommend purchase or rejection. Patent attorney expense is authorized by this committee and invoices audited by it. Patent department is in charge of the chief engineer who reports to the committee.

Chairman—The chief engineer.

Committee on Salaries—

Composed of president, secretary and assistant general manager.

Duties to handle all matters pertaining to salaries.

Chairman—The president of the company.

Committee on Sport and Recreation—

Consists of assistant general manager, secretary and works manager, and also the manager and assistant manager of each team.

Duties consist of arrangement for every kind of recreation such as baseball, bowling and other features which are financed by the company.

Chairman—The works manager.

Committee on Cost and Efficiency—

Composed of works manager, assistant general manager, secretary and two employees.

Duties consist of investigation into costs and efficiency systems.

Chairman—The works manager.

The president and assistant general manager are members ex-officio of all committees whether mentioned or not.

Any committee may appoint a sub-committee upon approval by the president or assistant general manager and all committees are governed by the general executive committee composed of the assistant general manager, who acts as chairman, and the sales manager, chairman of the engineering committee, chairman of the manufacturing committee and the chairman of the finance committee. It has charge of the execution of all matters pertaining to the sale and manufacture of the company's product as directed by the policy of the board of directors, which is represented by the president.

Each committee meets at least once a month and as much oftener as the chairman of the committee may demand.

System Is Satisfactory

The committee system has been in operation for several months and up to the present is giving excellent satisfaction. Many advantages have accrued including broader consideration of factory matters, elimination of any personal favor

that might possibly arise in the purchasing department, rapid determination of a balanced stock by the purchasing committee which thus permits placing purchase specifications for exact requirements when needed and avoids overstocking of material, increased and improved production, and economy.

The co-operation of the heads of departments working together in committee, thus effecting co-ordination of effort, is believed, by the company, to have produced maximum results with a minimum degree of labor.

Care has been taken not to destroy any of the good effects to be secured by decisions which are the result of careful study and analysis of the members of the different committees by a rule which forbids any employee of the company except the president or assistant general manager to change or cancel any decisions as rendered by a committee without first consulting the chairman of that committee. If in his opinion the change is of minor importance and not sufficiently of consequence to require a committee meeting he may authorize the change over his signature. Or if the suggested change is for betterment and is important he may submit it at once to the committee, as for example if a road engineer should attempt to change the design of any spring after the design has been approved by the engineering committee, he must first consult the chairman of that committee.

Final Salary Decision

No department head is allowed to promise or file application for an increase in salary without first consulting the chairman of the salary committee. And as an added assurance to the perfect operation of the system, and in order to place the responsibility for its conduct upon an individual, the chairman of the executive committee, the assistant general manager of the company, is given the veto power and final decision in all matters.

Thermoid Disk Coupling Replaces Steel

THE recent growth in popularity of fabric couplings immediately suggests the question as to why this material should be more satisfactory than steel. It will permit of a slight disalignment of the running parts, it is true, but so will a steel disk coupling, and yet steel has been replaced by the fabric in more than one instance.

A case in point occurred at the Mercer plant during the spring of 1914, when the present model 22-70 was being developed. E. H. Delling, who was at that time chief engineer of the Mercer company, was developing the experimental chassis. Originally the car was fitted with a large diameter flexible leather coupling between the clutch and the gearset, taking up all the play between the engine shaft and the main shaft of the gearbox.

Changes in the gear in the gearbox and the propeller shaft brake which was added necessitated a different type of joint in place of the leather. The leather had to be abandoned, as it was found that with the stresses that were added with the propeller shaft brake, it would not be strong enough in the small diameter that was required.

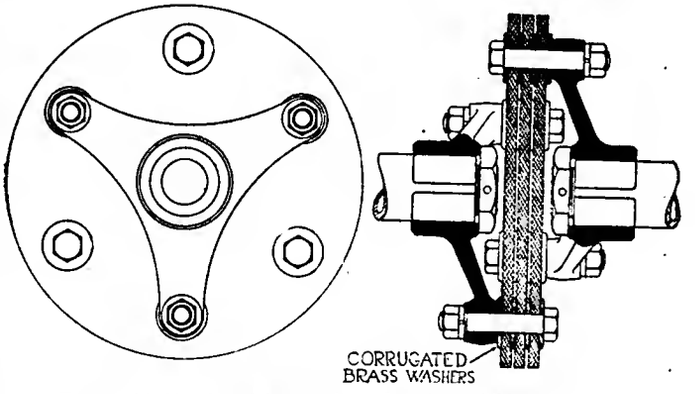
The three leather disks were replaced by two thin leaves of tempered saw steel on six or eight cars as an experiment. It was known that the strength of these leaves would be ample, but the uncertain part of the coupling was its action in practice and very soon after they were put on it developed that a rattle would occur. It took several days to locate this, as nobody suspected the coupling which was solidly bolted together. What made it particularly puzzling was the fact that the rattle would occur generally on direct drive and especially when running light or coasting. There was one peculiar feature and that is the rattle would never occur until the car had been run for 10 or 15 min.

The steel disks in the coupling were finally suspected, and to determine if they were really at fault they were removed and a fabric disk coupling made by the Thermoid Rubber Co. was substituted. Immediately the rattle ceased, and as a result of these experiments all the Mercer 1915 as well as the 1916 and 1917 cars were equipped with the Thermoid Hardy disks.

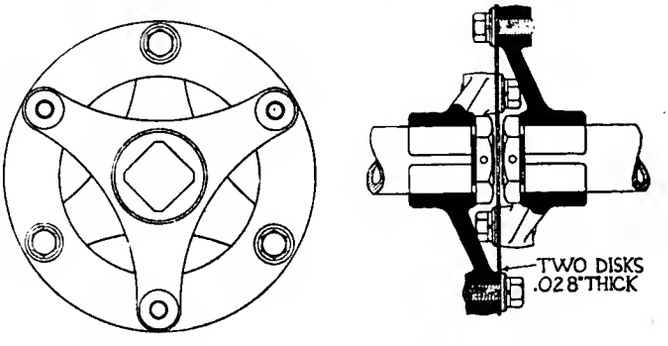
The laminated steel disk coupling which had to be abandoned is shown in the accompanying drawing. A three-armed dog is used on each shaft as a flange member and so arranged that the flange arms are bolted alternately between the arms of the flange on the opposite shaft. The flange members are secured to the shafts by squared ends and bolts which fit upon the ends of the shafts.

An investigation into what could have caused the noise in a coupling of this nature showed that it was due to a slight misalignment between the crankshaft and the mainshaft of the gearbox. This would cause a flexure in and out of the disks, similar to the action of a hand in pressing the bottom of an oil can, or in the disk devices that are used as a diaphragm in noise-making instruments. This in turn would transmit a torsional vibration to the gearset pinion whose teeth would naturally vibrate against the teeth of the countershaft gear, the clearance between the teeth being 0.004 in. The rattle would not show up for the first 10 or 15 min. until the grease would soften and cease to act as a cushion. After a little running the grease would thin out and thereafter the noise would be heard.

The Thermoid Hardy disks which replaced those of saw-steel are made under a patented process, of cross layers of high grade cotton fabric with rubber between them, and they are cured under compression similar to a tire. Their tensile strength is very high and is higher than that of leather as tests at the Columbia University have shown that couplings of the design illustrated which were worked out by E. H. Delling have withstood a torque of 21,000 inch-pounds before fracture.



Thermoid Hardy disk coupling for driveshaft mounting



Saw-steel disk coupling which was found to rattle

The Rostrum

Door Spring as Aid in Assembling

EDITOR THE AUTOMOBILE:—A few years ago when automobiles were built with the cylinders cast separately, it was not much trouble for two men to replace the cylinders after removing them. Now we have cylinders cast in blocks of from two to six and also piston rings with two and three parts, making it almost impossible for two men to assemble a motor, unless in an up-to-date shop, with all of the latest tools at hand.

For the benefit of those who have experienced trouble in entering the piston rings in a block of cylinders, where two or more pistons are entering at once, the best helper is a ⅜-in. screen door spring. Cut the spring into lengths, which, when stretched tight around the piston, will ride down with the cylinder, driving the rings into place without any trouble. The springs can be easily removed and used over, as soon as they have served their purpose on each piston.

Trenton, N. J. F. F. PALMER.

Data on Mean Effective Pressure

Editor THE AUTOMOBILE:—What is the brake mean effective pressure or the mean effective pressure of an internal combustion engine?

2—How can this be determined?

3—What is the pressure on the latest cars?

Orange, Cal. A. W.

—At the instant of explosion the pressure is very high and falls as the piston descends. The mean effective pressure is the average of the pressure existing throughout the firing stroke. Since a certain amount of power is used up within the engine and by friction the actual power delivered at the flywheel is less than it would be if figures from knowledge of what the mean effective pressure really is. We therefore take the mean effective pressure and multiply it by a decimal representing the percentage efficiency of the engine. Thus if the actual mean effective pressure is 100 and the mechanical efficiency 75 then the brake mean effective pressure would be 75 lb. per. sq. in. In actual engines this brake mean effective pressure varies between 60 and 100 lb.

2—When a horsepower test has been made the actual power delivered at a stated number of revolutions is none. We know this power comes from so many strokes of the pistons and of the impulse of the explosions. Knowing the area of the piston head and the length of the stroke we therefore know the brake mean effective pressure.

3—Answered under 1.

Troubled by Axle Shafts Breaking

Editor THE AUTOMOBILE:—I have a 30-hp. car with a semi-floating rear axle; the axle shafts are 1 5/16 in. diameter and at outer ends run in roller bearings which have a hardened steel sleeve 1¾ in. outside diameter, 1 5/16 plus bore which slips over the axle shaft and forms a bearing or inner race for the rollers.

The axle shafts frequently break off short at inner end of outer bearing and to remedy this I intend to have vanadium steel shafts made 1¾ in. diameter, dispense with the inner race of bearing and let the axle shaft run on the rollers. The rollers are of the high duty type and only about 2 in. long, so it is probable that the rollers would cut the shaft bad enough in a few thousand miles to require the replacement of the shaft.

Will it be safe and proper to case-harden the outer end of the axle shaft? I intend to do this by heating the outer end of the axle red hot in a bath of melted cyanide. Do you know of a better method? How long should the axle be left in the cyanide bath?

Should the axle be plunged in water after taking out of the cyanide?

My car is a 1913 Reo and it is easy to make the change in size of axle shaft without any large changes in the axle housing.

Carthage, Mo. F. B. N.

—You should have no difficulty in repairing the axle in the way you suggest. It would probably be unwise, however, to attempt to harden the vanadium steel shaft by the method you mention as this will almost certainly make the end very brittle. You do not say whether you are equipped for accurate heat treatment. Suppose you used a 0.3 or 0.4 carbon chrome vanadium steel, this should be quenched at 1650 deg. Fahr. and drawn at 850 deg. Fahr. The shaft should be gradually tapered from the back of the bearing down to the place where it fits in the differential hub. A somewhat easier heat treatment perhaps would be available if you used 3½ per cent nickel steel of a 0.3 to 0.35 carbon, allowing this to cool slowly after forging, heating then to 1550 deg. Fahr., quenched in order to reheat to about 650 deg. Fahr., allowing it to cool slowly in the air after this last heating.

Wiring Diagram of Wagner System

Editor THE AUTOMOBILE:—Kindly give wiring diagram of Wagner 12-volt starting and lighting system on 1913 Moon 48 roadster.

Wilmington, N. C. R. W. M.

—Wiring diagram of Wagner 12-volt starting and lighting system used on 1913 Moon is illustrated in Fig. 1.

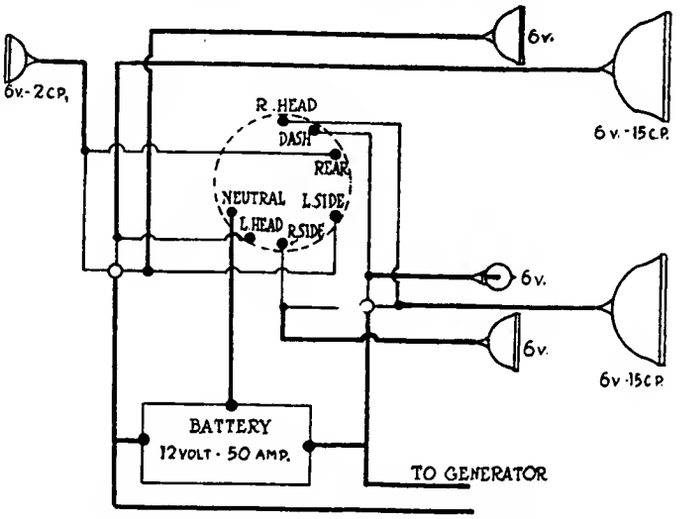


Fig. 1—Wiring diagram of Wagner 12-volt starting and lighting system on 1913 Moon 48 roadster

Empire 1-Ton Axle Has No Differential

The new 1-ton worm-driven axle made by the Empire Axle Co., Dunkirk, N. Y. It is characterized by the fact that it has no differential and is the first stock axle to be so offered on the market in this country. The housing is of the three-piece type, following previous Empire practice. The central part of the housing carries the worm and wheel as a complete unit

Central Part of Three-piece Housing on New Truck Type Carries Worm—Brake Shafts Oiled from Inside

NO differential is fitted in the new 1-ton worm-driven truck axle just brought out by the Empire Axle Co., Dunkirk, N. Y. This is the outstanding feature of the new axle, which was designed primarily for use by trucks of 1-ton capacity to sell at less than $1,000 and for converting passenger-car chassis into trucks of 1-ton burden. It is the only stock worm-driven axle so far to be placed on the market in which the almost universally adopted differential has been eliminated.

Advantages claimed for the use of a solid axle without a differential are that better traction is obtained over snow and bad roads, less tendency toward skidding when the brakes are applied, greater tire mileage and an appreciable reduction in the weight of the axle assembly itself.

The elimination of the differential enables a live axle to be used which is sufficiently strong to carry the weight and take the drive. This means that the casing for the worm gear need only be strong enough to support the driving stresses without any weight-carrying function. The elimination of the differential and the resultant decrease in the weight of the necessary housing makes the new axle light and simple.

The axle is designed to take both the propulsion and the torque through the springs, and is provided with a three-piece housing which follows previous Empire design. The center housing carries the worm and the worm wheel as a complete unit.

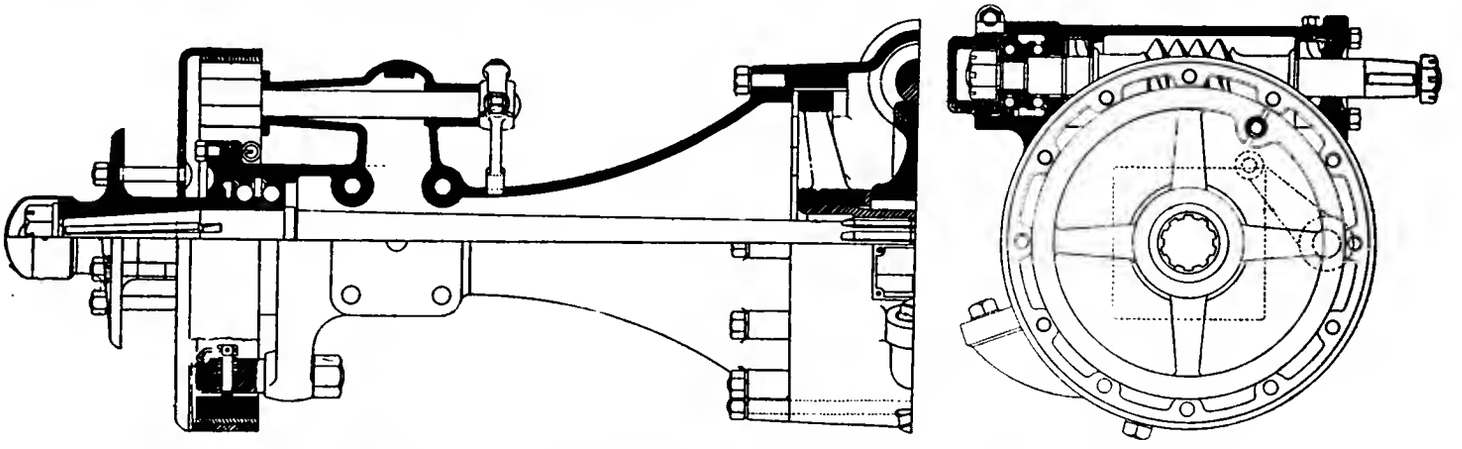
As shown in the sectional view, the complete housing is open from end to end and is characterized by a new construction in which the brakeshaft bracket is hollow and in open communication with the interior of the remainder of the housing, thus insuring the brakeshafts a sufficient quantity of oil for lubrication.

The worm and worm wheel are of the straight type. The worm is of 3½ per cent nickel steel, case-hardened and then ground to the correct tooth form. The worm wheel is cast from special phosphor bronze of high tensile strength. It is cut by the hobbing process, thus producing a generated tooth.

The driveshafts are of chrome nickel steel, heat-treated and ground to size. They are of the three-quarter floating type and are supported at the wheel ends on double-row radial-and-thrust type ball bearings, as is shown in the left of the section. As shown at the right of the section, the worm thrust is taken by double heavy-duty ball thrust bearings and the radial loads by two roller bearings of the Hyatt type.

The brakes are internal-expanding, with drums 13½ in. in diameter and 2¼ in. wide. The spring pads, which are integral with the side housings, are cubical in shape and hollow, forming the open interior connection between the housing proper and the brakeshaft supports. The spring centers are 38 in. apart, and are designed for springs 2½ in. wide.

The tread of the axle is 56 in. and the ratio between the worm and the worm wheel is 7.2 to 1. The axle is designed for a rated load of 3550 lb. on the tires, including chassis, body and live load.



Longitudinal half section and section through the worm carrier of the new Empire 1-ton axle which has no differential and which is designed for use on trucks of that capacity to sell at less than $1,000. Note that the spring pads are cubical and hollow, and that the brake shafts are lubricated from within the housing through the open communicating passage formed by the hollow spring pads. Also note the straight worm and how it is carried on thrust ball bearings and straight roller bearings for the radial load. The axle is of the three-fourths floating type, mounted on double-row radial-and-thrust type ball bearings at the wheel ends

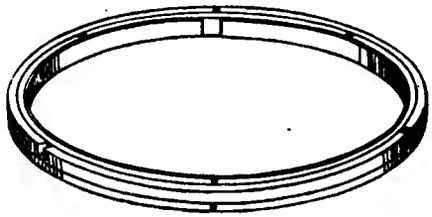
ACCESSORIES

Big 4 Tire

SEVERAL radical departures from conventional tire construction embodied in the Big 4 include construction in three parts, any one of which may be replaced if damaged, unusually low air pressure required and, according to the manufacturer, positive puncture-proof and well-nigh trouble-proof qualities. The tire consists of two side walls and a non-skid tread rim, an idea of the construction in which these units are assembled being given in the accompanying illustration. With this tire it is necessary to carry only spare side walls and tubes instead of complete spare tires. The tread rim is claimed to be exceedingly durable and the replacement of the tread or one or both of the side walls is much less expensive than to buy a new tire. Only 25 lb. pressure is required for a 34 by 4-in. size, as compared with 80 lb. for an ordinary tire of these dimensions.

The company also manufactures tires for truck use which are claimed to give the same high resiliency as the ordinary pneumatic tire and also the uninterrupted service and durability as the solid type. A non-skid tread rim is also made for winter service on the truck tires. —Big 4 Tire and Rubber Co., Cleveland, Ohio.

Section through Big 4 tire, showing the two side walls and the tread rim



Chopa compound piston ring

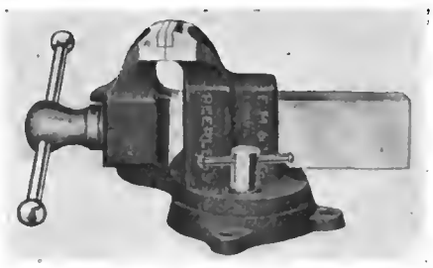
Chopa Piston Ring

This is a compound gray iron piston ring made of several sections overlapping in a manner said to prevent leakage. Because of the compound construction an even pressure is exerted on the cylinder walls and the ring will accommodate itself to worn pistons, it is claimed. Price, each, 3¾ in. diameter or under, $1; 4¾ in. and under, $1.25; 5¾ in. and under, $1.50.—Chopa Piston Ring Co., 264 East Jefferson Avenue, Detroit.

Pillsbury Hubpul

This is a combination hubcap, wheel puller and a device for pulling the car out of mud holes. It is made exclusively for Ford and Model 490 Chevrolet cars. The hub pull is quickly attached to each rear wheel of either of the cars above mentioned by simply unscrewing the original hubcap and inserting the device in its place. It may be left on permanently if desired, and, as it is neatly designed and nickel-plated, does not detract from the car's appearance.

The rubber-covered special hooks which attach to a rope are hooked around the spokes the rope wrapped once around the hub, then carried forward or backward from the underside and anchored to a stake, telephone pole, tree, post or any stationary object; the motor is then started and the wheels slipping causes the cable to be wound, which pulls the car gradually out with much greater leverage than could be obtained with the motor on ordinary traction. The device may also be used for removing wheels from the rear axle without stripping threads. The price per set is $6.—Pillsbury Mfg. Co., Minneapolis, Minn.



Fulton Peerless machinists' vise

Fulton Machinists' Vise

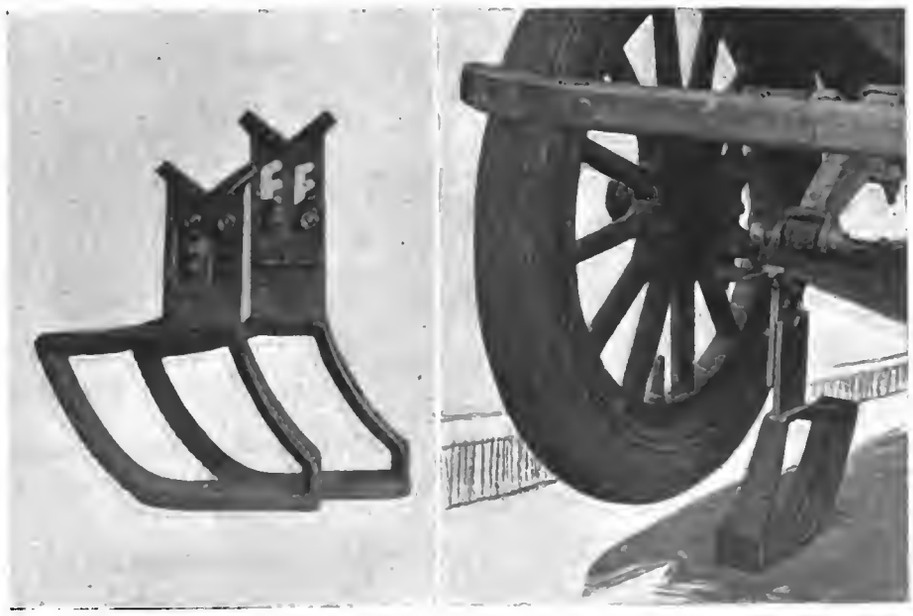
This light weight swivel base vise is suitable for the repair shop. The jaws are cast steel welded onto the face of the vise, giving a very strong construction. The vise may be swiveled to any desired position and firmly locked by a taper head bolt. Price, No. 295, with 3-in. jaws, $7.50; No. 31, with 4-in. jaws, $10.50.—Fulton Machine & Vise Co., Lowville, N. Y.

Rotary Jack

As shown in the illustration, this jack is inserted under the axle and the car driven ahead slightly so that the axle and wheel are automatically lifted up on the jack which is built on the rotary lever principle. The device is composed of two main parts together with an adjustable pillar for axles of different heights. The jack is made of malleable iron and weighs 7 lb. It sells for $2.50. —Rotary Jack Mfg. Co., 340 Moore Building, San Antonio, Tex.

Waynelight Headlight Regulator

The Waynelight is a small transformer designed to steady the headlight illumination of Ford cars. The current passes from the magneto through the trans-



Left—Two views of the Rotary jack, showing upper and lower extreme adjustments. Right—Rotary jack in use under a car axle

former to the lamps, which are wired in multiple. Such wiring prevents the possibility of both lamps going out, as is the case with the usual series winding. It is claimed that the transformer furnishes a steady light at all speeds above 10 m.p.h. The installation is simple, it being only necessary to substitute 6-volt lamps in place of 9-volt lamps, attach the present headlight wire to one of the magneto terminals of the transformer, and ground the other transformer terminal to the frame. A pair of wires, each connected to a lamp, extend to the two lamp terminals of the transformer. The Waynelight may be placed on the dash, under the hood or floorboards, or wherever it is most convenient. Price, $3.65.—General Electric Co., Fort Wayne, Ind.

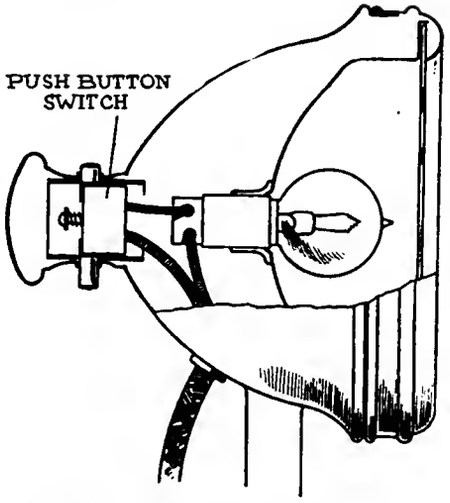
Spotlight Push Switch

This push-button switch placed in the neck of the spotlight permits the hand that directs the rays to also control the current. Two buttons project from the switch—one black and one white. Pressure on the white button causes the lamp to light, if out; the black button is used to shut the lamp off. The switch is insulated by means of a fiber sleeve, and the push-buttons are put in place in the switch after it has been placed in the small neck of the lamp.—Cutler-Hammer Mfg. Co., Milwaukee, Wis.

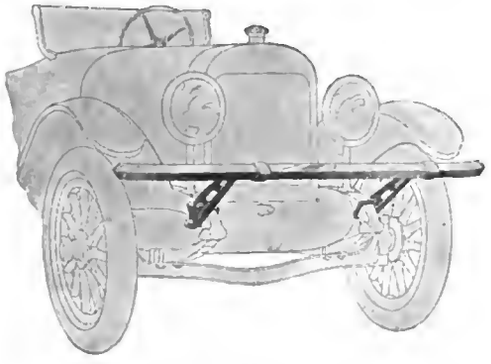
Compound Air Compressor

Air is taken into the large cylinder of this twin-cylinder air-cooled air compressor and compressed to about 50 lb. per square inch; at this pressure, and at about one-quarter of its original volume, it is delivered to the small or high-pressure cylinder, which compresses it to its final pressure. This system is claimed to give higher efficiency, to require less power and to reduce the wear on the parts. Belt drive is used, either from a general power line or directly from a motor. In this last case the motor is mounted on four uprights at the top of the compressor, making a very compact arrangement. Complete installations, including steel air-storage tanks of any capacity, are handled.—United Engine & Mfg. Co., Hanover, Pa.

Backus Utility baggage lock



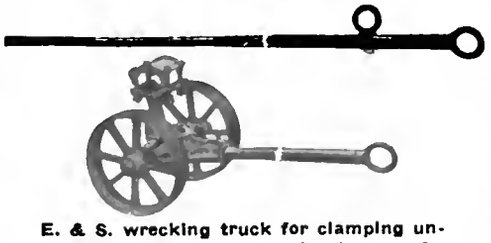
Cutler-Hammer push button switch for spotlights, showing connections and mounting in the lamp



Badger two-piece spring bumper

Waynelite transformer for Ford headlights

Compound twin-cylinder air compressor



E. & S. wrecking truck for clamping underneath the axle of a disabled car for the purpose of towing

Utility Luggage Lock

Luggage may be locked to the robe-rail or foot-rest with this lock. Two steel fingers may be closed together and locked, securing the articles to the car. For example, gloves or coats may be clamped to the steering wheel, a suitcase may be locked to the foot-rest or the control levers may be fastened to the steering-wheel quadrant, thus preventing the theft of the car. Two keys are supplied with each lock. Price, $1.—Backus Novelty Co., Smetheport, Pa.

Badger Spring Bumper

The Badger two-piece spring steel bumper is designed for indestructibility and may be fitted to almost any car. The cross-bar is made of high quality spring steel specially tempered, though very resilent to cushion a shock, is sufficiently stiff to protect the parts. The bar may be adjusted to any angle desired. Price, $12 with 2-in. nickel bar; $10.50 with black bar.—Auto Parts Mfg. Co., Chicago, Ill.

E. & S. Towing Truck

This is a wrecking truck that may be clamped beneath the axle, thus supporting the car and permitting it to be towed in. Two 14-in. wheels with an 18-in. tread are mounted on a malleable iron frame that has an adjustable upright clamp that may be bolted to the axle. Two towing poles are included, one 10 ft. long for a rear axle break, and one 5 ft. long for front axles. All bearings have grease cups and the total weight is 160 lb. Price, $27.50.—Ellis-Smith Mfg. Co., Buffalo, N. Y.

Edison Lamp Assortment

A display box of assorted sizes of Edison Mazda lamps has been brought out to aid dealers in their sales work. The assortment is the minimum stock which any dealer should carry and will enable him to meet the lamp requirements of 90 per cent of all the gasoline and electric cars for 1914, 1915 and 1916. The lamps are arranged in an attractive container and a list of the lamps carried is printed on the cover of the container.—Edison Lamp Works of General Electric Co., Harrison, N. J.

Industrial Miscellany

Factory

Jenkins Machine Co., Sheboygan, Wis., has been purchased from W. W. and Louis Wolff by A. G. Studeman, formerly an executive of the Falls Machine Co., Sheboygan Falls, Wis., and Mark Hoeper, until now assistant treasurer and purchasing agent of the J. I. Case Plow Co., Racine, Wis. The Jenkins company is capitalized at $70,000 and will not change its name or capital for the present.

Osborne Casting Co., Racine, Wis., recently organized, expects to take occupancy of its new 15-ton gray iron foundry on Jan. 1.

Burnell Fuel Saver Co., Milwaukee, Wis., has been organized by A. A. Giese and A. J. Melms to manufacture carburetion auxiliaries and similar appliances for the automobile trade. The capital stock is $10,000.

Nu-Way Puncture Cure Co., capital stock $20,000, has been organized in Green Bay, Wis., to manufacture a fibrous compound for automatically sealing punctures. R. C. Moore is the inventor. Offices have been opened at 403 West Walnut Street, Green Bay.

Four-Wheel Drive Auto Co., Clintonville, Wis., is spending approximately $20,000 in new tools and equipment for additions now being completed. It has a standing order for twenty trucks per week for an indefinite period, and is now producing four a day. By Jan. 1 the output is to be six a day.

Commercial Body Co., Trenton, N. J., manufacturer of bodies for automobiles, has acquired property at 809 South Broad Street for an addition to its plant.

Perfection Tire Co. will commence work soon on the erection of a plant at Niagara Falls, Ont., for the manufacture of tires and rubber goods.

Packard Motor Car Co. has acquired additional property in Long Island City, adjoining its present plant, on which it will erect an eight-story building, more than doubling its present facilities.

International Rubber Co., South Bend, Ind., maker of automobile tires, is pushing the erection of its new plant in this city. The building will be completed by Dec. 12. Half of the brickwork on the building, which will be 382 by 80 ft., is already done. The building with its equipment involves an expenditure of about $200,000. The plant is located on the Vandalia tracks and Edwin Boulevard, in the southern part of the city. The company has established 1500 selling branches.

H. W. Kardell, president of the Kardell Motor Car Co., plans to build a factory in Alton, Mo., to build a motor plow.

Simplex Automobile Co., New Brunswick, N. J., has opened the Simplex Recreation League. The old Middlesex Club house in Highland Park has been transformed into club quarters for its employees. The league was organized by the directors of the company for the benefit of the men who are employed at the plant and their families.

McCord Mfg. Co., Wyandotte, Mich., will build an addition.

R. H. Reynolds & Co., New Albany, Ind., is erecting an automobile woodstock plant, combining two factories now at Corydon and De Pauw, Ind.

Personal

J. K. Stewart, of the Stewart-Warner Speedometer Corp., Chicago, Ill., has purchased 2½ acres of ground on Jackson Avenue, Long Island City.

M. D. Randall heads the Randall Motors Corp., New York City, to handle the wholesale and retail distribution of the Grant.

G. F. Blake has been appointed district sales manager of the Auburn Ignition Mfg. Co., Auburn, N. Y., maker of the A. I. M. Auburn and Blazer spark plugs and valve lifters.

H. H. Cobe and **C. F. Coe** have joined the Burd High Compression Ring Co., Rockford, Ill., organization in Boston, Mass. Mr. Cobe has been in the automobile field since 1903, being connected with the Haynes, Locomobile, Jackson, Palmer Singer and G. & H. Carbureter Co.

W. J. McKechnie has been appointed general manager of the American Forging & Socket Co., Pontiac, Mich. He was for 4 years chief accountant of the Rutenber Motor Co., Marion, Ind. The American Forging & Socket Co. makes forgings and bow sockets for automobile makers.

C. E. Collard, formerly Philadelphia branch manager of the Chase Motor Truck Co., and C. N. Gillette, Southern division sales manager in the same organization, have both severed their connections with that company to become associated with the Selden Truck Sales Co., Rochester, N. Y. Mr. Collard becomes division sales manager in the Philadelphia territory, while Mr. Gillette assumes the same position in the Southern terri-

The Automobile Calendar

ASSOCIATIONS

Nov. 22—Boston, Mass., National Assn. of Automobile and Accessory Jobbers' Meeting.

Dec. 2-9—Electricians' Country-wide Celebration.

Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.

Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore. Special performance Ziegfeld's Midnight Follies.

Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.

Nov. 16—New York City, S. A. E. Meeting.

Nov. 23—Philadelphia, Pa., S. A. E. Meeting.

CONTESTS

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race. Arizona State Fair.

Nov. 24 and 25—Newark, N. J., 24-Hr. Endurance Run of N. J. Automobile and Motor Club.

Nov. 30—Uniontown, Pa., Speedway Race.

Nov. 30—Los Angeles, Cal., Ascot Speedway 200-mile Championship Race.

1917

April—Los Angeles to Salt Lake City Road Race.

May 19—New York Metropolitan Race on Sheepshead Bay Speedway.

May 30—Indianapolis Speedway Race, Championship.

June 9—Chicago, Ill., Speedway Race, Championship.

June 23—Cincinnati, Ohio, Speedway Race.

July 4—Omaha, Neb., Speedway Race, Championship.

July 14—Des Moines, Iowa, Speedway Race, Championship.

July 28—Tacoma, Wash., Speedway Race, Championship.

Aug. 4—Kansas City Speedway Race.

Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.

Sept. 15—Providence, R. I., Speedway Race, Championship.

Sept. 29—New York, Speedway Race, Championship.

Oct. 6—Kansas City Speedway Race.

Oct. 13—Chicago Speedway Race.

Oct. 27—New York Speedway Race.

SHOWS

Nov. 10-18—Providence, R. I., Show, Rhode Island Automobile Dealers' Assn.

Nov. 20-25—Worcester, Mass., Show, Worcester Casino; Worcester Automobile Dealers' Assn.

Dec. 2-9—Springfield, Mass., Show, Auditorium. H. W. Stacey, Mgr.

Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel I. R. Gates, Mgr.

Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 9-10—Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.

Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.

Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.

Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.

Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.

Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.

Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

March 6-10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

March 14-17—Davenport, Ia., Show, Coliseum Bldg., Tri-City Automobile Trade

tory, with headquarters at Charlotte, N. C.

J. F. Hill, who has been manager of the Splitdorf Service & Sales Co. branch at Kansas City, Mo., for the past 4 years, recently resigned his position and will open a garage business at Waterville, Me. His successor as manager at Kansas City is O. J. O'Donnell, recently with the Chicago office of the same company.

Newell Lyon, for 3 years general sales manager of New York State for the White Co., has been made manager of the Kansas City branch of the company, recently established after purchase of the Kansas City White Co. from J. H. Toole. Mr. Toole is now taking a vacation and his future plans are not announced, although he may be connected with the branch.

N. L. Le Blond, formerly secretary and general manager of the Hannibal Motor, Wagon & Body Co., Hannibal, Mo., has been made Western manager of the Dearborn Motor Truck Co. and will make his headquarters at Kansas City. Augustine Gilmore, formerly of Chicago, succeeds Mr. Le Blond in the Hannibal company as general manager, Miss Hattie Salee being made secretary.

A. D. Plughoff has resigned as vice-president and general manager of the Willys-Overland Co. of California and as vice-president of the Overland-Pacific, Inc. He is leaving San Francisco immediately for an extended trip through the Eastern factories before announcing his future plans. He has been connected with the automobile trade for 18 years, having been associated with J. W. Leavitt when he handled the Overland on the Pacific Coast.

W. L. Burgess, St. Louis, manager of the tire and tube department for the Dorris Motor Car Co., has resigned to become sales manager for the Sterns Tire & Tube Co., that city.

W. F. Kneip, manager of the Franklin Motor Car Co., Baltimore, Md., has been elected president of the Baltimore Automobile Dealers' Assn. C. H. Reeves, Jr., of the Foss-Hughes Co., was elected vice-president, and E. S. Bliven, of the Standard Motor Co., secretary and treasurer.

E. T. Backus, who came to Baltimore, Md., on Aug. 1 and assumed charge of the headquarters of the Ford Motor Co. in this city, has been appointed one of the three assistants to N. A. Hawkins, general sales manager of the Ford company, with headquarters at Detroit. Mr. Backus was in charge of the Ford branches in Dallas and Houston, Tex., before coming there. A. A. Grisham, assistant manager here, succeeds Mr. Backus as manager of the Baltimore headquarters. K. G. Harig, a Baltimorean, who was in charge of the State wholesale department, becomes assistant manager. H. W. Ford will be the successor in Mr. Harig's old place.

H. O. Foskitt has been placed in charge of the Jackson Motor Co. branch at Lawrence, Mass.

W. R. Dudley, St. Louis, manager of the Vesta Battery & Equipment Co., has been transferred to the Chicago branch as a traveler, and is succeeded by F. G. Fulkerson, formerly of Cleveland.

F. E. Miles has become purchasing agent of the Lewis Motor Corp., Detroit, Mich. Mr. Miles was formerly connected with The National Motor Vehicle Co.

Z. B. Leonard has resigned his position with The Perfection Spring Co., Cleveland, Ohio. He was formerly head of the laboratory.

Floyd Robinson of 251 Putnam Avenue, Detroit, advertising manager of the Regal Motor Car Co., Detroit, Mich., was seriously injured recently when he was struck by a motorcycle. His skull was fractured. Later reports are that Mr. Robinson's condition is much improved.

E. J. Warren, formerly general manager and treasurer of the Crosby Co., Bangor, Me., will open in January his new store, the Auto Supply & Rubber Co., on Post Office Square, with a full line of automobile accessories and rubber goods.

Dealers

Fisk Rubber Co., Philadelphia, has arranged to lease a four-story building which will shortly be erected at 664-66 North Broad Street at a cost of $100,000.

Henry A. Rowan, Jr., Co., 2036 Sansom Street, Philadelphia, has taken over the agency for the Smith Form-a-Truck.

Ramey Motors Co., Philadelphia agent for the Hal, has moved into its new showroom at Broad and Brown Streets.

Garwood Motor Car Co., 2248-52 Euclid Avenue, Cleveland, Ohio, has been organized to distribute the Pathfinder in northern Ohio.

J. R. Flannery, Jr., formerly of Stillman & Hoag, has entered into partnership with Wm. C. Brightly, Englewood, N. J., to conduct a garage and general machine shop under the name of Brightly & Flannery, Inc.

Standard-Racine Rubber Co., Oneida and Jefferson Streets, Milwaukee, distributer of Racine tires and a general line of accessories, will build a new tire and accessory store at Astor Street and Juneau Avenue, on a corner site measuring 175 by 135 ft. The present quarters will be continued as a general accessory and supply house.

Jesse A. Smith Auto Co., 215 Wisconsin Street, Milwaukee, State distributer of Hudson cars since 1911, has taken a long-term lease on the Welch garage building, Grand Avenue and Seventh Street, which has just been vacated by Harry Newman, Inc., former Chalmers distributer. It is one of the largest buildings in Milwaukee devoted exclusively to automobile distribution, being four stories high and containing nearly 50,000 sq. ft. of floor space.

Weber Implement & Automobile Co., St. Louis, Mo., has taken the Maxwell agency and the Brinkmann Motor Car Co. has withdrawn from business, its affairs being liquidated. Coincident with this, G. C. Brinkmann, former president of the Brinkmann Motor Car Co., filed a voluntary petition in bankruptcy in which his liabilities were given as $32,198 and his assets at $87, of which $5 was cash.

Aniser Mfg. Co., St. Joseph, Mo., has changed its name to the Mechanical Belt Co. and is now marketing the Crowe fan belts exclusively. This product will be sold through the jobber.

Willys-Overland Co. has opened a show and sales room at 71 Broadway, Yonkers, N. Y.

Motor Car Sales Co., Bloomington, Ill., has broken ground for a new garage. This structure will be located at 406-410 West Washington Street. The company will utilize the building as a sales agency for the Chalmers and Dodge.

J. W. Leigh Motors Co., St. Louis, has leased space in the Plaza Hotel building at 3302-3304 Locust Street as headquarters for the Apperson.

Paul Crawford, Birmingham, Ala., State agent for the Chandler, has opened his new salesroom at 406 Twenty-first Street.

Spangler-Tubbs Motor Co., Boston, has been formed to handle the Metz.

Stockyards Garage, Denver, is the name of a new business opened at East Forty-seventh Avenue and Lafayette Street to deal in accessories. The manager is A. J. Mosley.

Rocky Mountain Auto Sales Co., a new concern at 204 Sixteenth Street, distributer of Auburn cars and Gladiator tires for Colorado, Wyoming and part of Nebraska and South Dakota, has added the Regal distributing agency for Colorado and half of Wyoming.

Roberts Auto Co., Denver, Marmon distributer for Colorado and Wyoming, has moved from 220 Sixteenth Street into a new $20,000 building at 1231-1239 Broadway.

George H. Estabrook, Denver, is now the business name for the Briscoe and Hollier distributing agency for Colorado and Wyoming, formerly conducted as the Briscoe Auto Sales Co., of which Mr. Estabrook was president. The location is still 1646 Broadway.

Mulford Bros., Streator, Ill., have opened the old Halladay garage, corner of Kent and North Sterling Streets, and will carry on a general business in the repairing of automobiles and sale of supplies.

Tioga Automobile Co., Philadelphia Hupmobile dealer, has sold out to a firm headed by Robert McCormick, who was formerly in charge of sales for Hurley & Early, this city. The new company is looking around for larger quarters, and is at present located at 332 North Broad Street.

Richwine-Haines Co., Philadelphia, has leased the showroom at 719 North Broad Street, where it will handle the Liberty car. The territory includes Pennsylvania, New Jersey, Delaware and Maryland.

The Thomas-Bonner Co., accessories, electrical goods, etc., 152 Sixth Street, Milwaukee, has been released from bankruptcy litigation instituted in September. Creditors have caused the action to be dismissed and the business will be continued without interruption.

E. E. Williams and Clarence Heiderscheid, proprietors of the Kingdom Garage in Hardin, Ill., dissolved partnership, the former purchasing the interest of the latter. Mr. Heiderscheid remains in Hardin and will devote his time to the Ford car agency and service station. He has let the contract for a new garage and sales agency on Main Street.

Garber & Habecker, Washington, Ill., have dissolved partnership. The former will continue the garage and sales agency, while Mr. Habecker will occupy the W. H. Long building and will open a garage and sales agency of his own. Mr. Garber will continue to handle the Ford car, while the other lines previously handled by the firm will now be in charge of Habecker.

Moerschell Electric & Auto Supply Co., St. Louis, announced that H. E. Q. Kuhn, factory expert on Rayfield carbureters, has joined that company to handle Rayfield business.

Gearsets, Clutches and Steering Gears

The Automobile

Vol. XXXV
No. 20

NEW YORK, NOVEMBER 16, 1916

Ten cents a copy
Three dollars a year

Editorial Contents, Page 3

Advertisers' Index—Next to last page

STRONGER THAN EVER

Over 95 per cent of the equipped automobiles going into use this coming year will carry the Stewart Speedometer. Be sure it is on your car.

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Stewart

Speedometer

The Automobile

VOL. XXXV NEW YORK—THURSDAY, NOVEMBER 16, 1916—CHICAGO NO. 20

G. M. C. Earnings Break Record

Approximately $25,000,000 Cash on Hand—Buick Builds 400 Cars Daily

DETROIT, MICH., Nov. 15—October earnings of the General Motors Co. were the largest in its history, the treasurer reporting approximately $25,000,000 cash on hand. The Buick Motor Co., its largest subsidiary, is turning out 400 cars daily.

—

Cole Price Raised $100

DETROIT, MICH., Nov. 13—The Cole Motor Car Co. will raise the price of its eight-cylinder car $100, to $1,685, on the touring and roadster models. This change will go into effect Jan. 1.

—

Kissel To Raise Prices Dec. 1

HARTFORD, Wis., Nov. 13—The Kissel Motor Car Co., this city, will raise the prices of its Hundred Point Six models on Dec. 1.

—

Leonard Leaves Perfection Spring

CLEVELAND, OHIO, Nov. 15—Z. B. Leonard has resigned as chief of the laboratory of the Perfection Spring Co.

—

Belden Overland Chief Engineer

TOLEDO, OHIO, Nov. 10—Edward H. Belden has been appointed chief engineer of the Willys-Overland Co. this city. For the past 2 years Mr. Belden has been consulting engineer of the Packard Motor Car Co., Detroit.

Mr. Belden, who was born in 1868 at Jackson, Mich., began his business career as mechanical engineer with the McCormick Harvester Co., later becoming electrical engineer of the Fort Wayne Electric Co. and subsequently holding the same position with the Westinghouse Electric & Mfg. Co. Mr. Belden has been designing automobiles since 1905. In 1913 he was president and engineer of the Belden Engineering Co. and in 1914 became connected with the Packard Motor Car Co. He built one of the first six-cylinder motors constructed in this country and has been a member of the Society of Automobile Engineers since 1913.

—

Smith Form-A-Truck Co. Sold

CHICAGO, ILL., Nov. 15—The Smith Form-A-Truck Co., this city, maker of a motor truck unit that can be attached to the chassis of a low-priced car, has been acquired by Michaelis & Co. and affiliated interests. It is stated that the demand for the product is ahead of the present output, which will be immediately increased and additional buildings will be at once arranged for. The total sales for this year will reach approximately $3,000,000 and the net earnings will amount to at least $1,000,000.

—

Steenstrup with General Motors Export

DETROIT, MICH., Nov. 14—Peter S. Steenstrup has joined the General Motors Export Co., succeeding O. G. Bennett, who has resigned to embark in a new venture for himself. Mr. Steenstrup was formerly the general foreign representative for the Hupp Motor Car Co. and spent the past 3 years abroad studying conditions in South America and in Europe.

—

Abbott to Build in Cleveland

CLEVELAND, OHIO, Nov. 9—The Abbott Corp. has applied for a building permit to construct a $110,000 plant at 1131 East 152d Street, covering a ground space of 110 by 681 ft.

10,000 Regals Planned for 1917

Co. to Concentrate on De Luxe Eight and J. Models—To Discontinue Others

DETROIT, MICH., Nov. 15—The Regal Motor Car Co. production department is planning on an output of 10,000 cars for the 1917 season. The company will concentrate on model J and the De Luxe eight-cylinder type, dropping all other models. Enlarging the 1917 output to 10,000 cars represents almost 100 per cent increase over the production for the 1916 manufacturing season.

—

Humphrey Now in Detroit

DETROIT, MICH., Nov. 14—S. H. Humphrey, who resigned as vice-president in charge of production with the Chalmers company to become the vice-president in charge of manufacturing for the Briscoe Motor Corp., has resigned the latter position and returned to Detroit to engage in business for himself.

—

Whitman National Production Engineer

DETROIT, MICH., Nov. 14—F. H. Whitman has been appointed production engineer for the National Motor Vehicle Co. at Indianapolis. Mr. Whitman was formerly connected with Dodge Bros.

—

International Truck Incorporated

ALBANY, N. Y., Nov. 9—The International Motor Truck Corp., as a result of the recent refinancing, has been formed and will carry on business with $7,372,790. The capital consists of 71,043 shares of $100 each and 53,638 shares of no par value. The directors are A. E. Moore, G. F. Jebbitt, T. S. Buckingham.

Cummins-Monitor Reorganized

Monitor Motor Car Co. Formed—$1,000,000 Capital Planned for Near Future

COLUMBUS, OHIO, Nov. 11—A complete reorganization of the Cummins-Monitor Co., this city, makers of Monitors has been effected by the incorporation of the Monitor Motor Car Co. with a preliminary capital of $10,000. This capital will be increased to $1,000,000 in the near future, a large part of which will be paid in. The concern has been assembling and manufacturing two models for the past year and these models will be continued with slight changes. They are the four-cylinder, priced at $795, and the six-cylinder, priced at $995.

Under the reorganization C. C. Cummins will be president, H. P. Jeffers, vice-president and F. S. Cummins, secretary and general manager. The plant is located at 402 Mount Vernon Avenue, where it will remain for the time being. It is the plan to manufacture several thousand cars during the coming season and to strengthen the sales organization by securing agents in all of the larger distributing centers.

The Monitor is the result of the work of the Cummins brothers, who were formerly agents in Columbus. They conceived the Monitor several years ago and have been manufacturing a number of the cars.

—

R. J. Firestone Now Vice-President

AKRON, OHIO, Nov. 9—At the annual meeting of the Firestone Tire & Rubber Co., Nov. 2 R. J. Firestone was elected vice-president. Mr. Firestone has been sales manager for a number of years.

A. G. Partridge, formerly assistant sales manager, was appointed to succeed Mr. Firestone as general sales manager.

F. C. Blanchard becomes manufacturers' sales manager in charge of the company's increasing business among automobile makers.

—

Braender, of Tire Co., Dies

RUTHERFORD, N. J., Nov. 9—Philip Braender, president of the Braender Rubber and Tire Co., this city, died on Nov. 4 at his home in White Plains in his 68th year.

Mr. Braender was born in Germany in 1849 and at the age of 16 came to America where he entered the real estate and building business in New York City.

In 1911 he entered the rubber business in conjunction with the late Frank McGowan under the style name of Cable Pneumatic Tire Co. and later in 1912 took over this interest under the present name and associated with him was the late G. Strauss, formerly with the Goodyear Rubber Co. in the bicycle tire time.

Mr. Braender was also president of the Braender Building & Construction Co. of New York, a member of the Arion Society of New York and Teutonia Lodge, No. 617, F. & A. M. He leaves a widow and four sons.

—

VerLinden Elected Olds President

LANSING, MICH., Nov. 13—E. VerLinden, general manager of the Olds Motor Works, has been elected president of that concern. Announcement of VerLinden's election came after a recent meeting of the board of directors of the Olds Motor Works.

VerLinden's early training in production methods was gained with the American Radiator Co. Before joining the Olds organization in 1912, he was a production expert for the Buick company as manager of Plant No. 1.

Prior to his connection with Buick, VerLinden was in business for himself, under the corporate title of the Michigan Auto Parts Co., which was bought by the General Motors Co. in 1909.

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Laciar Is Kent General Sales Manager—Stock Being Underwritten

NEW YORK CITY, Nov. 13—R. J. Laciar has been appointed general sales manager of the recently formed Kent Motors Corp. Mr. Laciar made his entry into the automobile field in 1903, at which time he joined the late Capt. La Roche in the marketing of the Darracq car. Later he spent several years popularizing the two-cylinder Buick through the East. He has since been connected with W. E. Metzger in the sale of the E. M. F. car, with the Hupp company as Eastern district manager, and later with W. C. Durant in the Chevrolet organization.

The company, which will build a plant in Bellville, N. J., has a capital consisting of 200,000 shares of the par value of $10 each. Sixty per cent, or 120,000 shares, is held in the treasury. Against this will be issued negotiable trust certificates exchangeable in 3 years for stock.

The Security Transfer and Registrar Co., 66 Broadway, this city, has been designated as the depository and transfer agent of the company. The stock has been underwritten and is to be listed, it is stated, on the New York Curb market.

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McCulla in Overland Engineering Dept.

DETROIT, Nov. 12—William R. McCulla has joined the engineering forces of the Willys-Overland Co. Mr. McCulla was formerly the aircraft motor engineer for the Packard Motor Car Co.

New Plant for Saxon Co.

To Build on 40-Acre Plot—First Unit of 500,000 Sq. Ft. Floorspace

DETROIT, MICH., Nov. 12—The Saxon Motor Car Corp. is commencing the erection of a new plant on 40 acres of land recently purchased by them. The first unit will be 240 by 1262 ft. and will have 500,000 sq. ft. of floorspace, and will house several departments so grouped that a car will move steadily forward from one end of the building to the other for assembly construction.

Progressive manufacturing and assembling will be employed in every department possible. Incoming material will be moved by traveling cranes and elevators to the stockrooms, and a system of conveyors is planned by which stock will be carried to the different manufacturing departments. The first unit will be completed May 1, and the remainder of the buildings June 1, 1917.

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Empire Tire To Be Refinanced

TRENTON, N. J., Nov. 14—Increased business and expansion has forced one more company to join the long list of those to be refinanced this year. The Empire Rubber & Tire Co., this city, has about completed negotiations for reorganization and refinancing. The details of the plans of refinancing will be announced in the near future as soon as completed. At present the plans for the underwriting of the new stock are being worked out by Andrews & Co., New York. General C. E. Murray will continue as the active head of the company.

The Empire company was organized in 1913 with a capital stock of $500,000 common and $500,000 7 per cent cumulative preferred, with $500,000 common and $428,720 preferred outstanding.

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Hammers Is Hackett Consulting Engineer

DETROIT, MICH., Nov. 11—M. J. Hammers has been retained as consulting engineer for the Hackett Motor Car Co., and has been appointed as a non-resident director of the company.

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Lascaris Re-elected Salon Head

NEW YORK CITY, Nov. 13—At its recent meeting the Automobile Salon, Inc., which will conduct the Automobile Salon on Jan. 2 to 10 at the Astor, this city, re-elected Emanuel Lascaris president and T. E. Adams vice-president. Robert Schuette was elected secretary-treasurer, succeeding the late Stefan Kjeldsen, and J. R. Eustis was appointed manager of the salon.

N. A. C. C. Opposes Scare Ads.

Eighty Members Go on Record as Against It—Committee for Improvement

NEW YORK CITY, Nov. 13—With the object of eliminating what it terms "scare" advertising, eighty members of the National Automobile Chamber of Commerce at its last meeting recorded themselves as being opposed to advertising which can be classed under this head. This opposition is directed against not only concerns connected with the automobile industry, but against advertising in general which can be characterized under the scare heading.

Exactly what is meant by scare advertising might be made clear from the following extract bearing on the subject. "We may expect to see pictures of people dying in restaurants because they ate the wrong brand of bacon; of people mangled at the bottom of elevator shafts because they rode in an elevator using the wrong safety device; of children being rescued from fires because the wrong kind of window panes were used in the building; of passengers being carried under the ocean waves because they traveled on the wrong steamship line," etc., etc.

The N. A. C. C. has at present a committee working for a betterment of advertising along this line. This committee is expected to accomplish as much as possible by co-operation not only with vehicle makers, but also with those manufacturing parts and accessories. The question of scare advertising has already been taken up with certain companies, and it is expected that there will be an elimination of such as the result of this work.

The reason for the N. A. C. C. taking up this matter is that members of the chamber hold the view that scare copy is negative rather than affirmative in its effect, and that some more positive and constructive form of advertising could be used.

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A. O. Smith Corp. Incorporated

ALBANY, N. Y., Nov. 14—The A. O. Smith Corp., as a result of the recent refinancing, has been incorporated in this state with 130,000 shares, of which 100,000 shares are without par value. It will carry on business with $3,500,000. The directors are L. H. Gunther, S. B. Howard and A. W. Britton.

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Dodge Suit Against Ford Postponed

DETROIT, Nov. 15—A continuance of 1 week, by consent of opposing counsel, was granted in the injunction proceedings started by Dodge Bros. to restrain Henry Ford from extending the Ford plant and to compel a further distribution of profits to Ford stockholders.

"The preliminary taking of evidence will not be finished in the coming week," said Attorney E. G. Stevenson for Dodge Bros., "but we expect it will have reached a point where we can come into court and agree upon the fixing of the day certain for the commencement of the trial."

The plaintiffs state that they expect to present evidence to show that the expansion planned by the Ford head jeopardizes the monetary interests of the minority stockholders.

$200,000,000 Offered

Henry Ford on the witness stand today admitted the offer of $200,000,000 was recently made to him for his 58 per cent of the shares of Ford stock. This offer he rejected and stated that his company made $3,600,000 in August and September, 1916, following the price decrease.

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Lozier Bros. Co. Formed—$10,000,000 Capital

CLEVELAND, Nov. 14—Harry A. Lozier, former president of the Lozier Motor Car Co., and who recently retired as president of the H. A. Lozier Co., this city, has launched a new company, the Lozier Bros. Co., capitalized at $10,000,000. New York and Philadelphia capital is stated to be behind the company. Only 25 per cent of the capital is to be issued at present, the balance being reserved for subsequent disposal in expanding the business. The incorporators are F. R. Hansell of Philadelphia and G. H. B. Martin and S. C. Zymour of Camden, N. J.

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S. R. B. Creditors Ask for Sale

PHILADELPHIA, PA., Nov. 9—A committee consisting of 95 per cent of the creditors of the Standard Roller Bearing Co., which went into the hands of a receiver in 1913, has asked the Federal Court for an order to sell the property to pay the creditors. The sale has been objected to by some stockholders, who maintain that only the disposal of merchandise is necessary to meet all claims. Judge Thompson has decided to permit counsel to get together and draw a decree providing for a sale that will satisfy all claims and submit it to the court for approval.

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Burgess Resigns from Dorris

ST. LOUIS, MO., Nov. 9—W. L. Burgess, has resigned as sales manager of the Dorris Motor Car Co., St. Louis, and is now manager of sales of the Efficiency Oil Corp., St. Louis.

Bankers in Control of Hess-Bright

Vanderlip One of Group — Conrad Patent Control Remains with Hess-Bright

PHILADELPHIA, PA., Nov. 14—The Hess-Bright Mfg. Co., manufacturer of ball bearings in this city makes the following statement with regard to the purchase of controlling interests in its company by a group of financial men who also own a substantial interest in the S. K. F. Ball Bearing Co., Hartford, Conn. The company states that controlling interest in the shares of the Hess-Bright Mfg. Co. has been secured by a group of bankers including Frank A. Vanderlip, National City Bank, New York, and Phillip W. Henry, Thatcher M. Brown, and Franklyn B. Kirkbride, of New York, and Marcus Wallenberg of Stockholm, Sweden.

The Hess-Bright company and the S. K. F. company will be operated quite independently of each other. The manufacturing facilities of Hess-Bright will be increased materially. B. D. Gray, recently elected president, retains his former stock holdings and will continue to manage the business as president. F. E. Bright, one of the organizers of the company, has retired from active participation but remains as chairman of the board of directors. The remainder of the organization continues as heretofore, excepting the board of directors, which follows:

Chairman of board, F. E. Bright; President, B. D. Gray; Willard Parker Butler, New York; Arthur V. Morton, Philadelphia; Paul von Gontard, managing director of the Deutsche Waffen- und Munitions Fabriken, Berlin, Germany.

Last week THE AUTOMOBILE mentioned that control of the Conrad patent royalties would pass from the Hess-Bright Co. This is not the case, as complete control of the Conrad patents will continue with the Hess-Bright Mfg. Co. as heretofore.

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Edwards Joins Automatic Carbureter

CHICAGO, Nov. 14—F. E. Edwards of Chicago, one of the most widely known men in American motor-racing circles, has joined the Automatic Carbureter Co., Chicago, as efficiency engineer. His chief work at present will be the introduction of the new Church fuel feed. Edwards has been chairman of the technical committee of the American Automobile Assn. and its chief technical representative for a number of years, and has supervised the majority of the speed and economy tests during that time.

Winther Motor Truck Co. Formed

Capital to Be $330,000—Factory to Be Built at Kenosha in Spring

KENOSHA, WIS., Nov. 11—M. P. Winther, who has been prominent in the development of the Jeffery Quad and for many years was associated with the Thomas B. Jeffery Co., Kenosha, has organized the Winther Motor Truck Co., with an authorized capital stock of $330,000, and is making final arrangements for the construction and equipment of a large factory in this city. A tract of 4 acres just west of Kenosha was purchased yesterday, and it is hoped that by the middle of April work on buildings will have progressed sufficiently to make production possible. Further details concerning the personnel of the Winther organization, the extent of its shops, and the product, are not available at this time, but will be made public in due time.

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Watts Joins Republic Rubber

YOUNGSTOWN, OHIO, Nov. 9—L. A. Watts has been appointed purchasing agent of the Republic Rubber Co., this city. Other changes include the addition of James Buckley, who succeeds Neal Mahan as general foreman of the pneumatic tire and tube departments. Harry Davenport will be succeeded as foreman of the truck tire department by Thomas Wilson.

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Eaton Torbensen Axle Manager

CLEVELAND, Nov. 13—J. O. Eaton, treasurer of the Torbensen Axle Co., Cleveland, was elected general manager of the company at a directors' meeting held recently.

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Dudley Federal Truck Advertising Mgr.

DETROIT, Nov. 12—L. B. Dudley has been made the advertising manager of the Federal Motor Truck Co. He succeeds G. W. Cushing, who recently resigned to join the advertising staff of the Hudson Motor Car Co. Mr. Dudley was formerly connected with the Campbell-Ewald Co., advertising agent.

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New Acme Truck Worm Axle

DETROIT, MICH., Nov. 10—The Acme Motor Truck Co., this city, is now producing a worm-driven truck axle incorporating, as its principal feature, the M. & S. worm differential. Another feature of the axle is that the brakes, of special design, have a full contact for the entire circumference excepting the small space occupied by the actuating cams.

It is built in a size for 2½- or 3-ton trucks, the standard reduction for this size being 7¾ to 1. The axle is a one-piece steel casting, with the worm gear carried in a separate carrier secured by eight bolts and having the small worm housing and axle bowl cover integral with it. The axle is of the semi-floating type, running on ball bearings throughout. The worm is of the straight type.

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Glide to Make Its Own Motors

PEORIA, ILL., Nov. 13—In line with the general policy of the Bartholomew Co., maker of the Glide car, to concentrate the manufacture of its entire car in its local plant, is the announcement of a large addition to its plant for the purpose of building its own engines. The company is at present using a stock motor.

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National Carbon to Add

CLEVELAND, OHIO, Nov. 13—The National Carbon Co., this city, maker of batteries, will soon erect new factory buildings costing $1,000,000. The company has just bought a parcel of land across Berea Road from the present carbon plant. This 63 1-3-acre tract has a frontage of 3368 ft.

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Cornell Is Cole Asst. Sales Mgr.

INDIANAPOLIS, IND., Nov. 11—F. A. Cornell, formerly in charge of Willys-Overland service department and since then in charge of the heater department of the Perfection Spring Co., has been made assistant sales manager of the Cole Motor Car Co., in charge of the service department.

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Graves Joins Russel Axle

DETROIT, MICH., Nov. 11—H. S. Graves has been appointed sales engineer of the Russel Motor Axle Co., North Detroit, Mich. Mr. Graves was formerly connected with the General Motors Co. as engineer. He has been connected with the automobile industry for the past 11 years.

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Baker Resigns from G. V.

BOSTON, MASS., Nov. 13—Day Baker has resigned from the electric vehicle business of the General Vehicle Co. in New England.

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Wiltrout Joins Crow-Elkhart

ELKHART, IND., Nov. 13—R. S. Wiltrout has been made efficiency manager of the Crow-Elkhart Motor Co., Elkhart, Ind. He was formerly with the Stewart-Warner Speedometer Corp. and recently has been manager for the John W. Blackledge Mfg. Co.

Papers for S. A. E. Meeting

Aeroplane and Farm Tractor Engines Will Be Covered—Many Others Promised

NEW YORK CITY, Nov. 13—The technical papers to be presented at the 1-day professional session on Jan. 11 of the Winter Meeting of the Society of Automobile Engineers will be representative of the enlarged activities of the society. Some of the papers will relate to automobile engineering, but in addition subjects of interest to aeroplane, tractor and marine engineers will be presented. The papers committee, of which K. W. Zimmerschied is chairman, is making the arrangements.

Captain V. E. Clark, U. S. A., will present a paper an aeroplanes with special relation to engines. This paper will deal also with the expcriences of the army aviators on the Mexican border and suggest improvements in construction. It is also hoped that a detailed description will be given of a foreign aeroplane engine, which has recently been produced commercially in this country. A well-known engineer will discuss the design of engines for farm tractors. A paper will probably be read on motor trucks, with reference particularly to the proposed military specifications now being considered by the truck standards division of the S. A. E. standards committee and a specially appointed board of the War Department.

Tentative plans have been made to have experts contribute papers on passenger car spring-suspension, electrical equipment of gasoline cars, high-speed automobile engines, dynamics of the automobile and crankshaft balancing. It will thus be seen that the papers arc of sufficient variety to attract every member of the Society. The authors will give brief digests of their papers, thus allowing time for lengthy and adequate discussion of the more important ones.

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S. A. E. Dinner and Theater Party Tickets Scarce

NEW YORK CITY, Nov. 16—That the annual banquet of the Society of Automobile Engineers on Jan. 11 at the Hotel Biltmore will be a banner one in point of attendance is assured by the fact that to date 460 tickets have been sold. The capacity is 750.

Every seat, numbering 762 has been taken for the special performance of Ziegfeld's Midnight Follies, which comes as a climax to the dinner. The demand for these seats has been so large that thirty applications so far have been returned.

Toledo Plants Are Rushed

Factories Breaking All Production Records and Financial Outlook Is Promising

TOLEDO, OHIO, Nov. 13—Toledo automobile and parts makers are rushed to capacity. Each company is building or planning to care for increased demand. The chief difficulties of the plants are lack of skilled workmen and insufficient space. Everywhere the companies tell of remarkable prosperity and an extremely good financial future outlook.

The Electric Auto-Lite Co. has enjoyed a great expansion. The company employs 2200 people and occupies 422,000 sq. ft. of floorspace, and has four buildings in the plant, including a new one recently finished and utilized. One structure is used for heavy machine work and assembly, a second for stock rooms, receiving and shipping, mail order and repair work, and on one floor has 500 girls engaged in winding field coils and armatures. A third building is occupied as a factory for making lamps, horns and starting switches, and the fourth serves as the office, drafting and experimental structure. The new building is four-stories high and constructed entirely of steel, glass and brick.

The concern did $6,000,000 business in 1915 and to date has shipped $10,000,000 worth for 1916, manufacturing 1400 starters a day now as compared with 800 in the year preceding. Numerous mechanical improvements have been installed to increase facilities for production, and include electric ovens, cable conveyors, twenty automatic machines, automatic punch presses, milling machines and eighty Potter & Johnson machines.

Milburn's Big Increase

At the Milburn Wagon Works 900 men are employed, as compared to 600 men at the same time in 1915. The company is making 1500 cars this year as against 1000 in 1915. It has purchased the plant of the Toledo Bending Co. and converted it into plant No. 2 of the Milburn factories, adding 128,732 sq. ft. to the 514,931 sq. ft. already occupied. It is planned to use plant No. 1 for the manufacture of closed cars and bodies, and plant No. 2 for making custom-made bodies and to care for light delivery business.

The concern has recently developed the electric taxicab business and plans to engage in that particular branch of the industry with special effort. Body work has increased 100 per cent, and from present indications will grow an additional 100 per cent during the coming year.

The Ohio Electric Vehicle Co. states that October was one of the most successful months in the company's career. Business for the year has increased more than 100 per cent. The concern manufactured 650 cars to date in 1916, as compared with 300 cars in 1915, and have doubled the number of salesmen on the road, doubled their national advertising and increased the number of men employed by 40 per cent. At present they employ 250 men, but would take on 300 men if they could find the skilled aluminum workers they require. From present prospects they anticipate an increase of 1000 per cent in business for the coming year.

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Haynes to Add 600,000 Sq. Ft.

KOKOMO, IND., Nov. 13—The board of directors of the Haynes Automobile Co. last week authorized A. G. Sieberling, general manager, to prepare plans for a new building and to buy machinery for a capacity of 100 cars daily. It was announced that contracts will be let for buildings which will have a capacity of three times the number of cars made at present. The new buildings will have about 600,000 sq. ft. of floor space, which will be added to 350,000 sq. ft. now in operation in the company's plant.

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Standard Tractor to Move

ST. PAUL, Nov. 11—The Standard Tractor Co., St. Paul and Wilimar, Minn., will move to the old prison at Stillwater, Minn. The company has $500,000 capital. It makes tractor engine plows and other farm machinery.

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Briscoe Plants for K. C. and S. F.

SAN FRANCISCO, CAL., Nov. 11—The Briscoe Motor Corp., Detroit, Mich., has completed plans to build an assembling plant in this city and Kansas City, Mo. The local plant will be capable of turning out from 10,000 to 20,000 cars a season. The Kansas City plant will cost $300,000.

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More Room for Mayo-Skinner

CHICAGO, Nov. 13—The Mayo-Skinner Mfg. Co. has moved into enlarged quarters at 2115 Elston avenue. The company will enlarge its line in the near future.

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S. G. V. Creditors to Meet

READING, PA., Nov. 11—The creditors of the S. G. V. Co. of Delaware, which formerly operated its automobile plant here, will meet in the near future to distribute $85,000 in the hands of a receiver.

To Build Monarch in Hyattsville

Carter Brothers Co. Secures Exclusive Rights To Build Eight and Twelve

HYATTSVILLE, MD., Nov. 13—Monarch cars will be manufactured in this city as soon as all the machinery and materials arrive here. The Carter Brothers Co., this city, has secured the exclusive rights of the Monarch Motor Car Co., Detroit, and will build both Monarch models, an eight and a twelve.

In addition to the above standard models a new design of light car will be added to be known as the Monarch Midget.

The business of the Monarch company will be continued under the Monarch Motor Car Co., a subsidiary organization of the Carter Brothers Co.

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Holihan Completes New Plant

DETROIT, Nov. 12—The Holihan Mfg. Co. has just completed its new plant on the 3½ acres of land they recently purchased. The main building is 80 by 400 ft. of the latest construction and includes steel and glass windows and a monitor roof. In addition a steel storage structure 65 by 45 ft., and a shipping shed 65 by 45 ft. with floors raised to car level are in process of completion.

The company has made ample allowance for future expansion and the present plant will cover about 50,000 sq. ft. of floor space.

At a special meeting of the stockholders, the capital stock was increased to $135,000, and the board of directors was increased by the election of H. J. Moir of Donaldson & Moir, and S. E. Ferris of H. W. Noble & Co.

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Palmer-Moore To Quadruple Capacity

SYRACUSE, N. Y., Nov. 13—The Palmer-Moore Co. has increased its capital stock from $200,000 to $300,000. The additional capital will be used to quadruple the output of the plant, bringing the production up to above 600 trucks during the next year.

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Elgin Motor Corp. to Add

CHICAGO, ILL., Nov. 13—The Elgin Motor Car Corp., this city will erect several additions to its factory to take care of increased business. This increased space will enable the company to build from 20,000 to 25,000 cars after the original year's allotment of 7500 is completed. Another building is now in process of construction and will permit the building of thirty cars a day.

Build Ams-Sterling at Amston

C. M. Ams Becomes President —Headquarters in Bridgeport —Car Design Improved

NEW YORK CITY, Nov. 13—Headquarters of the Sterling Automobile Mfg. Co., Inc., have been moved from this city to Bridgeport, Conn., Charles M. Ams having become president of the concern. Ams-Sterling cars will be built in a factory at Amston, Conn., in one chassis on which will be mounted roadster, five-passenger touring car and ½-ton delivery bodies.

Car at National Shows

The Sterling company will exhibit a car and a chassis at the national shows. Present specifications, which may be slightly changed later, differ from last year's model in several particulars, the general tendency being toward larger and better dimensions and equipment. Wheelbase has been lengthened from 102 to 110 in. The engine will continue as a four-cylinder L-head type, but will be 3⅛ by 4½ instead of 2⅞ by 4 in. This power plant has a removable head and its power output is 28 hp. at 2200 r.p.m. High efficiency and economy are the aims of its designers. Oiling is combination pump and splash with sight feed on cowlboard. Cooling continues thermo-syphon with a honeycomb radiator with polished German silver shell. Timing gears are helical and valves are large diameter with moderate lift.

A Stromberg model M carbureter replaces the make used last year and ignition is now by Bosch high-tension magneto instead of optional. Bosch starting and lighting is used with Willard 12-volt battery.

Dry-Plate Clutch Used

A Borg & Beck dry-plate clutch replaces the cone type previously used. The three-speed-and-reverse selective gearbox is continued. A semi-floating rear axle supplants the three-quarter design, and semi-elliptic springs replace cantilevers. Hotchkiss drive is continued. Control is still left, steering being of the irreversible split nut type, a 17-in. corrugated walnut wheel being used. Gasoline tank is in the cowl with filler cap and gage in the cowlboard. Tires are 30 by 3½, the same as last year. Wheels are hickory with twelve spokes and fitted with demountable rims.

Equipment includes two-piece windshield, double-bulb headlamps, tail and dash lights, Warner speedometer driven from the propeller shaft, one-man Jiffy top and dust boot, tools, etc.

Bodies are low, rakish streamline types with comfortable seats and plenty of leg-room. They are upholstered in black and painted Sterling blue black. Although price has not yet been definitely determined, it will probably be between $700 and $725.

Abbott Downing Trucks on Market

BOSTON, MASS., Nov. 11—The Abbott Downing Co., Concord, N. H., one of the pioneer wagon builders in this country, which recently entered the truck making field, has leased salesrooms in Boston at 84 Brookline Avenue, in charge of F. S. Davis. The company is making two trucks of 1 and 2-ton capacities that will sell at medium prices.

The company will give special attention to truck bodies because of its facilities at its big plant at Concord, N. H. It will continue in the wagon making business also. Until the building is fully completed on Brookline Avenue where its sales and service station will be conducted, Mr. Davis will make his headquarters at 394 Atlantic Avenue.

Canadian Chevrolet Sells 8000 Cars

OSHAWA, ONT., Nov. 11—The Chevrolet Motor Co. of Canada with headquarters at Oshawa, Ont., which has been manufacturing cars for a year, has sold 8000 cars to Canadians and has under course of construction large extensions to its present plant. Three new buildings are in course of construction which will give a total extra floorspace of 277,075 sq. ft. Part of this extra space will be used for storage and part for service but the larger part utilized in increasing its manufacturing facilities.

Wants to Represent Tire in S. A.

NEW YORK CITY, Nov. 13—Walter E. Haumann, manager in Buenos Aires for Prowodnik tires, made in Riga, Russia, is in this city looking for representation of some American tire in Argentina. Mr. Haumann was manager of the Prowodnik interests from the start of the Buenos Aires branch until it was closed due to war conditions a few months ago. Previous to his South American experience he spent 4 years in Portuguese East Africa in export and import work.

Fisher Body Sales Record

DETROIT, Nov. 14—A new high record was established by the Fisher Body Corp. in October when the sales amounted to $1,470,000, compared with $773,000 in October, 1915, an increase of 90.12 per cent. For the 8 months ended Oct. 31 last the sales increased 79.74 per cent.

Chicago Warehouse for Marathon Tire

CUYAHOGA FALLS, Ohio, Nov. 13—The Marathon Tire & Rubber Co. will open a warehouse in Chicago at 1458 South Michigan Avenue. It will be under the management of H. F. Smith.

Pilot's One-Model Program

Touring Car and Roadster at $1150 Each—Production To Be Doubled

RICHMOND, IND., Nov. 13—The Pilot Motor Car Co. of this city will confine its 1917 manufacturing efforts to a single car model known as 6-45, which will list as a touring car and roadster at $1150. The two models 6-55 and 6-75, which the concern has been manufacturing, have been discontinued. Increased production is to be carried out on the one model, and factory additions are now nearly completed, which should double the production of last year. In addition to the 6-45 being produced as a five-passenger car with a double cowl, it will also be built as a four-passenger roadster type with divided front seats and access to the rear seat via the space between the front ones.

In this one chassis the motor is a six-cylinder block type, 3⅛ by 5 with valves on one side. The cylinders are cast integrally with the upper half of the crankcase and the camshaft, water pump, and magneto shaft are driven by helical gears. Delco ignition, lighting and starting is used with the Bendix drive for the starting system. Other equipment includes Stewart vacuum gasoline system and Gould battery. The clutch is a dry-plate type, and the gearset, a unit with the motor, is a three-speed design with nickel steel gears. The tubular propeller shaft carries two inclosed universal joints. The floating axle uses spiral bevel reduction. Steering is irreversible worm and sector type. Cantilever rear springs are used.

The equipment includes a motor-driven horn, Stewart speedometer, one-man top, single tire carrier, and demountable rims.

Kerosene Motors Co. Formed

PEORIA, ILL., Nov. 9—The Kerosene Motors Co. with a capital of $100,000 has been formed in this city to manufacture kerosene motors and accessories. The organizers are George McFarland, president of the Peoria Tractor Co., E. M. Smith and F. H. Bush. The motor is similar to that used in the Peoria tractors. Manufacturing is expected to start in about 30 days, the company planning to make the entire new motor and its parts. The company recently made a test trip of 8000 miles.

King Tire Opens New Plant

DETROIT, Nov. 12—The King Tubeless Tire Co. will open its new plant at Barberton, Ohio, this week.

Brunswick M. C. Co. Formed

To Assemble Car Selling at $1,950—Capitalized at $500,000

NEWARK, N. J., Nov. 13—The Brunswick Motor Car Co. has been formed with a capitalization of $500,000 to produce an assembled automobile selling at $1,950, f.o.b. Newark. A four-cylinder Wisconsin engine, 4¾ by 5½, with a Rayfield carbureter is used. Other features are: Fedders radiator, Bosch magneto, Westinghouse starting and lighting, Brown-Lipe gearset, Timken axles and Parish & Bingham frame. It also uses Gemmer steering gear, Stewart vacuum feed and Silvertown cord tires. Drive is Hotchkiss type.

The body is of a high quality job, all rear compartment woodwork being of mahogany, as is the instrument board. There are also five mahogany cabinets in the rear compartment, containing a set of Thermos bottles, sandwich tins, and room for other articles. Each cabinet has a Yale lock. Two Waltham clocks are furnished, one on the instrument board and one in front of the rear compartment.

Russel Smith is president of the company, Everett Cadmus is vice-president, J. T. Bunt is secretary, and A. V. Weeks is treasurer. The company is temporarily using a plant of 15,000 sq. ft. floor-space, but a new plant will later be established along the Pennsylvania Railroad tracks outside of Newark. From 500 to 1000 cars will be produced during the coming year.

Aniser Becomes Mechanical Belt

ST. JOSEPH, MO., Nov. 13—The Aniser Mfg. Co. has changed its corporate name to Mechanical Belt Co. and is marketing Crowe fan belts exclusively. L. D. W. Van Vliet is president, other officers being, secretary and treasurer, H. D. Gilbert; sales manager, O. G. Young, Jr.; directors, J. D. Richardson, J. E. Dolman and the officers.

Firestone Gives $1,000,000 for Welfare

AKRON, OHIO, Nov. 13—The Firestone Tire & Rubber Co., this city, has voted to give $1,000,000 for an employees' welfare and insurance fund. Two weeks ago the company opened its new club house, said to have cost over $300,000.

$1,000,000 Plant for Victor

PHILADELPHIA, Nov. 14—The Victor Motor Co., this city, capitalized at $2,000,000, will build a $1,000,000 plant at Grubbs Landing, near Claymont, Del., for the manufacture of the Victor Four, a moderate-priced car. The company recently bought 12 acres of land there for building purposes. It has also leased a group of eight factory buildings at Jenkintown, and will commence operations there in a limited way. One thousand men will be given employment in the temporary plant. The employees in the whole plant will number 2000.

Iowa Companies Merge

FORT MADISON, IOWA, Nov. 13—At a special meeting the stockholders of the Perfection Tire & Rubber Co., Fort Madison, Iowa, it was voted unanimously to consolidate the Perfection Tire & Rubber Co., the Perfection Tire & Rubber Co., Ltd., and the Champion Auto & Equipment Co. About 130 stockholders and officers were in attendance.

Goldman to Build Trucks

CHICAGO, ILL., Nov. 13—Eugene Goldman, Chicago Republic truck dealer, is severing his connection with that company and has organized his own company to build trucks. Complete announcement and specifications will be given later.

Pullmore Motor Truck Co. Formed

NEW CASTLE, OHIO, Nov. 2—The Pullmore Motor Truck Co. has been organized in this city with a capital of $600,000, the concern having purchased a site on the Gibson farm, along the Butler Avenue Road.

Advertisement Errors

A typographical error appeared last week in the advertisement of the U. S. Ball Bearing Co. in THE AUTOMOBILE. The advertisement stated: "A leading manufacturer of worm gear units in England advised against the use of annular bearings to carry worm loads." This was in error. The copy should have read: "A leading manufacturer of worm gears in England advises against the use of roller bearings to carry worm loads and recommends the use of annular bearings to carry worm loads."

A clerical error in the advertisement of the Golden, Belknap & Swartz Co. appearing in THE AUTOMOBILE for Oct. 19 made it appear that the cylinders of the G. B. & S. engine have a bore of 3¾ in. and a stroke of 4¾ in. The dimensions should have been 3¾ in. bore and 4¼ in. stroke.

Fisher Body Buys Regal Unit

DETROIT, MICH., Nov. 13—The impression given in a story last week that the whole plant of the Regal Motor Car Co. was sold to the Fisher Body Co. was due to an error, as the Regal company sold only one of its units to that company.

$2,000,000 Plant for Cadillac

Co. Plans To Increase Working Force from Present 8000 to 12,000

DETROIT, MICH., Nov. 14—The Cadillac Motor Car Co. has purchased a 40-acre site formerly owned by the American Car & Foundry Co. and will erect a new factory for the construction of Cadillac cars. The projected plant, upon completion, will entail an investment in buildings and machinery of approximately $2,000,000. The company plans to employ about 12,000 men in the new factory. At present the company has 8000 employees.

Goodyear to Make Own Fabric

HARTFORD, CONN., Nov. 11—The Goodyear Cotton Mills, of Killingly, Conn., has been incorporated with $5,000,000 capital, to engage in general textile manufacturing. The incorporators are Francis Seiberling, Fred Miller and Harold Hutchins. This concern is practically a subsidiary of the Goodyear Tire & Rubber Co., Akron, and will manufacture tire fabrics for that concern.

Erickson Building Front-Drive Truck

WARREN, PA., Nov. 11—C. A. Erickson, formerly with the Scripps-Booth Co., Detroit, Mich., has arrived in this city and is perfecting two models of a front-drive delivery truck in the plant of the Jacobson Machine Mfg. Co. The light delivery truck which Mr. Erickson is bringing out will carry from 1000 to 1500 lb.

Harroun to Complete Factory by Spring

DETROIT, MICH., Nov. 11—The Harroun Motor Corp. is hastening every detail in the endeavor to complete their new factory by the early spring of 1917, so that next May will witness the new structure, with 300,000 sq. ft. of floor space, complete and ready to produce 2000 motor cars a month.

To Make Borland Wheel

ST. PAUL, Nov. 11—A company is to be incorporated to make the J. A. Borland wheel with solid rubber tire invented by Borland, recently of Cincinnati. Hadley Summers is to be president and E. C. Piersal, Dodge Center, Minn., is to be treasurer. R. M. Lampman is secretary and C. F. Updike vice-president under present plans.

Youngstown Co. to Add

YOUNGSTOWN, OHIO, Nov. 9—Plant extensions that will involve an expenditure of about $4,000,000 will be made by the Youngstown Sheet & Tube Co., this city.

Grossman Reincorporates

Forms Corporation with $320,000 Capital All Paid in To Take Care of Expansion

NEW YORK CITY, Nov. 13—The Emil Grossman Mfg. Corp. with a capital of $320,000 has been formed as the result of a reorganization of the company, which is part of the management's plan for the enlargement of the business. The activities of the company will be concentrated on the production of Red Head spark plugs, Ever Good bumpers and Ever Good mirrors. The manufacturing facilities in the Bush Terminal No. 20, will be enlarged. The company has leased building No. 95, Bush Terminal, for the exclusive rust proofing process which will be applied to all metal goods. The producing capacity in the grinding, polishing, nickel-plating and black enameling departments will be trebled.

The capital stock is divided into $150,000 first preferred; $160,000 second preferred; and $10,000 shares of common stock of no par value. The entire capital has been paid in. The capital of the old company consisted of $250,000 common and $100,000 preferred. This was all bought back by Emil Grossman, president and general manager.

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O'Connor Back from Australia

DETROIT, MICH., Nov. 14—N. E. O'Connor of the service department of the Maxwell Motor Co. has returned to Detroit following a 3-months' trip in Australia and New Zealand.

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M. & A. M. Adds Six Members

NEW YORK CITY, Nov. 13—The Motor and Accessory Manufacturers has added six new concerns to membership, bringing the total membership of the association to 260. Those admitted are: Walker Mfg. Co., Racine, Wis., accessories; Becker Brothers, Chicago, Ill., brushes for starting motors, lighting generators and magnetos. Bay State Pump Co., Boston, Mass., engine driven tire pumps and piston packings. Universal Motor Products Co., Indianapolis, Ind., tops. Ericsson Mfg. Co., Buffalo, N. Y., ignition apparatus, Berling magnetos. Craftsman Motor Corp., Chicago, Ill., detachable wire wheels and heaters.

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Dazey Joins Chalmers Co.

DETROIT, MICH., Nov. 14—Roy Dazey has joined the Chalmers Motor Co. to take charge of the department that publishes the various house organs. Mr. Dazey was formerly connected with the Packard Motor Car Co. in the sales department.

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Wilson Tire Reorganization Planned

SPRINGFIELD, ILL., Nov. 10—A reorganization of the Wilson Tire and Rubber Co., this city, is now in process. W. W. Gardner, treasurer of the company, has resigned and it is stated that E. W. Wilson, president and chief promoter of the company, will be succeeded by a new president at the next meeting of the board of directors.

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Increased Capitals

NEW YORK CITY, Nov. 10—Brewster & Co., Long Island City, has increased its capital from $2,000,000 to $2,500,000 to provide funds for the manufacture of a chassis for its automobiles, formerly imported from England and France.

SPRINGFIELD, OHIO, Nov. 11—The Kelly-Springfield Motor Truck Co.; increase of capital from $3,014,000 to $6,000,000.

CLEVELAND, OHIO, Nov. 11—The Hall Motor Car Co.; increase of capital from $1,000,000 to $2,000,000.

DAYTON, OHIO, Nov. 13—The Acme Carbureter & Mfg. Co.; increase of capital from $10,000 to $15,000.

Daily Market Reports for the Past Week

Material	Mon.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.65	.65	.65	.65	.65	.65	...
Autimony, lb.	.13	.13	.13	.13	.13	.13	...
Beams and Channels, 100 lb	2.96	2.96	2.96	2.96	2.96	2.96	...
Bessemer Steel, ton	50.00	50.00	50.00	50.00	50.00	50.00	...
Copper, Elec., lb	.30	.30	.30	.30	.33	.33	+ .03
Copper, Lake, lb	.30	.30	.30	.30	.33	.33	+ .03
Cottonseed Oil, bbl.	12.99	12.39	12.45	12.70	12.60	12.67	+ .58
Fish Oil, Menbaden, Brown, gal	.60	.60	.60	.62	.62	.62	+ .02
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal	1.25	1.25	1.25	1.40	1.40	1.30	+ .05
Lead, 100 lb.	7.02½	7.02½	7.02½	7.02½	7.02½	7.02½	...
Linseed Oil, gal.	.90	.90	.93	.96	.96	.96	+ .06
Open-Hearth Steel, ton	50.00	50.00	50.00	50.00	50.00	50.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.95	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb	.82	.82	.82	.82	.82	.82	...
Rubber, Ceylon, First Latex, lb	.66	.68	.68	.67½	.67	.66	...
Sulpburic Acid, 60 Baume, gal	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	42.37½	42.85	43.00	43.37½	43.37½	43.87½	+1.50
Tire Scrap, lb.	.06⅜	.06⅜	.06⅜	.06⅜	.06⅜	.06⅜	...

Copper at 33 Cents Per Lb.

Highest It Has Been Since 1864—Steel Expected To Go Up

NEW YORK CITY, Nov. 13—Copper featured this week's market activities with a rise of 3 cents a lb. to 33 cents. Tin rose $1.50 per 100 lb. to $43.87½. Fish oil rose 2 cents a gal. and lard oil 5 cents a gal. Linseed oil rose 6 cents a gal. to 96.

The enormous demand for copper is not yet satisfied and sellers predict 35 cents a lb. A glance over the price range since 1860 shows the high range that copper has reached. In 1860 this metal sold high at 24 cents a lb., and in 1864 reached 55 cents, the highest that has ever been paid for it. In 1894 it dropped as low as 9 cents a lb., the lowest price ever paid. Last year this time it sold as low as 13 cents and as high as 24 cents.

Though no increase took place this week in the steel market there is an upward tendency seen in quotations. The greatest activity since the present movement in the steel trade started is now here. Prices are showing increasing signs of moving toward even higher levels, despite the sharp advances already made. Foreign countries are inquiring for the metal, and domestic consumers also are taking whatever quantities the manufacturers are willing to book.

The market for crude rubber, particularly fine Para, is firm. Owing to an unusual drouth in the upper Amazon districts it has been impossible to get the crop down to Para and Manaos in normal amounts. Quotations are now 82 cents a lb. as against 73 a month ago.

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Leak-Proof Business

ST. LOUIS, MO., Nov. 13—L. A. Safford, vice-president of the McQuay-Norris Mfg. Co., maker of Leak-Proof piston rings, says that business reports made at the meeting of the company's salesmen last week indicate a greatly increased business for the coming year. The reports, especially from Texas and the South, were the best ever received and indicated that the jobbers in that territory were set for their greatest year's business in 1917.

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Longuet Buys Accessories for S. A.

NEW YORK CITY, Nov. 8—C. Longuet of the firm of Longuet & Co., Buenos Aires, Argentina, is spending some time in U. S. A. making purchases of automobile accessory lines for Argentina.

Mr. Longuet is making a rather complete study of various accessories that should be suitable for his field. He is taking the careful course of submitting samples to his firm before placing orders. In this way he is making certain that the lines of accessories are suitable. Two years ago Mr. Longuet spent some months in this country making purchases of automobile accessories and hardware merchandise.

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Offer to Standard Welding Shareholders

CLEVELAND, Nov. 12—Shareholders of the Standard Welding Co. have received an offer from Borton & Borton, investment bankers, to purchase the property of the company at a price that will net them between $244 and $245 a share. The assent of 90 per cent of the total outstanding stock is necessary to transact the deal.

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Dividends Declared

Maxwell Motor Co.; quarterly of 2½ per cent on common, payable Jan. 2 to stock of record Dec. 11.

Texas Co., regular quarterly 2½ per cent, payable Jan. 1.

Pratt & Whitney Co.; quarterly of 1½ per cent on preferred, payable Nov. 15.

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Holmes Resigns from Michigan Welding

DETROIT, MICH., Nov. 15—A. L. Holmes has resigned from the sales department of the Michigan Electric Welding Co., effective Dec. 1.

Big Drop in Car Securities

General Motors Leads with 300 Point Loss—Maxwell, Chevrolet and Overland Drop

NEW YORK CITY, Nov. 13—Liquidation of automobile issues had the usual effect upon prices. Drops of from a fraction to 300 occurred. The recession, however, has not been taken seriously by automobile shareholders. October and November are generally poor months for automobile shares. With the approach of the automobile show, it is stated, motor shares will get stronger.

The most pronounced declines were shown in Chevrolet, Maxwell, Studebaker, Willys-Overland, and General Motors. The latter company featured the recession with a drop of 300 points from 810 to 510. Notwithstanding the depressing conditions of the market, there were several outstanding gains made by several of the stocks. Ajax Rubber, in face of the usual declines, has made an advance of 8⅝ points in 14 days. The company's stock within the last 2 weeks has sold as high as 77. White stock has also shown strength.

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M. & A. M. Show Week Schedule

NEW YORK CITY, Nov. 13—The Motor and Accessory Manufacturers announces the following events scheduled for show week, Jan. 7, as follows: Wednesday, Jan. 10, executive committee, banquet committee, finance committee, and board of directors' meetings at association's offices; thirteenth annual meeting at Waldorf Astoria at 3 o'clock, followed by the ninth annual banquet at Waldorf at 7.30 p. m.; Thursday, board of directors meeting at association's offices.

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Pierce-Arrow Assets $13,776,911

NEW YORK CITY, Nov. 11—The total net assets of the Pierce-Arrow Motor Car Co., which were taken over by the Pierce-Arrow Motor Car Corp., Buffalo, last week, were on Oct. 1 valued at $13,776,911. It is estimated that by Dec. 31, 1916, this value will have increased $1,000,000. For the 7 months ended July 31 last net profits before depreciation were $1,660,000 for August $540,000; September, $560,000, making a total of $2,760,000 for the 9 months, which after depreciation show a net profit of $2,460,000.

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White Stock on 8 Per Cent Basis

CLEVELAND, OHIO, Nov. 11—The White Motor Co. has declared a quarterly dividend of 2 per cent, $1 a share, placing the stock on an 8 per cent per annum basis. The stock has been on a 7 per cent per annum basis. The dividend is payable Dec. 31 to holders of record Dec. 15. The par value of the shares is $50.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co.	73½	74½	+3½
J. I. Case T. M. Co. pfd.	87	90	+4
Chalmers Motor Co. com.	130	140	+5
Chalmers Motor Co. pfd.	112	115	+7
*Chandler Motor Car Co.	103	103½	—2
Chevrolet Motor Co.	173	177	—13
Enger Motor Car Co.	7¼	8	..
Fisher Body Corp.	38	40	—1
Fisk Rubber Co. com.	80	95	..
Fisk Rubber Co. 1st pfd.	109	114	..
Fisk Rubber Co. 2d pfd.	95	105	..
Firestone Tire & Rubber Co. com.	1350	1400	+200
Firestone Tire & Rubber Co. pfd.	106½	108	+2½
*General Motors Co. com.	510	870	—300
*General Motors Co. pfd.	122	124	—2
*B. F. Goodrich Co. com.	68¾	69	+3⅜
*B. F. Goodrich Co. pfd.	113	114⅜	—1
Goodyear Tire & Rubber Co. com.	294	297	+1
Goodyear Tire & Rubber Co. pfd.	108¾	109½	..
Grant Motor Car Corp.	7	9	—1
Hupp Motor Car Corp. com.	4½	5½	— ¼
Hupp Motor Car Corp. pfd.	85	95	—7
International Motor Co. com.	5	6½	—1
International Motor Co. pfd.	22	27	—2
*Kelly-Springfield Tire Co. com.	74¾	75½	—2¼
*Kelly-Springfield Tire Co. 1st pfd.	96	100	—1
Kelsey Wheel Co.	55	56	..
*Lee Rubber & Tire Corp.	39½	39⅝	—2
Keystone Tire & Rubber Co.	15	16	..
*Maxwell Motor Co. com.	71¾	72¼	—12¼
*Maxwell Motor Co. 1st pfd.	82	82½	—3
*Maxwell Motor Co. 2d pfd.	49½	50	—4½
Miller Rubber Co. com.	242	250	+2
Miller Ruber Co. pfd.	105½	106½	+ ½
Mitchell Motor Co.	58	60	..
National Auto Corp.	40	41½	..
Packard Motor Car Co. com.	..	170	..
Packard Motor Car Co. pfd.	94	99	+1
Paige-Detroit Motor Car Co.	37	38	—1
Peerless Truck & Motor Corp.	22½	24	— ½
Pierce-Arrow Motor Car Corp.	55¾	56¼	..
Portage Rubber Co. com.	165	169	—5
Portage Rubber Co. pfd.	..	..	..
Regal Motor Car Co. pfd.	20	30	..
Reo Motor Car Co.	46¼	47	+ ¼
Saxon Motor Car Corp.	76¾	78	— ⅝
A. O. Smith Co. com.	43	43¾	..
A. O. Smith Co. pfd.	96½	96¾	..
Springfield Body Corp. com.	93	96	—2
Springfield Body Corp. pfd.	125	135	+5
Spicer Mfg. Co.	46¾	47	..
Standard Motor Construction Co.	7	8	..
Stewart Warner Speed. Corp. com.	109	112	—1½
Stewart Warner Speed. Corp. pfd.	..	..	..
*Studebaker Corp. com.	123½	124	—5
*Studebaker Corp. pfd.	112¼	115	..
Stutz Motor	64⅝	65¼	..
Swinehart Tire & Rubber Co.	88	91	—2
United Motors Corp.	61⅝	62	—2⅞
*U. S. Rubber Co. com.	59⅜	60	—1¼
*U. S. Rubber Co. pfd.	111	111½	—1
White Motor Co.	55	55¼	— ¼
*Willys-Overland Co. com.	37	37¼	—5½
*Willys-Overland Co. pfd.	100	101	—3

*At close Nov. 13, 1916. Listed New York Stock Exchange. Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	42	44¼	— ½
Chalmers Motor Co. com.	126	..	+2
Chalmers Motor Co. pfd.	109	..	..
Continental Motor Co. com.	37¾	38½	+ ¼
Continental Motor Co. pfd.	9½	10¼	..
Ford Motor Co. of Canada	293	300	..
General Motors Co. com.	..	825	..
General Motors Co. pfd.	..	126	..
Maxwell Motor Co. com.	74	76½	—9½
Maxwell Motor Co. 1st pfd.	82	84½	—2
Maxwell Motor Co. 2d pfd.	50	52½	—2½
Packard Motor Car Co. com.	160	168	..
Packard Motor Car Co. pfd.	100	102	..
Paige-Detroit Motor Car Co.	37	..	—1
W. K. Prudden Co.	..	50	..
Reo Motor Car Co.	46¼	47	+ ¼
Studebaker Corp. com.	123	126	—3½
Studebaker Corp. pfd.	109	..	..
C. M. Hall Lamp Co.	..	31	..

INACTIVE STOCKS

Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd.	20	..	..

Traffic Laws to Be Clear

To Affect All Vehicles and Will Be Uniform in All States —Registration Included

WASHINGTON, D. C., Nov. 18—Simplification is to be the keynote of the new uniform motor vehicle and traffic law which will be promulgated in a short time by the legislative board of the A. A. A. The motor vehicle laws now on the statute books of most of the States are unnecessarily long and cumbersome. Duplication and further confusion exists where a State has separate motor vehicle and traffic laws on its books.

"Highway traffic in its final analysis is but a single problem," says Chairman O. I. Yellott, "whether it relates to motor cars, horse-drawn vehicles, traction engines, or pedestrians. Traffic should be handled as one problem by one general set of laws, so that the rules governing one particular kind of traffic may fit into and be consistent with those governing all other kinds of traffic.

"The details of the uniform law to be framed by the A. A. A. board have not yet been fully worked out, but it may be stated in a general way that the first sub-division will deal with general provisions relating to the applicability of the law and definitions of terms used therein. The second sub-division will deal with the appointment, powers, and duties of a State traffic commissioner, who will have general supervision of traffic of all kinds on the public highways. The third sub-division will deal with the registration of motor vehicles and operators. The fourth will deal with the operation of vehicles of all kinds on the public highways, as well as with the conduct of pedestrians thereon. The fifth will deal with the enforcement of the preceding provisions.

"Thus each sub-division of the proposed law will be almost wholly self-contained, thereby doing away with a great deal of the confusion which now exists in so many State laws by reason of different kinds of provisions being intermingled. But the idea of simplification will be carried still further. The provisions relating to the traffic commissioner will be made quite brief and very simple. One section will define his duties; another, his powers; both in like general terms. Broad provisions will be used to extend these duties and powers as far as may be necessary to accomplish the general objects of his appointment. The courts, as a rule, may safely be trusted to amplify provisions of this kind with much more satisfactory results than where the law-maker himself attempts to enumerate all such duties and powers in great detail."

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Earle & Boggs Enlarge Accounts

NEW YORK, Nov. 14—Earle & Boggs, this city, manufacturers' representatives, will add to its account the Buda Co., Harvey, Ill., and the Fuller & Sons Mfg. Co., Kalamazoo, Mich., its territory covering the States east of the western boundary of Pennsylvania. They also handle the accounts of the Blood Bros. Machine Co., Allegan, Mich., and the Pierce Governor Co., Anderson, Ind.

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Fosdick Plans Automotive Company

BOSTON, MASS., Nov. 11—The Harry Fosdick, Inc. was formed here to-day. While its primary object is to deal in Pathfinder cars for New England, its main object is to go into everything possible along the lines of automotive power. Mr. Fosdick has been working on the plans for the past 6 months. The charter grants the right to sell, manufacture, buy and deal in all automotive powers, including automobiles, aeroplanes, marine, railroad or anything else that moves with a motor. The company has a capital of $20,000, and has leased temporary salesrooms here.

Mr. Fosdick's idea is to begin operations to meet the future which he realizes will mean the adoption of motors more generally for aeroplanes, submarines, vessels of all kinds, and even for railroads. William Hilliard, who was formerly with him, and who spent much time with the Burgess Aeroplane Co., learning to handle aircraft, has joined him. Mr. Hilliard, who was also with the Pathfinder, is known as the winner of the Climb to the Clouds, and for winning the light car race at Savannah with a Lancia.

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C. & C. Co. To Handle R. I. V. Ball Bearings

NEW YORK, Nov. 13—The C. & C. Sales Corp. has been formed by I. R. Caplan, formerly connected with the R. I. V. Co. and Belmont Corp., formerly purchasing agent for Fiat, Poughkeepsie, N. Y. The company will deal in various types of anti-friction bearings, having taken over the R. I. V. Co.'s entire stock, for which it will be retail sales agent.

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Fulton Takes C. & E. Products

MILWAUKEE, Nov. 13—The Fulton Co. has taken over the entire output of the C. & E. Mfg. Co., Marshalltown, Ia., the principal products of which are cutouts, Ford wheel pullers, accclerators for Fords, pedals, fender braces and camshaft bearings for Fords. These will be distributed to the jobbing trade in the United States and Canada.

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New 3500-Mile Alliance Tire

ALLIANCE, OHIO, Nov. 13—The Alliance Tire & Rubber Co., the corporation which has succeeded The Alliance Rubber Co., Alliance, Ohio, announces a 3500-mile tire for 1917, a product that will be marketed at a low figure to the retail trade.

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Peter A. Frasse & Co. 100 Years Old

NEW YORK CITY, Nov. 13—"One Century in Business" is the title of a booklet just issued by Peter A. Frasse & Co., this city, Philadelphia, Buffalo and Hartford, commemorating the opening of its first store in this country. This company is one of the large dealers in steel tube and tool steel, also mechanics' tools and machinery supplies.

Plan Tests of Fuel Consumption

Wisconsin Good Roads Assn. to Determine Relative Effects of Road Conditions

MILWAUKEE, WIS., Nov. 11—Exhaustive tests and demonstrations to determine the relative consumption of gasoline by motor vehicles on different types of highways, and also on roads in good and bad condition, have been arranged by the Good Roads Assn. of Wisconsin. The tests will be undertaken as soon as possible under the direction of Prof. M. F. White, department of agricultural engineering, University of Wisconsin, with the assistance of F. A. Cannon, secretary of the roads association.

The first tests will be made in Milwaukee county, which contains more than 100 miles of concrete highway, and also many miles of poor dirt, gravel and macadam highways not yet improved, thus offering the extremes of road and haulage conditions. The work will be done in this manner: A wagon will be loaded with a fixed load of agricultural products, say 2000 lb., to which will be hitched a pair of horses. By means of a dynamometer the tractive effort, resistance or pulling power will be fixed and determined.

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Allen Bour-Davis Southern Sales Mgr.

DETROIT, MICH., Nov. 11—Robert Allen has been made the southern district sales manager for the Bour-Davis Motor Co., Mr. Allen was formerly the manager of the Dallas, Tex., branch of the Chevrolet Motor Co.

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Livingstone Maxwell Cleveland Manager

CLEVELAND, Nov. 12—J. Livingstone has been appointed manager of the Cleveland retail branch of the Maxwell Motor Co. Mr. Livingstone was formerly assistant branch manager for the Studebaker Corp. at Indianapolis and Omaha.

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Cole Has Service Conference

INDIANAPOLIS, IND., Nov. 10—More than 100 service men employed by the various important distributors and dealers of Cole cars have been assembled in Indianapolis by the Cole Motor Car Co., for their first service men's conference to outline a new service program which has been adopted.

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Miles Is Buyer for Lewis Motor

DETROIT, MICH., Nov. 13—F. E. Miles has become the purchasing agent for the Lewis Motor Corp. Mr. Miles was formerly connected with the National Motor Vehicle Co.

Paige Wins Desert Race

Negotiates 273-Mile Phoenix-Douglas Course in 8 Hr. 30 Min.—14 Entered

PHOENIX, ARIZ., Nov. 13—E. L. Cord, driving a Paige, won the 273-mile Phoenix road race in 8 hr. 30 min., or 30 m.p.h. P. Thomason, driving a Buick, came in third, his time being 8 hr. 40 min. Fourteen cars started and five of them finished.

Entry in the race was open to cars and drivers from Arizona, New Mexico and Texas, with the condition that both driver and entrant must have been a resident of one of the three States for 6 months prior to the race. The race started at Douglas and finished at the State fair ground, Phoenix. The course followed the Borderland highway from Douglas to Phoenix, including some of the fastest stretches of desert road in the southwest and some tortuous sections of mountain and desert road. Hugh Miller holds the course record of 7 hr. 4 min., in 1914, made in the Pope-Hartford that he drove to-day. The race was conducted under sanction of the A. A. A. and by the Arizona State Fair Commission.

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Uniontown Speedway Nears Completion

UNIONTOWN, PA., Nov. 13—The local 1⅛ mile speedway is now nearly completed and will be ready for practice the latter part of next week. The total number of entries to date for the race meet on Nov. 30 is fifteen. In addition to the $4,250 offered in cash prizes for that day, C. W. Johnson, president of the speedway association, received a special prize in the form of a trophy valued at $3,000, to be known as the Universal Trophy, presented by Carl Laemmle, president of the Universal Film Mfg. Co. This trophy is to be contested for a period of 5 years at Uniontown, according to the terms on which it is offered.

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Maxwell Makes Speed Test Run

DETROIT, MICH., Nov. 11—A Maxwell stock car, driven by Ray McNamara, completed a speed test from Detroit to Kalamazoo and return in 9 hr. and 45 min., covering a total distance of 350 miles, with an average running speed of 36 m.p.h.

The test was held, preliminary to the engagement of a Maxwell stock car in a contest which may arise as a result of the Maxwell challenge issued recently to all cars selling for $1,000 or less. The route taken included the towns of Lansing, Grand Rapids, Kalamazoo, Battle Creek, and Jackson, and the run was officially observed and checked by Detroit newspaper men. More than 50 per cent of the run was made over roads that were in the worst possible condition for touring and in several places the car was forced to make long detours because of construction work.

The start was made from Detroit at 3.15 a. m. and the car was checked into Detroit at 1 p. m.

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Chevrolet Makes Promotions

OAKLAND, CAL., Nov. 13—R. C. Durant, son of W. C. Durant, has become sales manager of the Chevrolet Motor Co. of California. He was formerly assistant sales manager. W. A. Coleman has become assistant sales manager. Norman DeVaux has become general manager of that company, his former position being sales manager. They will make their headquarters at the local assembling plant.

T. L. Coleman has become sales manager of the Chevrolet Motor Co. of Canada, Oshawa, Ont., succeeding H. Horsman, recently resigned. Mr. Coleman was formerly with the Goodyear Tire and Rubber Co., New York.

—

Milburn Branch Manager for Hupp

DETROIT, MICH., Nov. 14—E. W. Milburn has been appointed branch manager of the Hupp Motor Car Corp. at San Francisco. He succeeds E. A. Morrison. Mr. Milburn was formerly the coast representative for the Thomas B. Jeffrey Co.

—

Timken Employees to Own Store

DETROIT, MICH., Nov. 14—The 3300 employees of the Timken-Detroit Axle Co. plan to reduce the cost of living by the operation of a store owned by themselves. It will be known as the Co-operative Store of the Timken-Detroit Co. and will sell food staples to all employees at the lowest possible prices. L. R. Judson, welfare manager for the company, will supervise it.

—

Vail Rubber Changes Its Name

CHICAGO, ILL., Nov. 13—The name of the Vail Rubber Co. has been changed to Ehman Tire & Rubber Co., under which name the business will be continued. A. C Ehman is president, the other officers being Francis Lackner, vice-president and N. J. Flynn, treasurer. The company makes pneumatic tires, packing, gaskets, and mechanical rubber goods.

—

Olympian Offices in Pontiac

PONTIAC, Nov. 13—The general offices of the Olympian Motors Co. have been moved into the main office building formerly occupied by the old Flanders Mfg. Co.

Amateur Races for Chicago?

Series May Be Run on Speedway Under Mid-West Motor Club

CHICAGO, ILL., Nov. 10—It seems possible that next year will see a series of amateur races run on the Chicago speedway quite similar to those that were fortnightly events on the Brooklands track prior to the war. These races probably will be run under the auspices of the Mid-West Motor Club, which was formed this week by a number of those who took part in the amateur races held here this year and present plans include competition among all cars up to and including 230 cu. in. piston displacement.

—

American Speedways Assn. Formed

CHICAGO, ILL., Nov. 15—Speedway managers met here to-day and formed the American Speedways Assn. in the form of a national organization to standardize racing conditions and to draft up uniform regulations and co-operations in getting drivers in all events.

The meeting to-day held at the Chicago Automobile Club is the culmination of a number of previous futile attempts to organize during the past 18 months.

At this meeting a constitution was adopted and officers elected as follows: president, Harry Harkness, New York Speedway; vice-president, Allison, Indianapolis Speedway; treasurer, H. S. Lehman, Cincinnati Speedway; and secretary, T. E. Meyers, Indianapolis.

The following speedways had personal representatives present; Indianapolis, Uniontown, New York, Providence, Des Moines and Chicago. Cincinnati and Omaha sent proxies.

In the newly formed organization there are two classes of membership. Class A is open to speedways having a course of 2 miles in length or over and class B is open to speedways having a course of less than 2 miles. In each case those speedways will be admitted whose construction is approved by the membership committee of the association. Chief control will be in the hands of a governing board consisting of three representatives of class B and four representatives of class A. The governing board consists of Allison, Harkness, Reid, Lehman, and C. W. Johnson, of Uniontown, as class A members. F. H. Perkins, Providence and Samuel Orloff, Des Moines, are members of class B. The governing board and officers elected will serve until the next meeting in New York, Jan. 12.

The American Speedways Assn. supercedes the Speedways Assn. of America which it was intended to organize earlier in the year.

The Automobile

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Convincing Advertising

THE advertisements of the concerns constituting any industry is in general a good indication of the business ethics of that industry. In all new industries more or less undesirable advertising is bound to be published, but it is a satisfactory indication when a national organization such as the National Automobile Chamber of Commerce takes up the problem of advertising with the object of discouraging what might be classed as scare or fear copy and lending its influence to more positive forms of publicity.

Potential Quality Doubted

While scare, or fear, advertising might be looked upon as potential still it is questionable, after administering the psychological test, if such copy is as potential as other copy might be. There is generally a positive and a negative aspect to each subject. A good positive example of advertising is that of the Pennsylvania Railroad, which advertises the number of passengers it has carried over a certain period without a single loss of life. It would be difficult to find a more potential kind of copy. Other positive railroad advertising has had to do with block-signal systems, rock-ballasted roadbed, full crews and other assets.

Contrast such advertising with that copy which might be used, showing trains on their side in the ditch, passenger cars on fire and women and children being rescued, engines colliding head-on and trains crashing through weak bridges. Such fear copy that might be used would in general build up through the traveling clientèle a feeling of fear, a feeling that would not engender a love for travel, but that would rather induce you to stay at home. The effect would be negative rather than positive.

Negative Tendencies Undesirable

In all advertising copy relating to automobiles and the industry the message to be conveyed is not one of fear or scare but one of desire to own and use an automobile. Every picture used in an advertisement that suggests accidents and the horrors that follow them is a possible source of injury. It has a negative tendency in that its influence breeds fear for the automobile rather than confidence in it.

Clutches and Winter

MISSING motors and clashing gears seem to be particularly common in the cold weather which has just commenced to settle over the country. The first item can of course be laid at the door of the heavy fuel which is difficult of vaporization. The second, however, can be traced to a defect which should be rectified in some of the clutch designs.

There is a tendency to drop the clutch brake and in place of this substitute a quick releasing device which will disengage the driving from the driven members instantaneously. This trend of design is no doubt a matter of progress, but one phase which must be watched is that the stiff lubricant which is attendant upon cold weather does not interfere with the action of the clutch.

The lighter weight clutches which are coming into use year by year naturally have less tendency to spin, and therefore lessen the danger of clash and also are not prone to drag. The effect of the heavy oil on even a light-clutch member is sufficient at times to give this clash. In fact, it will be so severe in some instances that it is difficult to pull the gears out of mesh after the clutch pedal is depressed, and when they are re-engaged the grinding noise which is particularly noticeable at this time of year ensues.

The remedy is, of course, in having the disengaging mechanism positive as well as quick. At the same time the leverage on the clutch pedal must not be reduced because with the ever-increasing number of women who drive it is necessary to keep in line with the tendency of having the force required to disengage the clutch as small as possible. Furthermore, the amount of motion of the pedal cannot be too great, because it will make the car unsuitable for a large number of leg lengths. This opens up a problem which is of course nothing new to the clutch builder. The amount of clutch member travel must be small, it must be quick to reduce spin, and in all the lubricated forms of clutch it must be absolutely unaffected by changes of oil viscosity due to temperature changes.

Steering Gears Offer Many Opportunities

Details of Layout and Construction Present Field for Enterprise—Truck Type Problems Differ from Passenger Car Requirements—Elimination of Wear

By J. Edward Schipper

STEERING gear design is largely a matter of compromise. It is a compromise between what is mathematically perfect and what is attainable practically; between stress on the driver and stress on the mechanism; and again between quickness of action and effort required to manipulate.

With this three-fold problem, each having its answer in a compromise, it is human to conclude that there will be a great variation in opinion, and this is true regarding the generalities of steering gear design as well as of the details.

Steering gears are probably the part of the car which has undergone the least change in the last 5 years and there are many cars to-day using the same gear as they did in 1912, with the exception of a few refinements in the direction of reduced weight and the changes required in shifting the gear from the right to the left side of the car.

Two big factors enter the design of the steering gear, and these determine practically every point in relation to the gear. They are:

First—the car weight.
Second—the car speed.

The layout of the gear is governed largely by the wheelbase and the structural details of the frame, but the steering gear itself depends upon the two factors named.

Truck Designs Differ

Because a truck is heavier and slower than a passenger car, it necessarily has a different kind of steering gear. Theoretically the layout would be the same for both machines if they were of the same wheelbase, but practically, it is necessary to have a great reduction in the truck because it is heavier and naturally takes a greater leverage to turn the wheels; and secondly, since the truck acts at a slower rate of speed, the reduction can again be greater because it is not so necessary to be able to turn the wheels from one side to another so quickly.

Owing to the great inertia of a moving loaded truck it is not desirable to make quick turns with the front wheels on account of the tremendous stresses involved by the inertia force and the high center of gravity. With a passenger car, the wheels must turn quickly in order to make the vehicle good for traffic work.

The passenger car problem calls for the reduction gear in the steering mechanism to have a final ratio that will give the result desired in quickness and at the same time the gear must prevent the reception of road shocks by the driver, or, in other words, it must not allow the wheels to be swung out of their proper line or the steering wheel turned by every little impact between wheels and road obstructions. In other words, the gear must be to some degree irreversible.

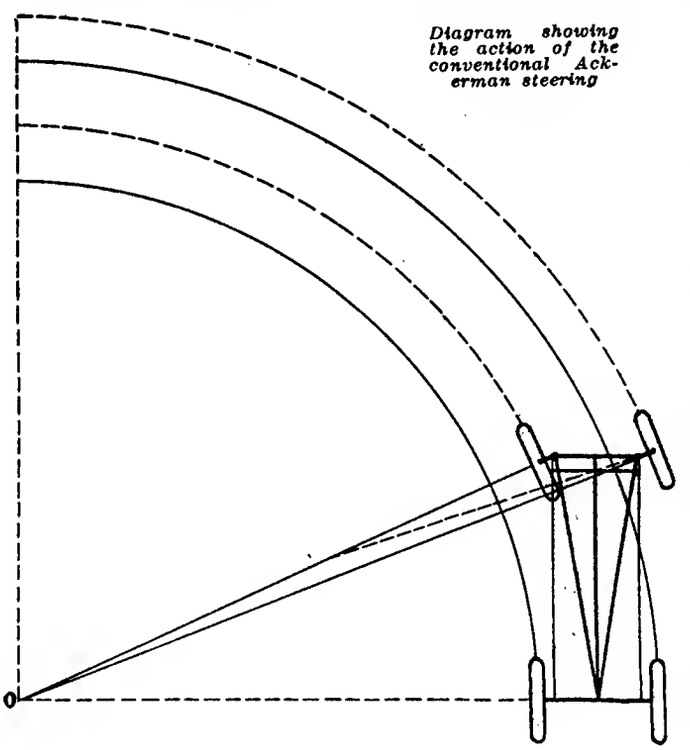


Diagram showing the action of the conventional Ackerman steering

The term irreversible in itself is confusing, because it has no exact meaning when applied to steering wheels beyond the rather indefinite condition that it means that any ordinary road wheel impact will be insufficient to turn the steering wheel. It is simply a question of reduction between worm and gear, sector or nut, whichever system is used. The greater the reduction, the less reversible the system and likewise the slower the motion of the road wheels in relation to the movement of the steering gear. Hence,

the steering gear for a heavier car will be normally less reversible than the steering gear for a lighter vehicle.

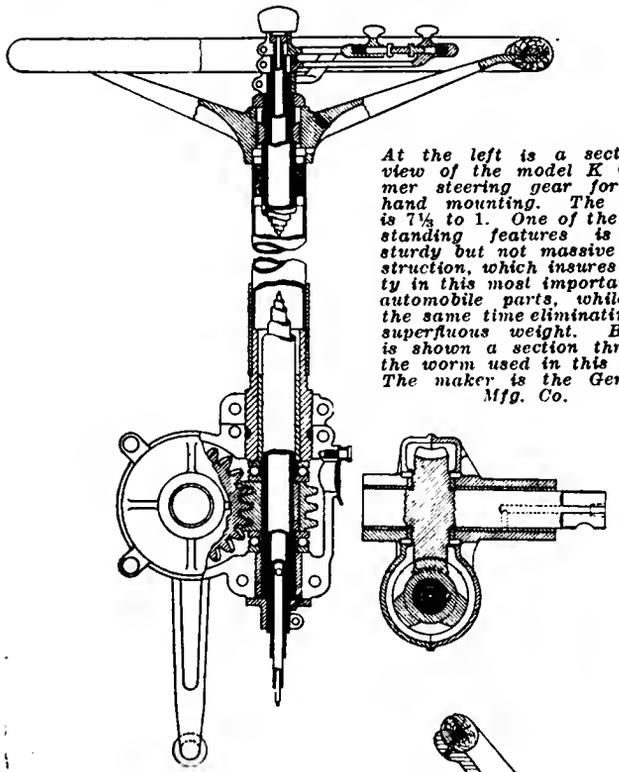
Elimination of Wear

The straight mechanical problem of steering gears is to eliminate wear. This occurs in all the joints, the order of progress of wear being first the link joints at either end of the drag link and tie rod; and next between the worm gear or nut and the swivel joints. The order of wear is very much the same as the order of lubrication difficulty, and where the different steering gears differ largely is in these points where different styles of ingenuity are employed to get the joints so that they will retain the grease and at the same time allow it to be applied at the proper points.

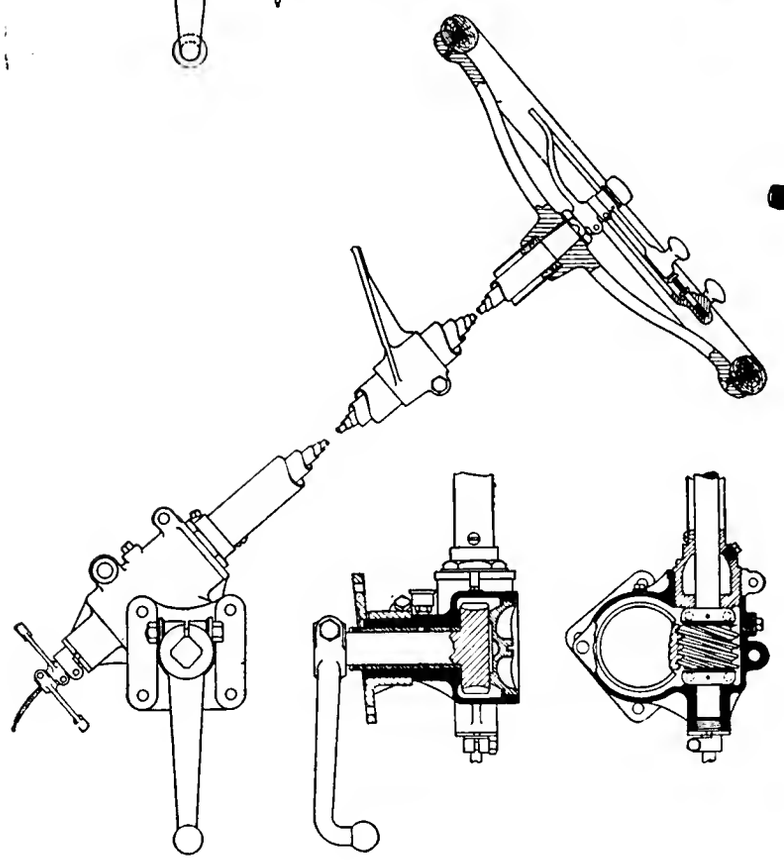
There is also a variation in the grades of lubricant used. The Warner company, for example, recommends a heavy graphite grease as a general rule, although it states that in very cold weather a thinner oil would be of advantage. The great point of importance is that the oil or grease is retained in the gear once it is put there so that the operation of oiling the gear will not have to be repeated over frequently.

Lubrication Points Inaccessible

There are at least seven important points to lubricate on a steering gear, and none of them is accessible for a man who has good clothes on, therefore, as far as the passenger car owner-driver is concerned, he will not lubricate the gear until two conditions obtain, first that he has on a set of working clothes and second that he thinks of the gear. In many cases the first of these circumstances is rare, and in many more instances the second circumstance is still more rare. The combination of the two, therefore, will be so much of a long chance that steering gears must be designed to hold enough oil and grease to furnish lubrication for a long time. The majority of steering gear manufacturers favor a light transmission grease.

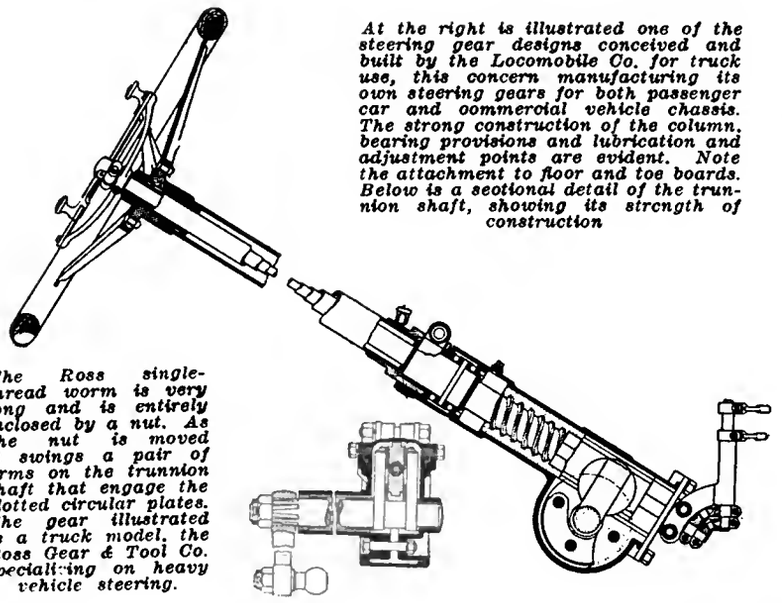


At the left is a sectional view of the model K Gemmer steering gear for left hand mounting. The ratio is 7½ to 1. One of the outstanding features is the sturdy but not massive construction, which insures safety in this most important of automobile parts, while at the same time eliminating all superfluous weight. Below is shown a section through the worm used in this gear. The maker is the Gemmer Mfg. Co.



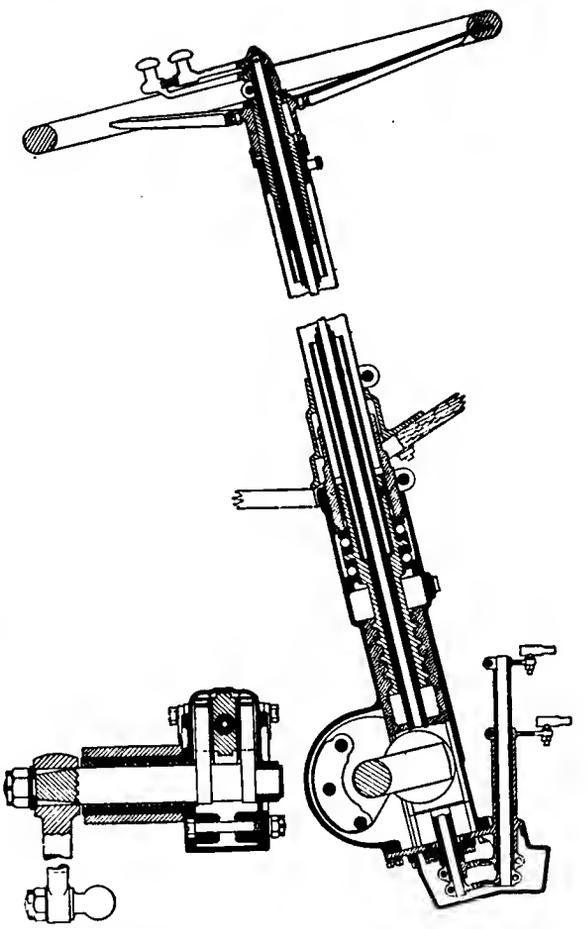
Above is the Lavine gear which uses a divided nut operating on right and left hand threads cut in a double worm, each of the blocks of the nut having a worm. The steering arm is operated through a rocking arrangement. To the left of the steering gear is a detailed section showing the trunnion shaft, its bushing, trunnion block, etc. The Lavine Gear Co. is the manufacturer

To the left is a Warner steering gear which is widely used and which is representative of modern worm and wheel practice. There is an adjustment for the thrust bearing behind the worm. Note the bracket midway up the steering column for attaching to the cowlboard or dash and also wiring for the horn. Immediately to the right of the steering gear is a sectional view showing details of the trunnion-shaft and farther to the right is a similar illustration of the worm assembly. This gear is made by the Warner Gear Co.



The Ross single-thread worm is very long and is entirely inclosed by a nut. As the nut is moved it swings a pair of arms on the trunnion shaft that engage the slotted circular plates. The gear illustrated is a truck model, the Ross Gear & Tool Co. specializing on heavy vehicle steering.

At the right is illustrated one of the steering gear designs conceived and built by the Locomobile Co. for truck use, this concern manufacturing its own steering gears for both passenger car and commercial vehicle chassis. The strong construction of the column, bearing provisions and lubrication and adjustment points are evident. Note the attachment to floor and toe boards. Below is a sectional detail of the trunnion shaft, showing its strength of construction



In the design of the gear itself, it is generally believed that the kind of gear employed is not so important as to have the gear of proper design. This materially affects the lubrication, as it bears directly on the pressure exerted on the surfaces. The pumping effect on the steering gear is very slight, so it is difficult to keep the lubricant properly distributed and therefore another feature to compromise arises. The unit pressures must be kept down on one hand, and, on the other hand, the thread area of the worm must not be too great.

The Two Schools of Design

Referring this matter to the two different schools of design, the worm-and-split-nut and the worm-and-gear, the probabilities are that in the worm-and-gear type the pressures run quite high, because of the nature of the gears there is simply a line contact; whereas with the worm-and-split-nut type the thread area has a tendency to become so large that it is difficult to permit the lubricant to reach the innermost threads unless a very light oil is employed.

Allowable Backlash

All the wear in the different joints is reflected in backlash in the steering wheel. Fortunately, adjustments are provided on all the gears to get this lash out, because it becomes annoying at first and then dangerous, as a car with too much is apt to commence swaying on a down grade, and the sway becomes greater and greater until it reaches the limits of safety unless retarded.

Exactly what should be the allowable backlash in the steering wheel is subject to a difference of opinion. The Jackson, Church and Wilcox company states that the ideal is a 0 backlash. Warner states from 1 to 1½ in. is permissible. As a matter of fact, everyone knows that it should be kept as small as comfortable. Even drivers will differ, however, on what constitutes a fair amount of play and what is bothersome, but the steering gear manufacturer cannot adjust every product to the individual desires of the driver, so a standard has to be set and adhered to in each factory, and this ranges between the limits of practically 0 to 1½ in. A slight play generally helps to reduce shock.

Steering Pivot Tilt

If there is one change in steering gears, it is probably in arranging the steering pivot tilt. This has been increased in the last year or two, in order to help in attaining the so-called castor effect. In laying out the steering gear on the Willys-Overland cars, an angle of more than 5 deg. is given every steering pivot, to make it hold the road. On the other hand, a tilt of more than 10 deg. is extreme and it will be very difficult to make the car hold a turn on account of the great tendency for it to straighten out. This would make a desirable car on a long, straight road, but an undesirable one on a twisting road. Here again there must be a compromise and a moderate tendency to straighten out gained, without causing a tiring effort to hold the wheels on turns.

Tilting the Axle

Tilting the axle gains the same effect as tilting the steering spindles and even the flattening of the front springs has been a decided help in making cars hold the road. It is not all design, however, as soft front tires will counteract the best of steering layouts, or if the weight on the rear axle is greater than that on the front, there will be a decidedly unbalanced car to drive, the tendency being for the car to try to have the rear end catch up with the front wherever the course deviates from a straight line or lies over a slippery stretch.

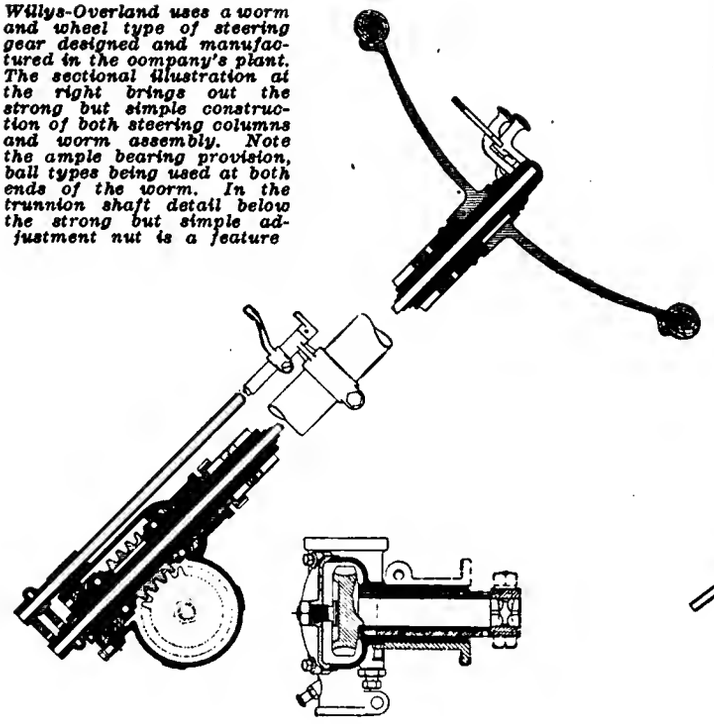
Adjustments Are Complete

Steering gears are all particularly complete in the matter of adjustments. This allows the driver to hold the backlash in the gears to just about the desired amount. Play in the wheels that is not detected in the steering wheel is due to variations in tightness of the linkage, and signifies worn parts, generally those which have either been neglected by the driver or which have bearing surfaces that are too small for the loads the gear is called upon to stand and hence have worn away too rapidly.

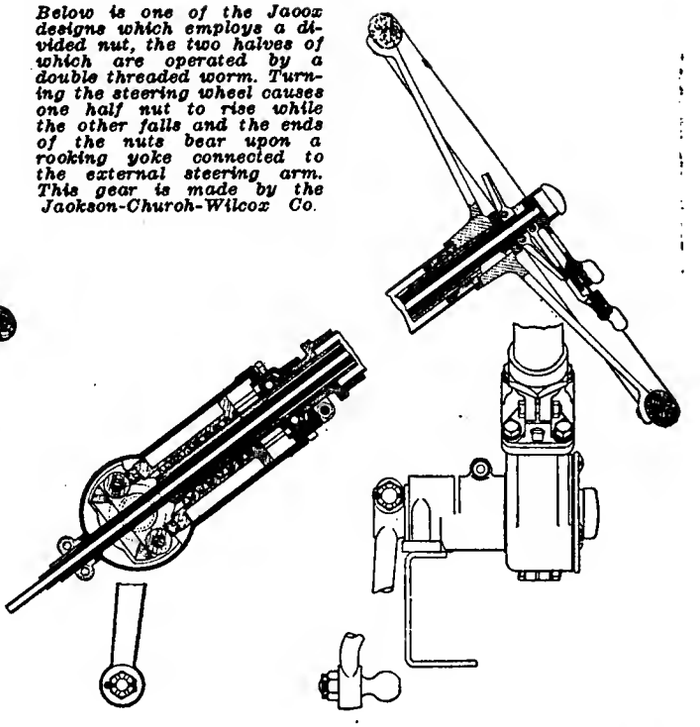
Bearings Are Renewable

Bushings are renewable even in the case of the worn parts, so that steering gear maintenance is really on about as good a basis as anything on the car. The trend of the times, however, will probably cause an improvement in gears in the

Willys-Overland uses a worm and wheel type of steering gear designed and manufactured in the company's plant. The sectional illustration at the right brings out the strong but simple construction of both steering columns and worm assembly. Note the ample bearing provision, ball types being used at both ends of the worm. In the trunnion shaft detail below the strong but simple adjustment nut is a feature



Below is one of the Jacox designs which employs a divided nut, the two halves of which are operated by a double threaded worm. Turning the steering wheel causes one half nut to rise while the other falls and the ends of the nuts bear upon a rocking yoke connected to the external steering arm. This gear is made by the Jackson-Church-Wilcox Co.



way of self-lubrication and again in self-adjustment. The self-aligning feature comes with the castor effect, the others are still waiting for full development. Oilless bearings are suggested for parts of the gear that do not have a great amount of motion, and they have been tried extensively and are in some use.

Worm-and-Wheel Adjustment

With the worm-and-full-wheel gear there are two adjustments possible; one method is to turn the eccentric bushing at the center of the wheel and the other is to turn the wheel, bringing a new surface into engagement with the worm. As the whole wheel is not used at once, this gives all of the effect of a new wheel. The latter method is generally preferred by manufacturers and it is recommended that the adjustments be made generally in this manner.

With the worm-and-split-nut type of gear, adjustments are simple. The Jacox gear is an example, as the gear is adjustable for wear by one single adjustment, and this is quite accessible. The adjustment is accomplished by loosening the bolt in the housing cap which locks the adjusting nut. The adjusting nut is then screwed down and locked. The adjusting nut bears directly on the thrust bearing which rests on the shoulder of the screw. When the adjusting nut is turned down, the screw is forced down against the threads of the half nut, the half nuts are in turn forced down against the rollers of the yoke shaft, taking up the wear on the threads of the half nuts and on the rollers.

Mechanical Layout Problems

Mathematically the layout of the steering gear presents a problem with ramifications that are not approached in any other part of automobile design. The mere statement of the problem of getting two pairs of wheels, one stationary and the other movable axially, to roll around a given point without sliding is sufficient to indicate the impossibility of ever securing in practice mathematically correct steering. As a matter of fact, the variation from the perfect is not so great as would at first be supposed, and although it cannot be said that the past year's improvement has brought us any closer to it, still steering, taken as a whole, is not unsatisfactory.

Practically every automobile has the same type of steering so far as the system is concerned, the Ackerman. With Ackerman steering it is assumed that the tie rod arms projecting from the swivels should meet at the middle point of the rear axle if their center lines are produced. Now, when on a curve the two rear wheels roll on two circular paths of different radii, and each wheel makes a tangent to its rolling circle, as viewed in plan. The front wheels meanwhile roll on separate circles of their own and the ideal steering gear is such that each of the four wheels should make a tangent to the circle along which it is rolling.

This true rolling can occur at three positions only: One is the straight position when the car is turning neither to right nor left, and the other where two wheels are at some definite angle of lock to right and left respectively. The effect for all other positions is that three wheels may roll perfectly, but the fourth must do some skidding, or perhaps two wheels roll and the other two divide the skid.

When Skidding Occurs

It is obvious that the rear wheels must roll on concentric circles and that the rear axle center line produced must be the diametrical line of the circles. Thus neither one of the rear wheels can skid unless both do. Suppose the point about which the car is turning is O, then the center lines of both the front wheel spindles must meet at O if every wheel rolls perfectly, without skidding. It is obvious that by turning the steering wheel we can bring one of the front wheels into such a position that the spindle center line passes through O, but the second front wheel will then take up a position depending upon the length of the tie rod and the layout of the tie rod arms.

Necessarily a Compromise

The practical geometry of steering gears involves a considerable amount of thought regarding the angles of the links and the intersections of link lines produced, and, as stated, the result from a commercial standpoint must always be a compromise. The difference between really good steering, however, and that of the average car is so marked that any improvements which would tend to make practice line up to a closer degree with theory would be welcomed, not only by the car owner but also by the industry.

Gearsets Simplified and Refined

Main Elements of Design Practically Unchanged—Adaptation to Unit Power Plants and Center Control a Continued Development—Provision for Tire Pump and Speedometer Drive

By Donald McLeod Lay

GEARSETS and clutches are so nearly inseparable in these days of unit power plants that the latter may well be included in a summary of the tendencies and refinements which mark the progress of gearset design during the past year. As was the case in 1915, there have been no radical alterations in construction or changes in basic principles. The leading tendency manifested during this year may be characterized as a general trend toward simplification, not only in manufacture and in the number and type of gearsets produced by each factory, but also in the reduction of the number of parts and slight alterations in the design of others which succeed in doing away with more or less complication and its inevitable accompanying weight.

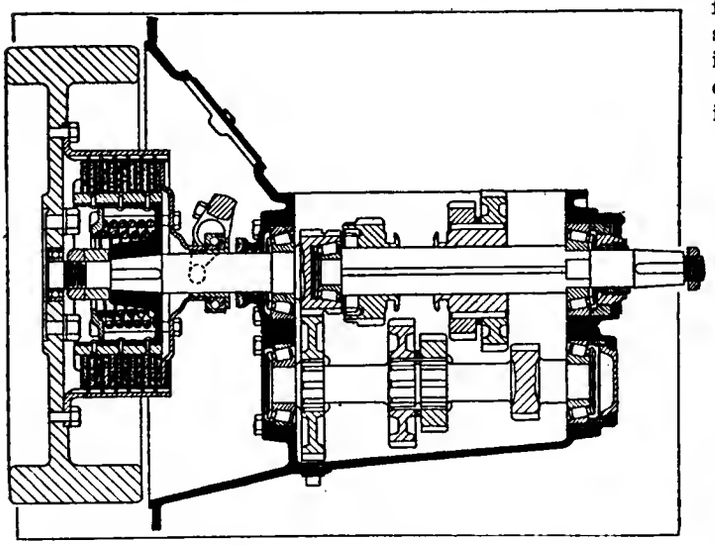
Unit Power Plant Gains

The continued trend toward unit power plant construction which became evident to such an extent last year has been emphasized by the increased production of multiple-cylinder engines, most of which are of the unit design. Naturally, gearsets have been improved in their adaptability to this type of mounting, not only by the methods of attachment, but also by the shape and construction of the bell housing, mounting of the clutch and improved bearing arrangement, although there has been comparatively little change in the latter respect. It was pointed out last year that the general adoption of the unit power plant had not led to the use of plain bearings throughout the gearset with pressure lubrication from the same oil pump that supplies the engine, and the comment was made that this seemed remarkable in that such a development could logically be expected. This year, however, there has been no trend toward such a construction. The manufacturers have not been idle on this question, but those who have been conducting experiments in the effort to arrive at a practical solution of the problem report almost unanimously that difficulty of securing satisfactory lubrication has to date rendered this impossible. Thus, ball or roller bearings continue to hold in practically all constructions for both portions of the mainshaft and, in fact, while some may consider them slightly more noisy than the plain bearing which they consider as the ideal, all the makers recognize their efficiency as a very close approximation of the latter.

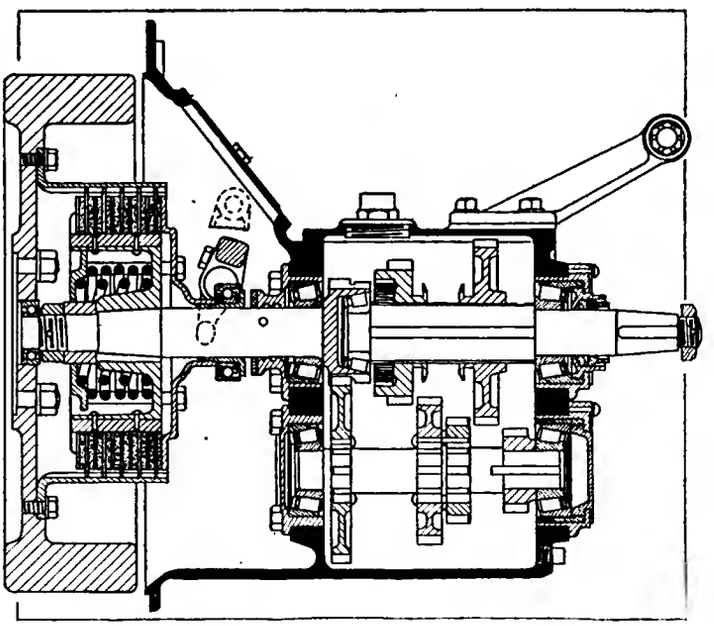
Iron has been increasing in favor as material for gearset housings, largely due to two considerations. One of these is the present high price of aluminum, and the other is the fact that iron seems to make a quieter casing than aluminum, in spite of being a more resonant metal. The greater rigidity of iron is one explanation put forth for this apparent contradiction.

Center Control Still Growing

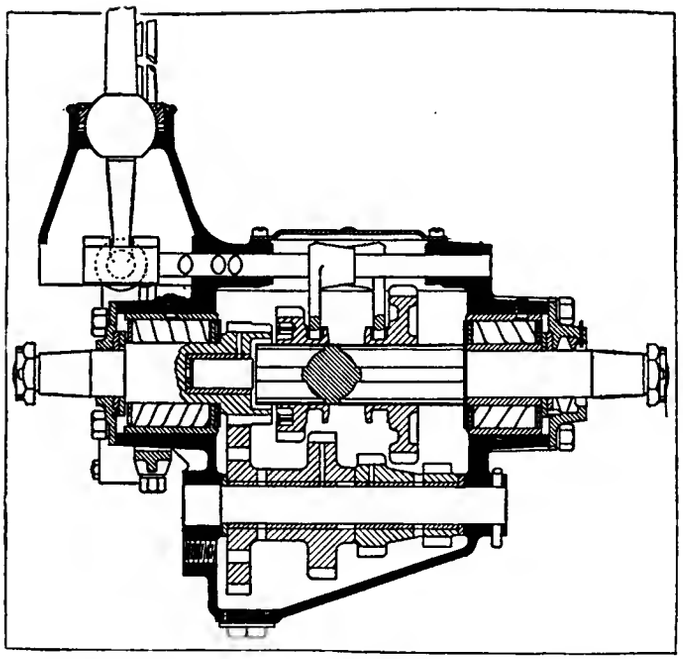
Center control, like the unit power plant construction, has been gaining so steadily that it is now almost standard, especially in the small, low-priced cars. The gearset manufacturers have welcomed this trend from the beginning, as it simplifies their work not only in designing and manufacturing their product, but also in the matter of expense, as it eliminates an enormous amount of material for rods, shafting, etc., which was formerly used up in adapting the stand-



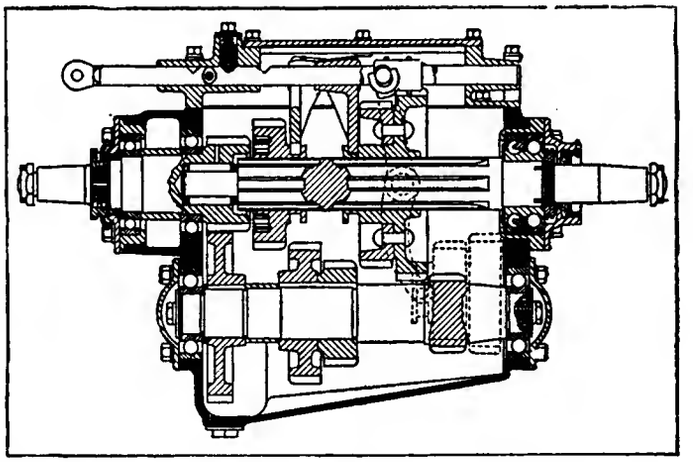
Above—Brown-Lipe four-speed gearset for unit power plant mounting. The company finds the demand for four-speed types for commercial car work to be gradually increasing, this applying especially to 3½ and 5-ton trucks. Where used for this purpose the gearset is universally furnished with direct drive on fourth speed



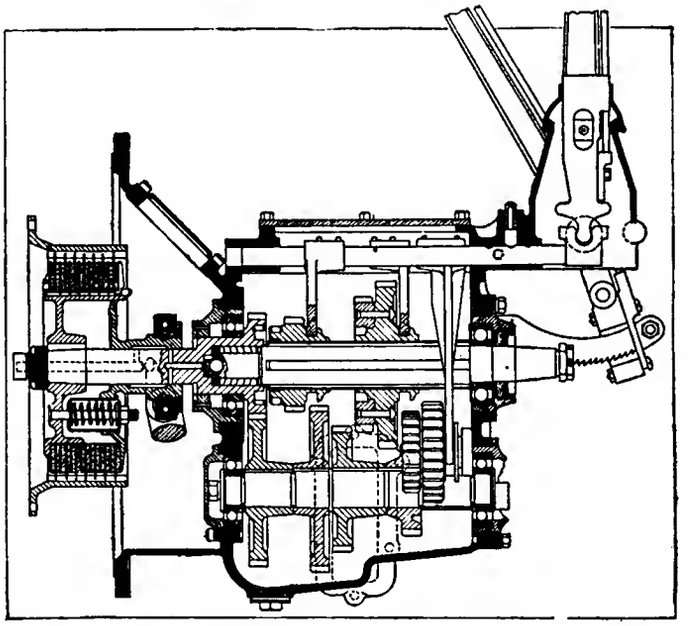
Right—Three-speed Brown-Lipe gearset, which is very like the four-speed design, having the same taper roller bearings. The sliding shaft is of square section. The use of a double clutch spring is characteristic of Brown-Lipe practice



Warner three-speed and reverse gearset with gears at ¾ in. space and 6-8 pitch. The main shaft is round in section with four integral keys and is carried at one end in a Hyatt roller and the spigot at the opposite end in a plain bushing with oiling facilities adequate to all conditions



Warner four-speed and reverse gearset with both shafts carried on annular bearings and with a spigot end of the main shaft carried on a roller bearing within the stub shaft. The main shaft has six splines on which the sliding gears move. The gears are nickel steel 1¼ in. face and 5-7 pitch. The speed reductions are: 4.99-1; 3.16-1; 1.79-1; 1-1, and reverse 5.78.1. Single race annular bearings are used for the countershaft. There is a double race bearing at one end of the main shaft and two single race bearings well spaced to support the short shaft at the opposite end



Warner four-speed and reverse gearset with nickel steel gears ¾ in. face and 6-8 pitch. Single race annular ball bearings carry both shafts. The spigot bearing on the end of the main shaft is supported in a Hyatt roller within the short shaft, and at this point end thrust is taken by a single ball. The gear ratios are: 2.73-1; 1.53-1; 1-1 and 1-1.251. The clutch assembly is a multiple disk type

ard gearset to the special requirements of various chassis.

While some of the gearset concerns still make it a practice to bring out special designs of housing cover plate and control lever mounting to suit the requirements of their customers, the majority build a standard design for center control chassis and adapt it to varying constructions by bending the levers either hot or cold. Regular models are usually available for right and left side lever mounting.

During the past year the makers have been able to still further simplify and refine their control mountings as compared with the 1915 designs, and many of them have arrived at such a point of development that it is necessary to cut only one hole in the floorboard for the passage of the levers, which are mounted, almost as a rule, upon the tops of the gearboxes. The connections between the control lever and the gears have been minimized and shifting is now very simple, requiring almost the least possible number of motions through the smallest distance, besides calling for the expenditure of considerably less energy than was the case in previous years. Last year much progress was made in this direction with the gearsets, but clutches lagged somewhat, a situation which has largely been remedied during the past 12 months by the increased popularity and more general adoption of the dry-disk type, which has now secured a commanding lead over its old rival, the cone. One of the greatest advantages of the dry-disk type is that the inner member can be made extremely light, so that shifting becomes correspondingly easy. Furthermore, for such a light-weight clutch no clutch stop or brake is necessary and the action is equally easy whether the operator is changing from an upper gear to a lower or the reverse. A good clutch brake makes the upward shifting with a cone clutch as easy as with the disk type, provided the weight is kept fairly low, although the extremely light construction which characterizes the dry disk is out of the question with a cone construction.

Clutches Are Better Inclosed

Clutches naturally share in the advantages conferred upon the gearsets by improved methods of inclosure. As an example of the progress made toward the ideal of a small, light, compact clutch unit of maximum efficiency as a transmitter of power, the Borg & Beck three-plate, dry-disk type may be mentioned. This unit also is fitted with a simple method of adjustment, requiring only the shifting of two bolts arranged diametrically opposite one another and working in slots in the housing. One mount produced by this firm combines a flywheel and clutch chamber in one casting. The other model is characterized as a self-contained design, the clutch being furnished in a separate inclosed casing which has a mounting-flange that bolts against the flywheel web.

One of the special features of this clutch is the ease of cleaning. Kerosene may be squirted into it, washing out the gummy substance which is caused by the sediment which mixes with the oil. The clutch may slip for a time after the kerosene has been applied, but the slippage soon disappears.

The four-speed gearset is now used in only a few of the

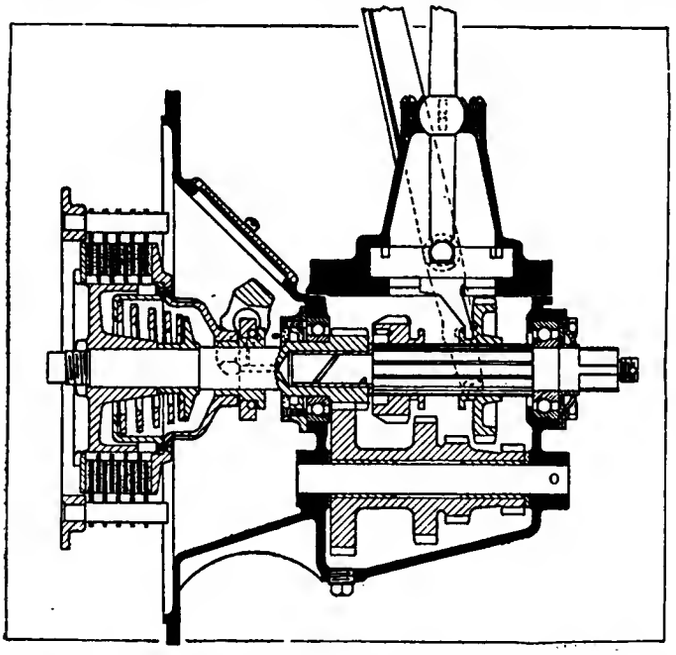
high-priced cars, the development of multiple-cylinder engines rendering it unnecessary except as an additional refinement or touch of luxury. Three speeds may now be considered practically standard for gasoline passenger car construction. For truck use, however, the four-speed gearset is becoming increasingly popular, Brown-Lipe pointing out that this type is in growing demand, especially for 3½ and 5-ton trucks. The Cross Gear & Engine Co. finds an increasing demand for 1-to-1 ratio on high where four-speed constructions are used for commercial vehicle chassis.

Gear ratios have been determined by the manufacturers largely through observation during years of experience and experimentation. Brown-Lipe is an example of this, others being Mechanics Machine Co., American Die & Tool Co. and Grant-Lees Gear Co. The Warner Gear Co. states that too much variation in the conditions of the range covered by standard models prevents the provision of ideal gear reductions. This company endeavors to arrange the gears approximately in geometrical progression, varied of course, according to circumstances.

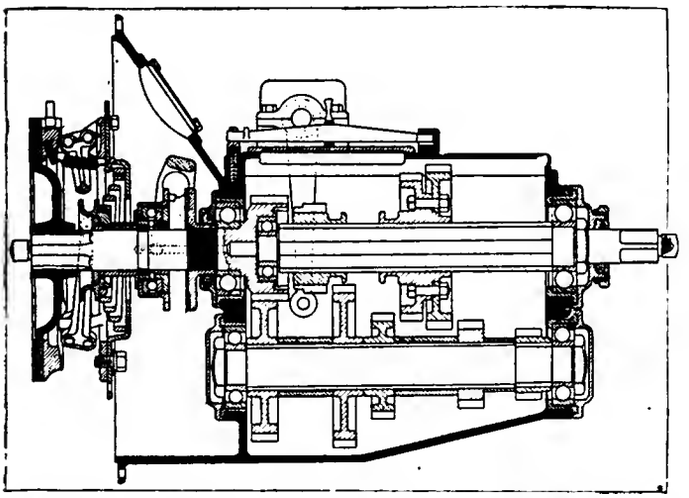
There seems to be some tendency toward the wider use of a stationary countershaft. Either plain bushing or straight roller bearings within the countershaft gears are used as a rule. With the Warner Gear Co. construction the countershaft gears are cut in pairs mounted on plain bronze bearings and the two pairs are driven by clutch jaws between them. Integrally forged countershaft gears are used by a number of makers, the Mechanics Machine Co. using this construction on the four counter gears used in its smaller gearsets. Brown-Lipe makes the three smaller gears integral in its smallest model, mounting them on a plain-bearing countershaft. The American Die & Tool Co. uses a built-up countershaft with sliding gears bolted together in one model while in another it uses the solid forging with extensions at the ends which support it in the case and which run on ball bearings.

Interlocking Devices Universal

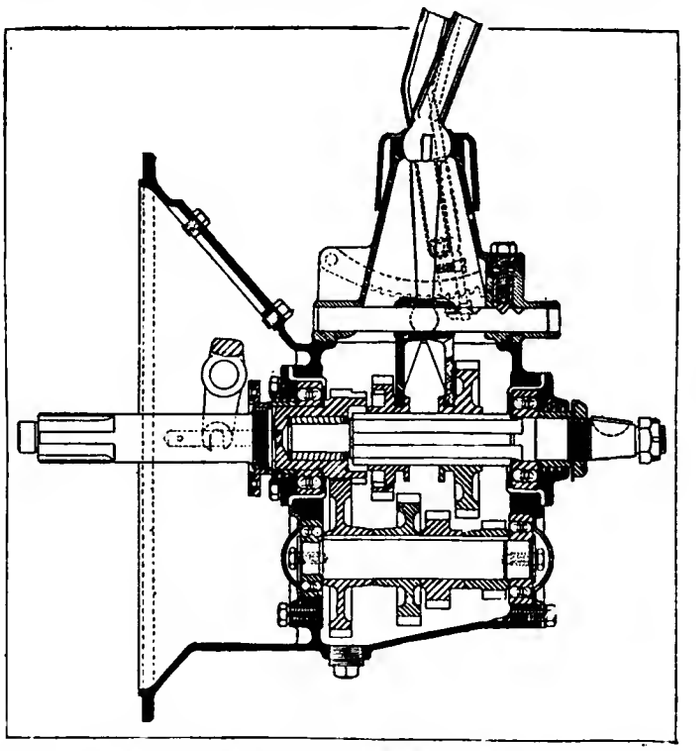
Interlocking devices to prevent the meshing of more than one gear at a time are almost universal. The Warner Gear Co. employs vertical plungers to give the gears their proper meshing position and plungers with a cross movement prevent more than the shift rail being moved at any given time. The Mechanics Machine Co. uses a small steel plate cast into the gearbox cover, this plate being notched for the gear change lever so that it is impossible to engage two speeds at once. When one set of gears is in mesh the lever is at one side of this plate and it is necessary to bring this through the notch and over to the other side of the plate before another set of gears can be brought into mesh. Three types of interlocks are used by the American Die & Tool Co., the ball or rod with spherical end between shift rods and the tilting bar mounted on a bracket underneath the sliding forks which



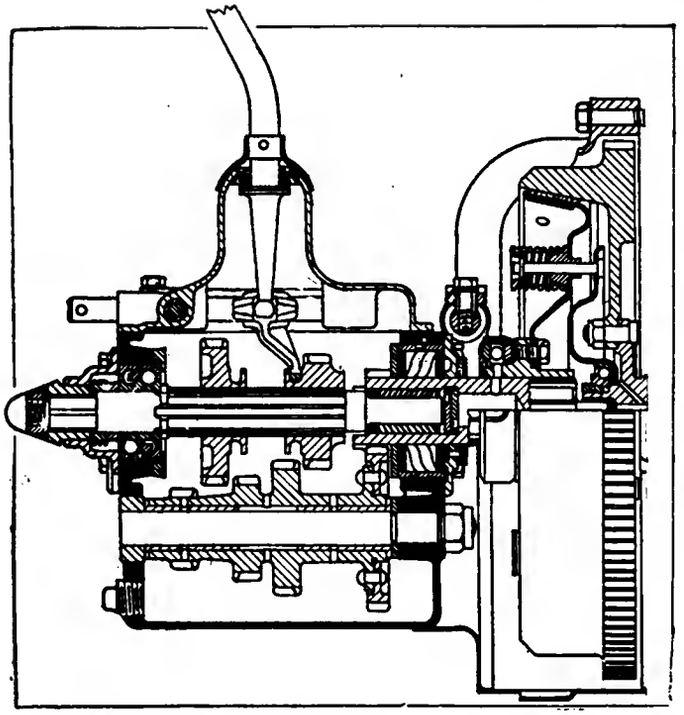
Mechanics Machine Co. three-speed and reverse gearset in which the main shaft is carried on annular bearings and the countershaft on plain bearings. The spigot end of the main shaft is carried in a plain bearing within the stub shaft. The main shaft is splined for the sliding gears. The ratios are: 1.5-1 on intermediate, and 3.4 to 1 on low. The clutch assembly is a multiple disk type with an inclosed conical engagement spring. There is a ball thrust collar for clutch disengagement



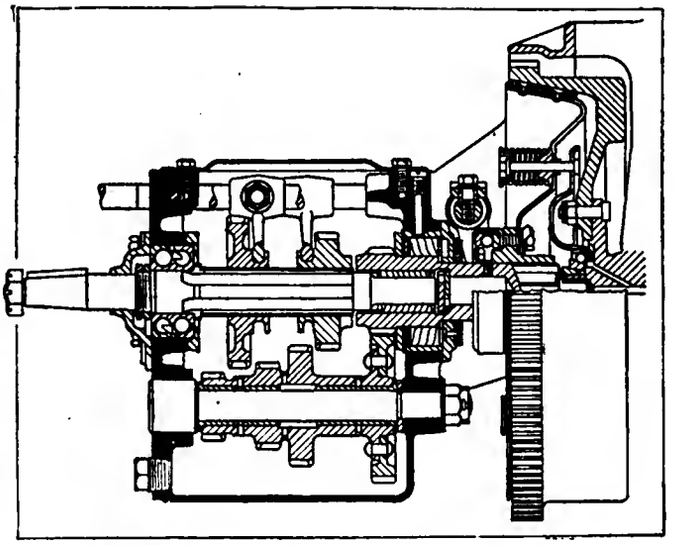
American Die & Tool Co. four-speed and reverse gearset with ball bearings for carrying main and countershaft as well as the spigot end of the main shaft. The main shaft is a circular cross section with 4-in. integral keys. The clutch assembly is a three-disk type with conical engagement spring and ball thrust collar for clutch actuation



Grant-Lees three-speed type of gearset. Gears are renewable separately and only one control housing is made. This is designed so that it is necessary to cut only one hole through the floorboard, the levers being bent cold to accommodate different bodies. Grant-Lees has changed from the gland stuffing box type to the spiral lead end plate



Northway three-speed design with reductions in the gearbox of 3.09 to 1 on low gear, 1.73 to 1 on second and direct drive on third. The reverse ratio in the box is 3.98 to 1. These ratios are, of course, multiplied by the rear axle for final reduction. The clutch used in this installation is a cone type with a ball bearing release

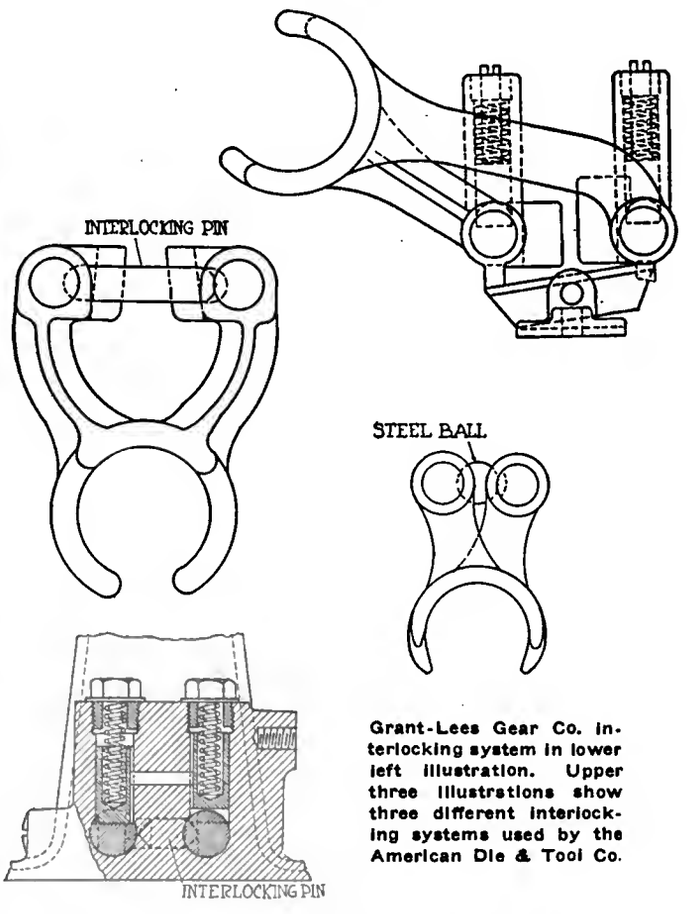


Northway gearset with main shaft on double annular ball bearings at one end and the short shaft at the opposite end supported on spiral roller with a similar bearing supporting the spigot. The clutch assembly is a cone type with small engagement springs regularly spaced. The countershaft is carried on plain bearings

is pressed into a notch in either fork when moved from neutral. Grant-Lees uses an interlocking pin fitting between the two pull rods, the grooves in which are deep enough to accommodate this pin in neutral position to allow either pull rod to move forward or back but the guide hole in the control housing prevents the other pull rod from moving while one rod is out of the neutral position, either forward or back. The pin is hardened and very little wear is said to take place in continual use. In a new constant mesh four-speed design which Cross Gear is bringing out for truck and bus work, there is a special locking device, which is said to be positive in its action. Two of the shifting fork shafts are held in neutral position by locking pins, which pass entirely through them, while the third shaft is shifted into the required position.

Gear Face and Pitch

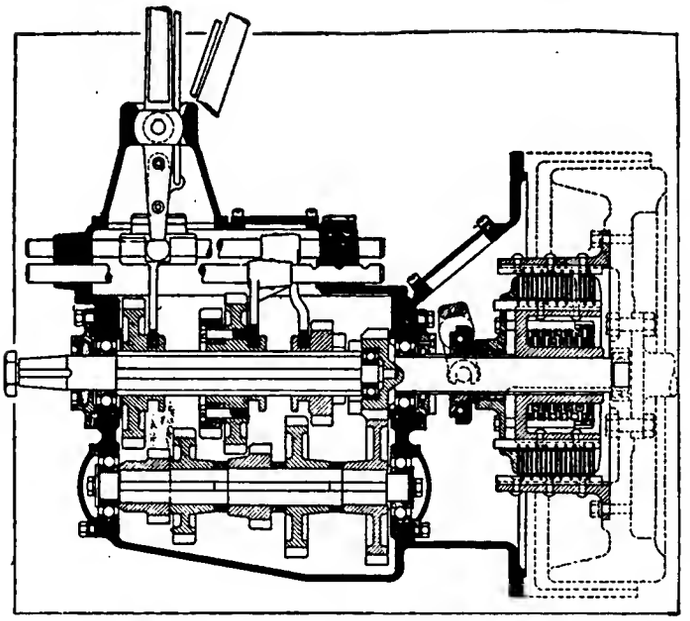
There seems to be a considerable difference among the gearset makers as to the quietest and most efficient types of gears in respect to pitch and width of face. Warner considers the finer pitch gears and those of narrower face as less likely to create noise, making the point that distortion is unavoidable during the hardening process as applied to wider gear faces. Brown-Lipe agrees in this contention but Grant-Lees considers stub toothed, coarse pitch gears more quiet in operation than gears of finer pitch of a given face. Thus for a ¾-in. face gear it finds a 6-8 pitch 20-deg. pressure angle has an advantage over 7-9 pitch 20-deg. pressure angle on account of less distortion in hardening although a coarser tooth 4-5 pitch would not be advisable for the same tooth width on account of the pitch diameters not allowing enough teeth to be in contact. The Mechanics Machine Co. does not believe that pitch and width of gear face have any great effect upon quietness but considers it inadvisable to make gears with less than thirteen teeth, counting on the care and manufacture to insure quiet operation. The American Die & Tool Co. reports that on various tests covering both 8-10 with 9/16-in. face gears and 6 and 6-8 with 1 in. and ⅞ in. face respectively, it has had both quiet and noisy operation.



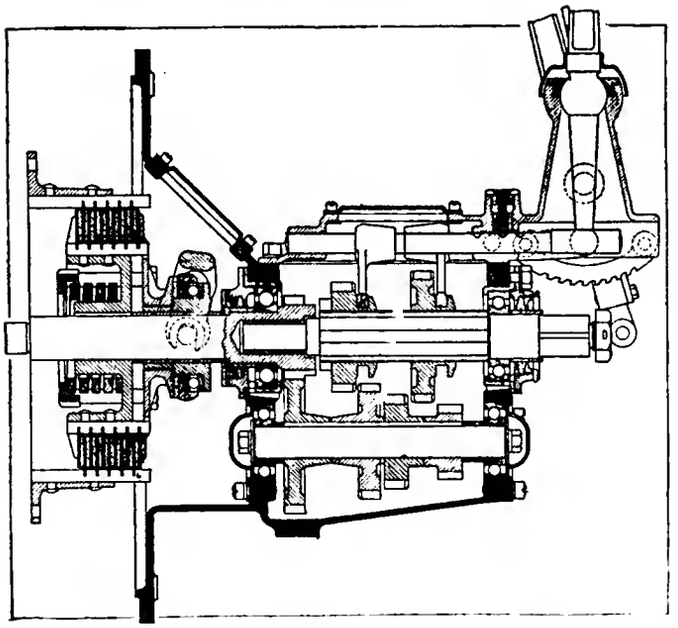
Grant-Lees Gear Co. interlocking system in lower left illustration. Upper three illustrations show three different interlocking systems used by the American Die & Tool Co.

It points out that the design in both cases has a bearing on the question, and when either of the sets is mounted in the cast iron housing even with ball bearings, noise has been a negligible factor. For standard practice this company considers the 6-8 pitch with the ⅞-in. face as most serviceable. Northway considers pitch, form of tooth and diameter important factors in securing a quiet gearset, the width of the gear face determining the duration of this quietness.

On the whole there is little tendency to make any change of the type or arrangement of bearings. Brown-Lipe uses

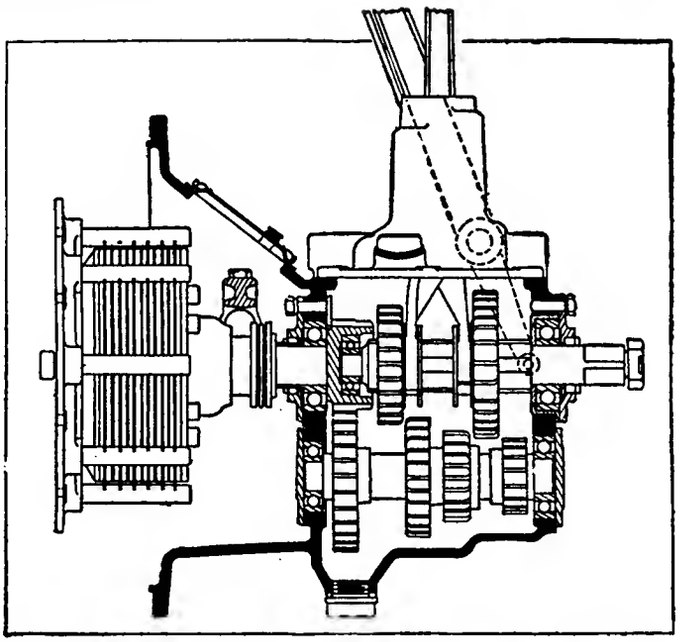


Muncie Gear Works vertical design gearset employing annular ball bearings throughout, including the spigot end of the main shaft. Gears are 5 pitch and ⅞ in. face. There is a ball thrust collar for clutch action and the clutch assembly of multiple disk type employs a double spring. The usual packings at each end of the main shaft are used to avoid leaking



Muncie Gear Works three-speed and reverse gearset using annular bearings throughout except at the spigot end of the main shaft, where a plain bearing is used. Gears are of 6-8 pitch. The main shaft is round section with four integral keys. Gears on the countershaft are held by keyway. The clutch assembly is inclosed within the usual flange construction

taper roller bearings throughout wherever possible in its standard constructions. Warner considers the use of either plain bushings or straight roller bearings within the countershaft gears and in connection with a stationary countershaft to be growing in favor. Northway finds a trend toward the adoption of spiral roller bearings type for the forward end of the main shaft and a double-row ball bearing in the rear. The American Die and Tool Co. has been using ball bearings throughout, its experiments with plain bearings on countershaft and spigot proving unsuccessful because of lubrication difficulties. For eliminating noise and reducing cost of manufacture this company recommends a combination of ball



Fuller & Sons Mfg. Co. gearset employing annular bearings throughout, including the ends of the spigot shaft. This unit assembly is made with flanges to fit all makes of motors

and roller bearings, or roller bearings throughout with a small roller bearing for the spigot.

Tire Pump and Speedometer Mounting

Provision for demounting of tire pump and speedometer is becoming more general with the gearset makers. With the Grant-Lees design the tire pump base can be bolted to the gearset housing and is driven off the reverse idler gear. Northway makes provision on the left side of the gearbox for the application of the tire pump, the drive being secured in the same manner as on the Grant-Lees. Similar constructions or their equivalents are to be found on practically all of the standard gearsets now being manufactured. Speedometer drives from the gearset are now largely inclosed, an example of this being the Northway, in which the speedometer drive is contained in the rear bearing retainer.

Ease of disassembly and assembly has been one of the important aims of the gearset designer for some time and during the past year a number of concerns have made slight improvements in this particular, one of the most salient of which is the practice of having all the parts assembled outside of the case so that they go in as a unit and may be removed in the same way. With the now almost universal central location for the gearshift and emergency brake levers, control members are neatly and conveniently mounted on the cover plate of the gearset housing, which still further simplifies the task of disassembly. Another factor in this situation and one which simplifies to a great extent the matter of replacements, not to mention its accompanying reduction of expense in case of repair, etc., is the increasing adoption of separate units in the gearset which can be easily removed. Thus in case of stripping the teeth of one gear or some similar mishap, the car owner is not obliged to replace a large part of his gearset at considerable expense, as was formerly the case with some constructions.

Differ on Lubrication

In the matter of lubrication there appears to be a wide diversity of opinion among the gearset manufacturers, both as to class of lubricant which is most desirable and the frequency with which it should be renewed. Brown-Lipe recommends extra heavy fluid oil filling the gearbox only to the top of the countershaft, stating that this will give sufficient lubrication for any emergency and will avoid leakage around the various joints of the gearbox, a condition which the company

states is almost invariably caused by high pressure due to heat expansion of the lubricant. This concern fits all its gearboxes with breather tubes to take care of this phase of the situation. Warner prefers transmission oils, stating that greases do not flow into the smaller spaces properly. This company has found that it secures best results with the oil depth about ½ in. from the top of the countershaft. Northway favors a fairly heavy grade of engine lubricating oil at a level about the center of the lower shaft. Manufacturers who do not agree with any of these views usually do not concern themselves with the matter, leaving the car builder to recommend whatever lubrication he considers best adapted for the gearset in its capacity as a unit of the chassis he is producing. On most of the modern gearsets oil level plugs are provided to determine the correct depth of the lubricant. Grant-Lees has changed from the gland stuffing box type to the spiral lead end plate, having found the latter superior in that it keeps the oil in the gearbox and requires no attention. The Cotta Transmission Co. recommends a medium light grease of a depth to cover both shafts of the gearset.

The majority of gearset makers agree that the lubricant, irrespective of the sort used, should be renewed every 5000 miles. Some, one of whom is Grant-Lees, consider that the lubricant should be examined once every 2 months with average driving, the frequency of renewing the lubricant depending upon how much the car is driven on its lower gears. Others, of whom Warner is an example, have secured best results when the lubricant is changed every 1200 to 1500 miles of car travel. When this lubricant is changed it is generally approved practice to drain out the lubricant thoroughly and then wash out the interior of the gearbox with kerosene oil.

Electric Gearshift Makes Progress

The use of electrically operated gearsets has made some progress during the past year, equipment of this type having been adopted as standard by a number of automobile companies, while several others have been conducting experiments with this method of control with a view to announcing it as standard or optional equipment about the first of the year.

For the future, little can be predicted as to probable alterations in the gearset and clutch design. It would seem most likely that present constructions will continue for some time without any appreciable change in their basic principles, the only alterations being in the way of refinements and simplification of parts or assembly and hence naturally of a minor nature. This state of affairs bids fair to endure until some radical developments in automobile construction call for correspondingly radical modification of gearsets and clutches as means for the transmission of power from engine to wheels.

Clutch Design Greatly Improved

Simplification Due to Elimination of Adjustments, Weight, Etc.—Disk Type Increasingly Popular—Fewer Plates Permit Increase of Pedal Leverage

By J. Edward Schipper

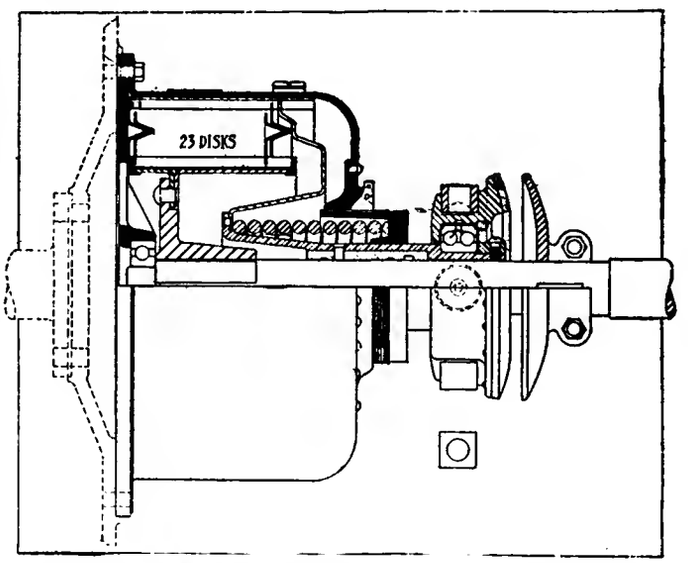
THE question of clutch design as shown by those clutch makers who supply to the automobile trade in general shows improvements from year to year. Elimination of adjustments and weight is the summation of clutch tendency in design as denoted by the changes during the past year. Broadly there is a tendency among the automobile manufacturers toward the employment of the disk rather than the cone. In the disk design itself there is a leaning toward the use of fewer disks.

If the figures on clutch weight per horsepower transmitted could be plotted in a curve they would show that this has been dropping, year by year. The aluminum cone for the cone type was one of the earlier indications of this and although the tendency is a little toward the pressed metal cone, the light-weight characteristic remains.

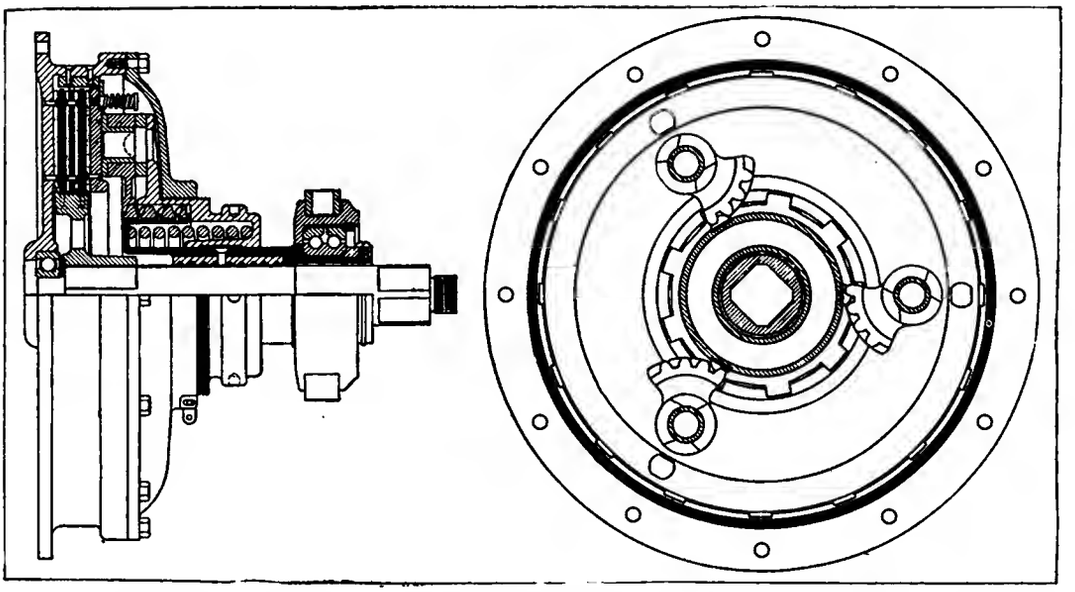
Lubrication Generally Automatic

Mechanically the clutch is a much simpler proposition now than heretofore. The adjustment points are fewer and the lubrication is generally automatic so that a clutch may go 50,000 miles without attention. Clutch wear is taken up automatically inside the assembly and on some of the prominent makes the only adjustment provided is that to prevent the pedal from striking the floorboard.

Another line of improvement is in the pedal linkage which permits clutch disengaged with much less effort. The leverage is increased in some instances directly on the pedal, but in general the reason for improvement is that the fewer plates on the disk clutch require less motion on the part of



Hele-Shaw standard No. 6 clutch with twenty-three disks for 40 hp. at 1000 r.p.m. This clutch is very widely used, being designed for flexibility and ease of operation in conjunction with positive engagement, insuring against loss of power in this unit of the transmission system. The case is of pressed steel, the core of steel and the presser is steel and malleable iron. Phosphor bronze is used for bushing and for the outer disk, the inner disk being sheet steel. The brake is of malleable iron with an asbestos lining

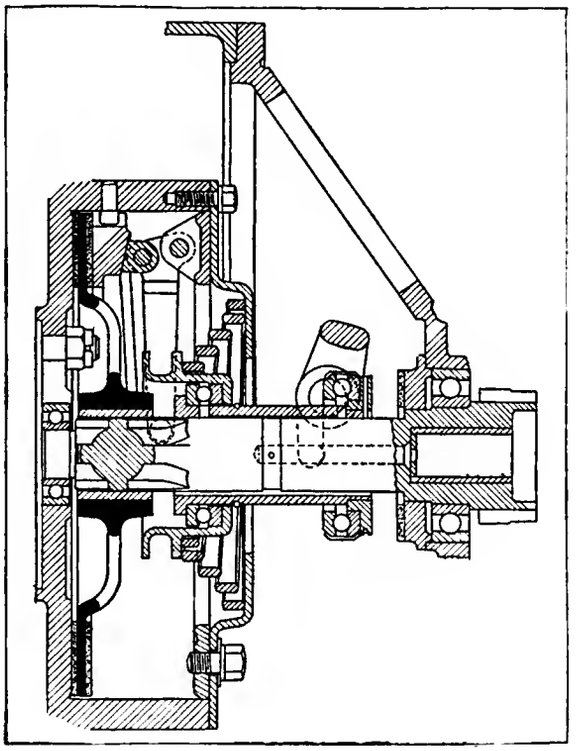


Hilliard Clutch & Machinery Co. disk clutch assembly with double annular bearing and inclosed spring. The forward end of the clutch shaft is supported within the flywheel disk by an annular ball bearing

the clutch linkage and hence it is possible to make this smaller travel up in increased pedal leverage.

The increased engine speed and greater reduction at the rear axle have influenced clutch design. It is naturally much more difficult to transmit in a given weight clutch, 40 hp. at 1200 r.p.m. than it is at 2500 r.p.m., the question being one of torque. With the greater rotative speeds of the clutch members, the torque transmitted at a given speed falls off and hence this will aid somewhat in clutch design, although factors of safety have increased rather than decreased, due to the use of better materials.

Lightness in clutch rotating parts is necessary if clashing of the gears is to be prevented. The clutch brake is an aid but independent of the clutch brake, makers have reduced the inertia and spinning tendency of the clutch members by a decrease in weight.



Borg & Beck clutch assembly showing three-plate clutch type with conical engagement spring and ball thrusts. The use of ball bearings is conspicuous in this clutch assembly

Ease of engagement is looked after in different ways in disk clutches, but with the cone, it is common practice to use about six bowshaped springs beneath the surface of the leather. On the clutch made by the Warner Gear company these are adjustable by means of screws on the inner side of the cone. There is no other adjustment.

With a ball-type thrust of two hardened and ground races of the best quality of material, and with the balls carried in a retainer that not only retains the balls but also a sufficient quantity of lubricant to take care of them readily, there is no need for an adjustment, as such an installation will serve indefinitely unless dirt or foreign matter enters. In that case, even an adjustment would not serve, as a replacement would have to be made anyway.

Cone clutch angles are about the same as formerly, running about 12 or 13 deg. Nothing has supplanted good quality leather as a facing for the cone. With the disk clutch the use of woven asbestos fabric quite similar to that used in brake installations is considered best by the majority. The leather is always riveted on with the rivets countersunk beneath the surface of the leather to secure against metal to metal engagement.

Engaged Area Decreasing

While with the disk clutch the total area of surface engaged is growing smaller, due to the falling off of the disk-in-oil type and the gaining of the dry-plate type, the trend is going the other way on the cone clutches. With the cone the surface area is less than the area given by the disk type, the difference being that it is more effective because applied at a greater distance from the axial center of rotation. The amount of clutch area in consideration for the work to be done, however, compares very favorably with the similar problem that comes up in brake design.

The Hilliard Clutch & Machinery Co. makes a feature of the point that no clutch brake is used. The spinning of the rotating members is prevented by simply having a combination of a quick-acting release which does not permit of a drag while releasing and further by having the parts so light, that the rotation does not continue long.

On the clutch made by Fuller & Sons Mfg. Co. the development has been typical in that all adjustments are eliminated. The clutch requires no attention except that the throwout bearing must be oiled occasionally. The only adjustment on the clutch is the adjustment which prevents the pedal from striking the floorboard. The clutch brake has been eliminated on all the Fuller clutches except the oil type, and in its place a quick releasing scheme with light parts has been substituted.

German Truck Design Is Improved

Commercial Vehicles Are Stronger But Lighter, Due to War Developments—Electric Types Gain—New Batteries Features—Gasoline the Fuel of the Army

By E. A. Langdon

WHILE passenger car design has made comparatively little progress in Germany since the outbreak of the war, motor truck construction has been greatly improved and the scope of both gasoline and electric commercial vehicles has been considerably widened. Strength and light weight are the features which most impress one in inspecting these machines, both being due to the need for economy in both construction and operation and to the use of lighter materials such as steel-reinforced wood frames, hydraulic spring systems instead of steel springs and other similar innovations.

Many Electric Trucks Used

The number of electric trucks has been greatly augmented, the ever-present necessity for economy being partially responsible for their popularity since current is unusually inexpensive, due to the abundance of coal Germany is mining from the northern section of France occupied by its armies. Highly efficient batteries of a new type have been developed because the demand for lead by the munitions factories rendered lead cells out of the question and the scarcity of nickel in Germany prevents the extensive use of the nickel-iron type. Gas batteries, in which slightly acid water is decomposed by the current on entering into oxygen and hydrogen, are said to be used in large numbers as reserve sources of current in stationary plants. When the oxygen and hydrogen is released from compression in the cathode and anode spaces through reduction valves they again combine as water, liberating current to the amount originally absorbed in the process of decomposition.

Gasoline Fuel for Army Cars

While gas obtained from distilled coal constitutes a large percentage of the automobile fuel used in the interior of the German Empire, gasoline is used almost entirely in military operations. The Germans consider their gasoline supply, at least sufficient for the needs of the army, to be secure for an indefinite period.

Material for spark plug terminals for a long time proved a stumbling block to German automobile engineers, as platinum is unobtainable. A new alloy has been developed, however, and is claimed to give very satisfactory results, although it has not yet had an opportunity to prove its serviceability in general use.

A Glass Cylinder Head

A number of interesting experiments have been made with new and unusual materials for automobile construction. One of the most novel of these was a cylinder head made of what looked like glass reinforced with wire fitted with valve seats of nickel steel. The material turned out to be an oxide of silica molded on a steel wire skeleton.

Wooden wheels are almost universally used on German cars and trucks, as the metal formerly employed in steel and wire types is now required for war purposes.

There are not many instances which illustrate so well the change industrial Germany has undergone during the last 2 years as the automobile situation in the interior of the empire. For life in general does not differ so very much from that in a normally operating country; the number of able-bodied men in the streets is considerably above what outsiders would imagine, and the people are fully as busy as in times of peace.

Few Passenger Cars on Streets

However, the moment one leaves a home, store or factory and enters the street, the abnormal condition of German existence becomes evident. For there is an absurdly small number of passenger automobiles, and what there are consist of old, invalid hacks, vehicles which nobody would think of using in normal times; and at the same time there is a very great number of commercial vehicles, but these, too, are of an entirely different type from what was seen before the outbreak of the war. Let us consider both of these phenomena.

All Good Cars Drafted

Passenger automobiles, like all things which are not a matter of absolute necessity, have become utterly negligible in German eyes—principally because they had to. The military operations at the front could easily employ all passenger automobiles German and Austrian factories could turn out, and more; and the absolute subjection of individual interests to those of the State has resulted in the drafting into service of every car which is at least 40 per cent efficient. These cars are used for the extremely rough work which frontal operations necessitate; and the result is that every part of the car suffers, though not in equal degree. Some of these machines, as has been described in a former article, are overhauled in field automobile hospitals, of which there are several at each front, and by this expedient the life of each car is increased, on an average, by 100 to 200 per cent. But finally the time arrives when the automobile can no longer be kept serviceable in this fashion, and when, in times of peace, it would be consigned without mercy to the junk heap. In war, however, the junk heap is merely the assorting department for the materials needed by the divers factories of the empire. Hence, these unserviceable automobiles are taken to one of the enormous plants handling this work of assorting waste materials—there are, in all, five such plants in Germany and Austria, employing in all close to 80,000 hands—where they are taken apart and segregated.

Some Parts Still Useful

Some parts of these disassembled cars with slight chemical treatment, can be used over in assembled cars which are continually being built for service at the front; other parts are put aside to be melted and entirely refashioned; whereas a minimum quantity of parts is always placed aside and used in the makeup of the passenger vehicles, police and ambulance wagons which are absolutely necessary in the interior. It stands to reason that these latter classes of vehicles are of a lamentable kind, most of the time entirely devoid of any

design, and built rather along lines of expediency than of harmony or looks.

Progress in Truck Design

As for trucks, the difference between the importance given to them and that allowed for pleasure cars is most striking. For commercial vehicles are not only, without exception, harmoniously and suitably designed, but every one gives a decided impression of strength, coupled with light weight. The latter point is the result of two conditions; first, the necessity of economizing all sources of energy; second, the use of lighter materials than were the vogue before the war. These lighter materials include spruce frames stayed by steel braces, as well as combinations with other principles of construction. It is surprising to an observer not accustomed to these types of vehicles what strength can be obtained by these means, if proper weight distribution is had by suitably designed braces and stays and if the suspension is ample. German engineers are not tempted to false economy in this latter regard.

Hydraulic Spring Systems

Hydraulic spring systems, often including a set of different-sized cylinders arranged in suitable series to take gradually varying shocks, have become very common during the last 2 years. Some of these hydraulic shock absorbers, which, by the way, have almost completely taken the place of steel springs on commercial vehicles, are not working on the principle of internal friction in the liquid or between the liquid and arduous passages, but are so constructed as to utilize the resistance of the container against an outward radial stress, whereby advantage is taken of the full tensile strength of the metal.

Electric Current Cheap

In regard to economy of energy—the word "fuel" being purposely avoided in this instance—the number of electric trucks has increased enormously ever since the outbreak of the war, and is still increasing, for all purposes where automobiles are used on good roads; and, generally speaking, all roads in the industrial sections of the empire *are* good. Electricity is one of those many commodities the productions of which is now under governmental supervision, but current is surprisingly cheap; the explanation being, very likely, that the Germans are deriving great quantities of coal from the mines in the territory held in France. In many cases, where numerous trucks travel along fixed lines of transportation, as between industrial centers of moderate distance—railroads being used chiefly for purely military passenger and freight transports—the vehicles are propelled by single or double electric motors in place on the rear axles, current being drawn from overhead conduits by means of a trolley. Where the importance of a route is not great enough to justify the construction of such a conduit-wire line—and it is remarkable with what degree of "scientific management" and statistical study the Germans determine whether a route is of greater or lesser national importance—the trucks are fitted with batteries. Very little can be learned just now about the construction of these batteries; but it is certain that almost all are other than lead cells, though it is not very likely that they are of the nickel-iron type, as nickel is quite rare in Germany at the present time.

New Type of Battery

Apropos of these conditions, it is interesting to note that a great many lead batteries which served as reserve sources of current in stationary plants have been supplanted by an entirely different type of battery, as lead is needed in the making of ammunition. These novel batteries are said, in a number of cases, to be of the "gas" type, wherein water with a slight acid percentage is decomposed by the current upon entering, is stored in cathode and anode spaces in form of oxygen and hydrogen, being compressed there by suitably designed mechanism, and when the battery is drawn upon, the gases leave from their chambers through reduction valves in proper proportions and again combine to water, freeing the amount of electricity first absorbed in the decomposition of the liquid.

Poles Faced with Platinum Powder

The poles of this battery are faced with "Platinmohr," black amorphous powder of platinum, which is at once a good conductor of electricity and a good catalyzing agent, being used to a great extent in the making of sulphuric acid, one of Germany's most important industries. The use of this material for batteries shows how the industries of the empire have become linked and, as it were, reshaped along lines of "interchangeability of parts." For the sulphuric-acid industry has been drawn upon for much of the platinum used there and is now using in place of the platinum method, a new kind of "contact process," as they call it. This is only another illustration of how, so to speak, not a molecule of matter is lost within the empire, no matter how great a quantity is shot and burned away at the battlefield.

Soldiers Understand Gasoline Cars

The fuel of the automobiles used at the front consists almost exclusively of gasoline, and the reason for this is that hundreds of thousands of soldiers are well familiar with the operation of gasoline engine and average automobile, as well as with the chief points of its construction; consequently the risk of the personal equation is smaller in the case of the average gasoline car than if any other type of automobile were used. Moreover, the Austrian oil fields in Poland, the wells of the occupied Russian territory and what oil and oil products were imported from Rumania heretofore are ample for the requirements of the field automobiles, and the more perfect organization developed during the war has quite overcome the need of using industrial alcohol, or benzol, for that matter. At the time of this writing, it is a few days since Rumania has entered the war, and according to the military experts who predicted with fair precision the development of the Serbian campaign under General Mackensen, the Germans expect to be in secure possession of the Rumanian oil fields within less than 8 weeks. This, of course, is problematical, but the fact is that even if the Rumanian supplies of gasoline to Germany be cut off, the other two sources mentioned would suffice for the needs of the army—and navy, for the latter now includes a number of vessels, both of the submarine and light cruiser type, using kerosene or gasoline for propulsion.

Material for Plug Terminals

One of the difficulties experienced by German engineers lies in the terminals of spark plugs. Platinum, used solid or as a coat, is absolutely unobtainable, as Russia, the chief former source of supply, is now of course shut off, save for small quantities which find their way into Germany via Sweden, or which were taken from craft captured in the Baltic. The Germans have been working on an "Ersatz" (substitute) for some time, and while it is not used generally as yet, engineers claim to obtain surprisingly fair results therefrom. They are, of course, very secretive about the matter; but from what the writer could learn, in a vague manner, here and there, it would seem that the substitute is an alloy of gold and a metal of the "radium" group, very likely uranium. Some experiments made with a selenium compound or rather alloy are also said to have been fairly satisfactory, except for the variable conductivity of this element which changes with the degree of light or radiation to which it is exposed; which fact caused fluctuations and disturbances throughout the ignition system of the car and

led to the abandoning of the idea as hardly practicable.

One peculiar innovation was witnessed by me some time ago when visiting the Western front. It was a cylinder head made of a material which resembled wire-reinforced glass, and, it was stated, was indeed of a similar composition, namely, an oxide of silica made in one of the chemical factories along the Main and reinforced by a skeleton of steel wire. The valve seats, made of nickel steel, are put in place when the head is being made and still at a very high temperature. These cylinder heads are, except for the connecting ways to the manifolds, without jackets; small wire points protrude from the inner wire skeleton and are cooled by the stream of air directed upward by the inclined fan.

Wood Wheels Employed

While the French and English armies use thousands of cars fitted with wire wheels, the Germans have practically departed from their use, principally because the empire's enormous lumber reserves permit of easy and cheap wholesale production of good wooden wheels, while every metal is comparatively scarce and economy is necessary. The metal which has been less subject to this rule than any other seems to be aluminum, for which new uses are found every day and which is produced very cheaply by the electric furnace process.

Thermite Welding Process Important

The aluminum powder, or Thermite, process of welding has also become of tremendous importance, and the equipment for this process forms part of every "Automobil-Hilfe-Automobil," that is, an automobile containing the repairshop equipment needed for quick repairs of automobiles and motor trucks. These traveling "Automobillazaretts" contain a simple but complete outfit for welding, a lathe, punch, a small drop forge, and a full set of minor tools, so that almost any repair can be made anywhere and at any time, the necessary power being furnished by the motor of the repair wagon. These traveling repairshops are, morever, fitted with wireless telephones and small generators geared to their motors, so that they can easily and immediately get into communication with the nearest motor department, "Kraftwagenfluegel," of the army to which they belong. The crew consists of three men, each one an expert driver and mechanic and electrician.

Young Drivers Well Trained

Every kind of labor which is connected with the driving and repairing of automobiles is plentifully supplied to the army. The boys between 17 and 19 years of age are trained in the school, with a view to preparing them for military service when they reach the full age, and from among those showing mechanical ability and inclination the future automobile operators are picked. These are trained by experts, not only in driving, but in repairing every conceivable kind of accident or damage, as well as first aid to the injured; so that in all likelihood Germany will possess, when the war is over, the greatest number of automobile expert drivers among all countries in Europe, which will make these young men vastly superior in earning power and serviceableness to what they would have been without this training.

Automobile Corps of High Class

Wherever possible, the automobile drivers are chosen from the soldiers knowing the language of the enemy the particular army is in contact with, so that if by accident they come into possession of military information they are in a position to report it with the greatest possible speed to their superiors. A stranger would be most surprised to note the high percentage of intellectual men, engineers as well as students of medicine, languages and theology, among the contingent of automobiles attached to the German army.

Spring Starters Widely Used

While the construction of automobiles, as heretofore mentioned, has become much simpler, no desirable accessories are spared to make operation efficient. For instance, spring types of self-starters are almost universally used where hand cranking is not retained; and speedometer, thermometer and barometer form part of every automobile equipment; the same thing may be said to hold true of the "trench periscope," a vertical tube with inclined mirrors at each end, and about 6 ft. long; a small heliograph, detailed map, compass, etc.

A Big Tractor Market

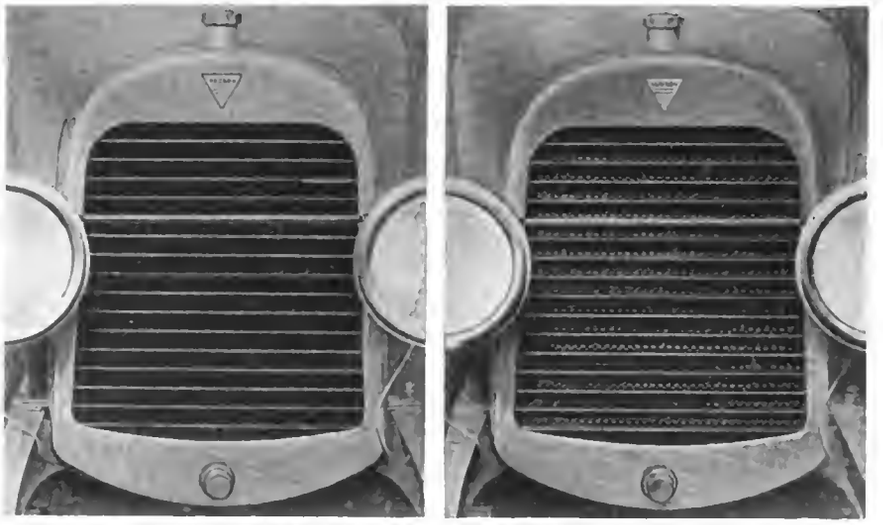
There is no doubt that when the war will be over, the automobile industry of Germany will emerge as something reborn and as far advanced over what it was before July 31, 1914, as it was at the latter date over 1900, both because of the improvements and developments made during the war, and on account of the practical annihilation of most draft animals, except what specimens were reserved for stock breeding. But there is little likelihood of the German peasant ever turning to horses again for his agricultural work. What he will look for, will be a moderately priced, highly reliable, simple, efficient automobile, which can be rapidly transformed into a tractor. For such a machine, Germany will offer a wonderful market, because, in spite of the empire's enormous industry, agriculture is still one of the two greatest, if not the greatest method of occupation of the German people.

Touring Land Yacht on a Moreland Chassis

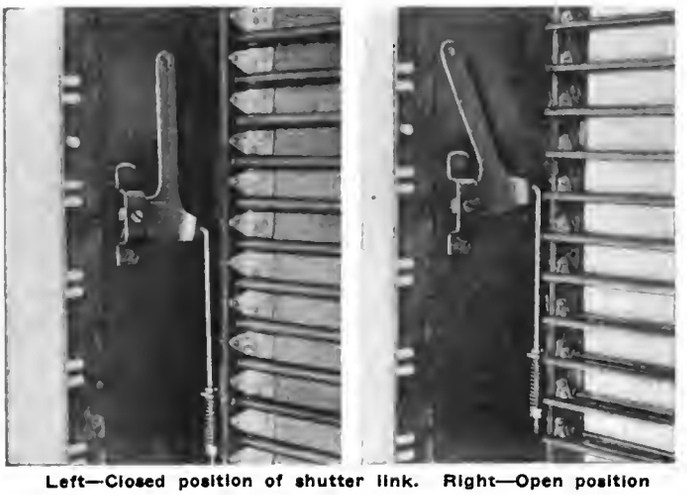
Touring palace built for Mrs. Ruth Kohler, Fresno, Cal., by Moreland Motor Truck Co., Los Angeles. Interior shows mahogany woodwork, carpeted floor, dome lights, curtains dividing compartments and davenports making full size beds

Hudson Fits Dash Radiator Control

Illustrating operation of the Hudson radiator shutter control by means of pull rod from the dash



At the left is a view of the Hudson radiator with the shutter closed and at the right with the shutter partly open



Left—Closed position of shutter link. Right—Open position

TO remove the necessity for using padded covers. etc., on the radiators of Hudson cars, the company has brought out a device which acts as a radiator shutter and which is being listed as special equipment. The new device is operated from the dash by the driver and permits him, by means of a simple plunger, to govern the amount of air that comes in contact with the radiating surface, and hence puts the temperature of the cooling fluid under his control.

The device acts very much as a shutter, with a series of vanes which open and close in accordance with the movement of the controlling device on the dash. In summer the mechanism need not be detached, as it does not cut down materially the area of the radiator when it is full open, so that in warm weather it is simply left untouched.

In order that the device will be complete, it is necessary for the driver to know the temperature of the cooling water accurately enough to determine whether the shutter is open or closed to the correct degree. This part of the equipment is provided by a Boyce Moto-Meter mounted in its customary position on the radiator cap.

The device is valuable in warming the car in very cold weather, as the air can be entirely shut off from the radiator until the water temperature reaches its efficient temperature, which in the case of the Hudson is stated to be 130 deg. Fahr. The shutter vanes can then be opened to the desired amount by simply operating the pull-rod on the dash.

From a maintenance standpoint the device is simple, as there is nothing to it except the shutter and the rod and bell-crank operating mechanism. There is no need for any adjustments, and none is provided. The installation is simple, and is made possible by using a longer radiator shell which not only houses the radiator, but also the shutter. It can be fitted to all Super-six Hudsons, the cost of installation being $25, with Moto-Meter complete. If the owner has already a Moto-Meter the shutter assembly costs only $15.

The accompanying illustrations give a very clear idea of the construction and operation of the device, the neat and simple pull rod mounting on the dash being both conveniently situated and by no means detrimental to the appearance of the instrument board. The front views of the radiator showing the shutter both closed and in a partly open position make it evident that appearance has not suffered in this direction; in fact, if any comment is to be made on the matter, it may be said that the new design is more attractive than the old and far less likely to become clogged with dust and debris from the road.

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Goodyear Employees Paid for Ideas

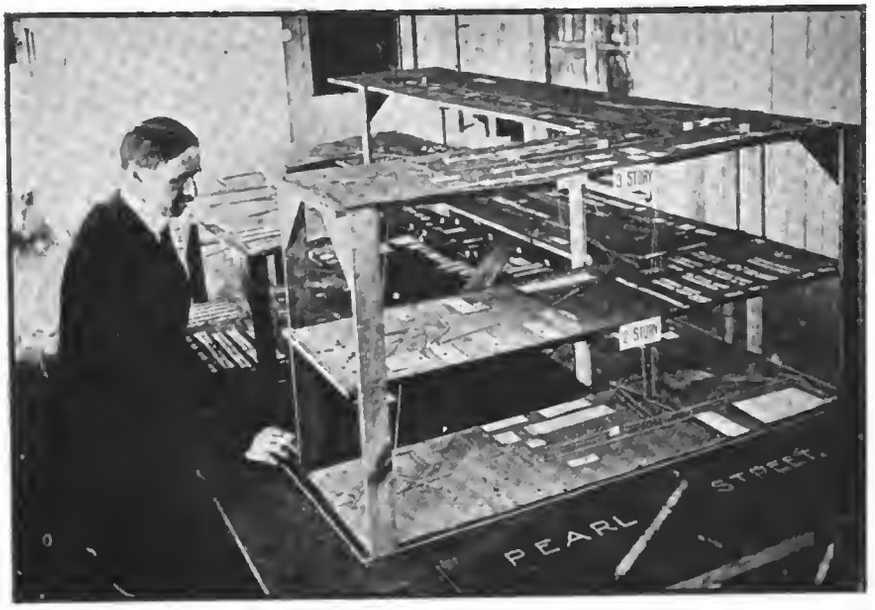
ONE of the most popular operative features at the plant of The Goodyear Tire & Rubber Co., Akron, Ohio, is the suggestion system, which enables employees to capitalize their ideas for improving machinery, conditions, methods and product.

The workmen who make Goodyear products are given every opportunity to advance their ideas, and all suggestions adopted are well paid for. Interest in the system is well sustained, and thousands of dollars have been paid to employees for their ideas.

The suggestion box method is used, with boxes placed throughout the plant in convenient places. Employees are asked to put their ideas in writing and deposit them in the suggestion box. The suggestions are gathered each day and referred to the proper persons for consideration. All are carefully gone over, however inconsequential they may seem.

Motion Study as a Production Factor

Examining the Worker's Motions To Ascertain Causes for Inefficiency—Frank B. Gilbreth's Methods and Instruments



Model of factory as laid out before plans for analysis are made to determine lost motion

DOES the average worker become fatigued unnecessarily? Is the production of the usual factory below its capacity? Are many factories increasing the number of men and the amount of floorspace needlessly? Is it possible for the average workman to be raised to a higher level of efficiency, raising his productive abilities, yet lowering his fatigue? Do wasted motion and wasted effort cause a vast loss of wasted time to the majority of manufacturers? These interesting and vitally important questions form a great part in the study of motion that Frank B. Gilbreth, efficiency engineer of Providence, R. I., has made a life problem and to which he introduced many novel and consequential theories and devices.

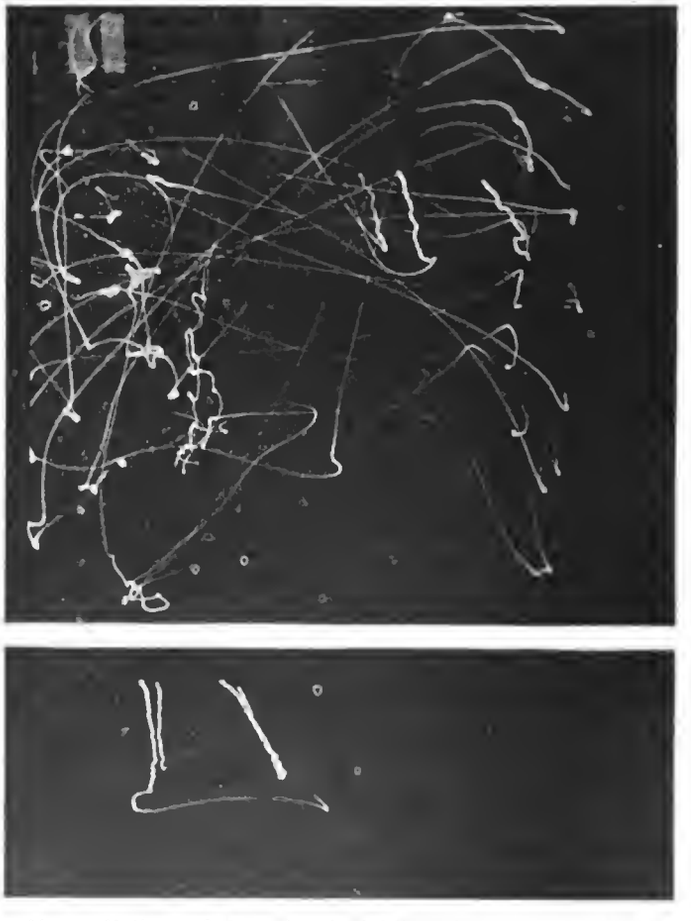
Wasted Energy

Thirty years ago Mr. Gilbreth was an apprentice bricklayer. He asked the foreman to show him the proper way to lay bricks. Though a master mason, the foreman had many methods. One was for hurried labor, another for times when speed was not required and so forth. The boy studied the work thoroughly. He saw that many of the men, like the foreman, never laid the bricks with the same motions for two jobs. He became convinced that a very valuable study would be found in an attempt to determine the least number of motions for brick laying that would at the same time have the effect of not tiring the worker. Since that time he has devoted himself to efficiency, first as a student, and now as a consulting engineer confining his time to the discovery of waste motion in various factories and industries.

He investigates factories, makes improvements, omits stages of manufacture and substitutes skilled labor for unskilled wherever possible. In a handkerchief factory he noticed one girl whose work, consisting of folding handkerchiefs, slackened perceptibly each afternoon until it fell far below the work of the others. Investigation revealed that the chair upon which the girl sat had worn, that the front legs were so low that the girl was forced to use her arms at so high an angle that they tired and consequently became less efficient. A carpenter repaired the chair and a few days sufficed to show the girl working with all the speed of her companions in the shop.

Motion Study a Science

Mr. Gilbreth defines his work as motion study and says: "Motion study is the science of determining methods of least waste and my work is the installation of laboratories for large concerns and the creation of examining processes to determine how the work can be done with the least number of movements. The discovery of such a method allows the manufacturer to secure the greatest possible output, to pay his employees more money and to make more money for himself." He believes that

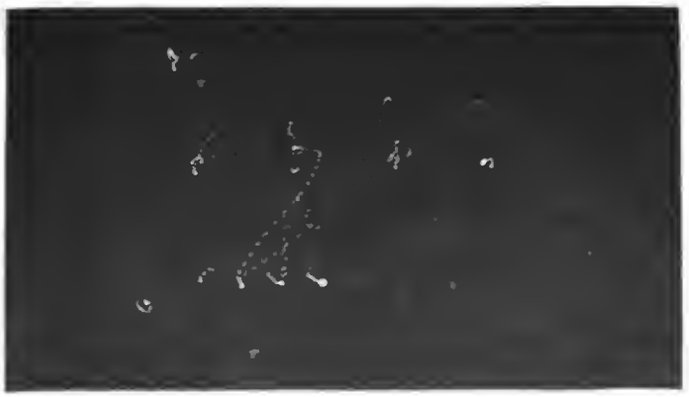


Above—Motions of a worker in loading sixteen boxes before motion study methods were adopted. Below—The same operation when efficient methods of concentrated motion are used

Right—Foremen of a factory being instructed in the wrong and right methods of operation by means of moving picture application of motion study

Below—Cross section method of studying motion to eliminate fatigue, the worker standing before a background of checks, so that each motion can be recorded according to its appearance before the squares

Lamp used with cinematograph to display the motions of the worker. Lamps are attached to fingers, knees or forehead



Hand of a bricklayer photographed with lamp attached and showing the operation of laying bricks when motion study methods minimize the expenditure of effort

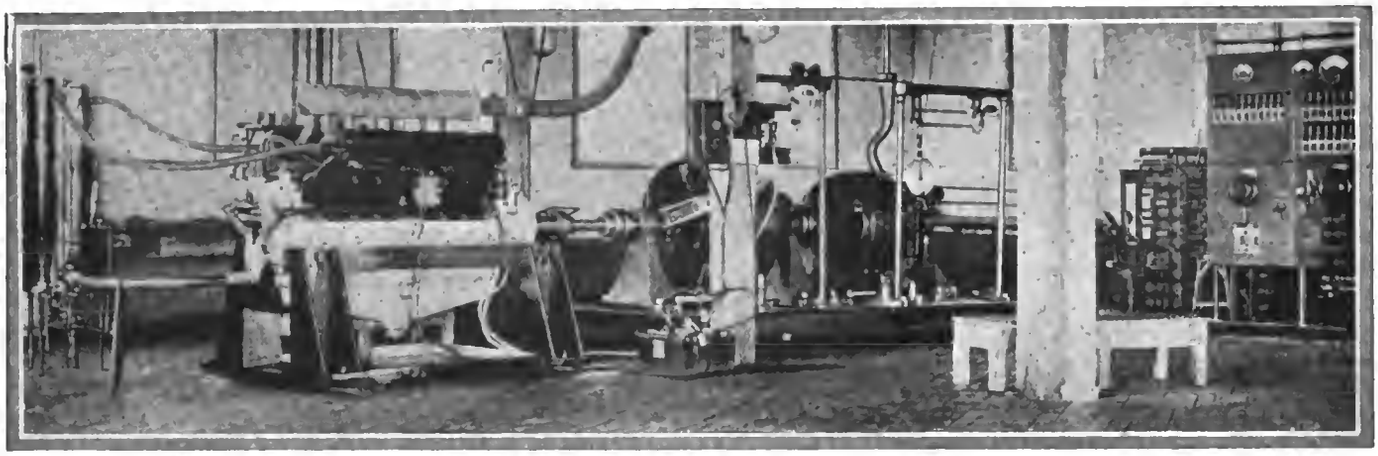
the only way to study an industry or trade is to learn the fundamental motions and to do these rapidly even though the speed, at first, affects the quality as he finds that the elimination of unnecessary motion is more important than spending time learning the process by slow and elaborate methods. The slow way, he states, requires far different motions from the quickest way and as a consequence, the worker is forced to learn two methods before he becomes proficient.

To ascertain the motions of workers, Mr. Gilbreth has utilized and invented many instruments. He commenced his work with a stop watch but found it too slow and often inaccurate and has combined with it the cinematograph, which is able to photograph every motion and preserve it and, in addition, when used with a special clock, allows him to time each movement. The clock is an appliance that makes a complete revolution every 3 sec. and measures to the millionth part of an hour. It has a watch attachment to check its accuracy. Temperature and humidity are always taken into consideration. A penetrating screen is used on which the proper motions are marked and before which a photograph of the worker is taken so that his movements can be compared with the correct ones. Thus, by means of the moving pictures and the screen, the worker not only sees himself as others see him but also is able to witness many movements not ordinarily seen by the eye and is shown all of the wasted effort he has used.

Lights Show Motions

To facilitate the camera, lights, similar to those used by physicians for examination of the throat and operated by a make and break apparatus, are used. They are placed upon the hands, fingers, knees and foreheads of workers and photographs taken reveal each movement of the various lamps. The photography is consequently utilized to determine time when compared with the clock and the flashing lamps, and to discover the width, length and breadth of the motion of the worker. Complete assembly operations are often photographed and each movement required by the different workers is displayed and timed and measured. The work of the best men can thus be shown on a slow moving cinematograph machine so that it can be followed by the unskilled and adopted by them.

Another instrument used is a background of checks against which the worker stands and moves so that each motion can be recorded according to its appearance before the squares. Utilizing this system, Mr. Gilbreth checked a man loading boxes. He classified his motions by sixteen acts under the headings of search, find, select, grasp, position, assemble, use, disassemble, inspect, loaded, position for next operation, relieve load, transport empty, wait unavoidable, wait avoidable and rest. The results of these checks are shown in the two illustrations at the bottom of the opposite page.



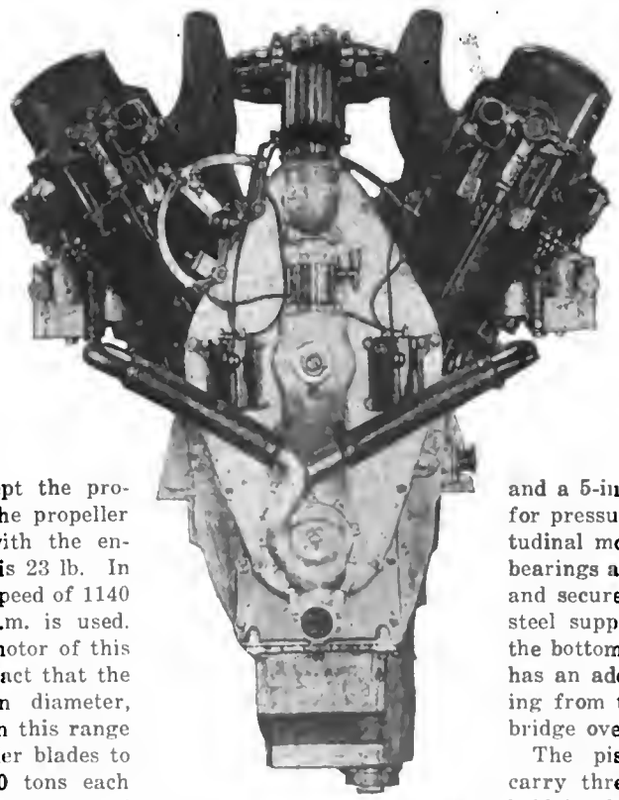
Knox twelve-cylinder aviation engine designed by F. H. Trego undergoing tests with a Sprague dynamometer at the Knox laboratory

Knox Aviation Twelve Tested

300-Hp. Engine Designed by F. H. Trego Has 4 3/4 by 7 In. Bore and Stroke—8-Hr. Run Made

SPRINGFIELD, Mass. Nov. 15—One of the largest V-type aviation engines ever built in this country has just been put through a series of tests in the laboratory of the Knox Motors Co. here by Frank H. Trego, chief engineer and designer of the motor. The engine is intended for high-power aviation work and is rated at 300 hp. It has been designed to meet the severest aeroplane service in Europe, and since work was started on it a year ago representatives of foreign concerns have not only been watching its development but keeping very closely in touch with all engineering details. Engineer Trego has been working on the matter consistently for nearly a year and has now a power plant capable of withstanding the severity of 8-hr. tests.

The engine, a twelve-cylinder, V-type valve-in-the-head design, has the aluminum cylinder blocks formed in groups of three, and the two sets of threes mounted at 60 deg. to each other. The bore and stroke of 4¾ and 7 give a piston displacement of 1488.53 cu. in. With this piston displacement the weight complete with starting and lighting motor and generator, ignition equipment, exhaust pipes, and tachometer is 1400 lb. This weight includes everything except the propeller hub, which is a part of the propeller assembly, although furnished with the engine. The propeller hub weight is 23 lb. In the preliminary test a propeller speed of 1140 and a motor speed of 1600 r.p.m. is used. Some conception of the work a motor of this type has to do is shown by the fact that the four-bladed propeller, 14 ft. in diameter, turns at 1100 to 1200 r. p. m. In this range of speed the effort of the propeller blades to fly off the hub approximates 20 tons each and the propeller has a pushing power of 2000 lb., according to Engineer Trego.



End view of the new twelve-cylinder Knox aviation engine

The cylinder blocks are aluminum castings open at each end and in these are pressed ⅛-in. cast iron liners, these liners having a flange on the lower end are pressed into the bottom. Although the cylinders are cast in blocks of three, the heads are cast in blocks of six and are of aluminum alloy with cast iron valve seats, cast integrally with head casting. The head for each of the cylinders is secured by sixteen nickel steel studs passing through the head. The four valves in each cylinder are carried in the head and the water-jacketing so arranged as to surround each valve seat. The water-jacketing of the cylinder blocks is so carried out as to extend below the bottom of the stroke and to allow ½-in. water space between adjacent cylinders. In addition each cylinder head has an aluminum cover which entirely conceals and protects all of the valve mechanisms.

The rotating and reciprocating parts of the engine have been designed with the thought of enduring the heaviest service imposed on an aviation motor. The crankshaft, a chrome nickel steel forging, is 3 in. in diameter at its three bearings as well as at the crankpins. The shaft has a total bearing length of 13 in., 4 in. at the front and center, and a 5-in. bearing at the rear. It is drilled for pressure lubrication and held from longitudinal movement by a center bearing. The bearings are babbitt, backed by a bronze shell and secured by aluminum caps backed up by steel supporting plates ⅝ in. thick all over the bottom of the bearing. The rear bearing has an additional supporting steel bar hanging from two bolts which pass down from a bridge over the top of the crankcase.

The pistons of special aluminum alloy carry three rings and have the piston pin held in the upper end of the connecting-rod with its bearing in the piston where the

aluminum alloy serves as a bearing metal.

Connecting-rods are drop forgings with a bearing cap at the lower end held by two bolts and with cap and rod locked together by tongue-and-groove formation to prevent twisting The rods are side by side on each crank throw.

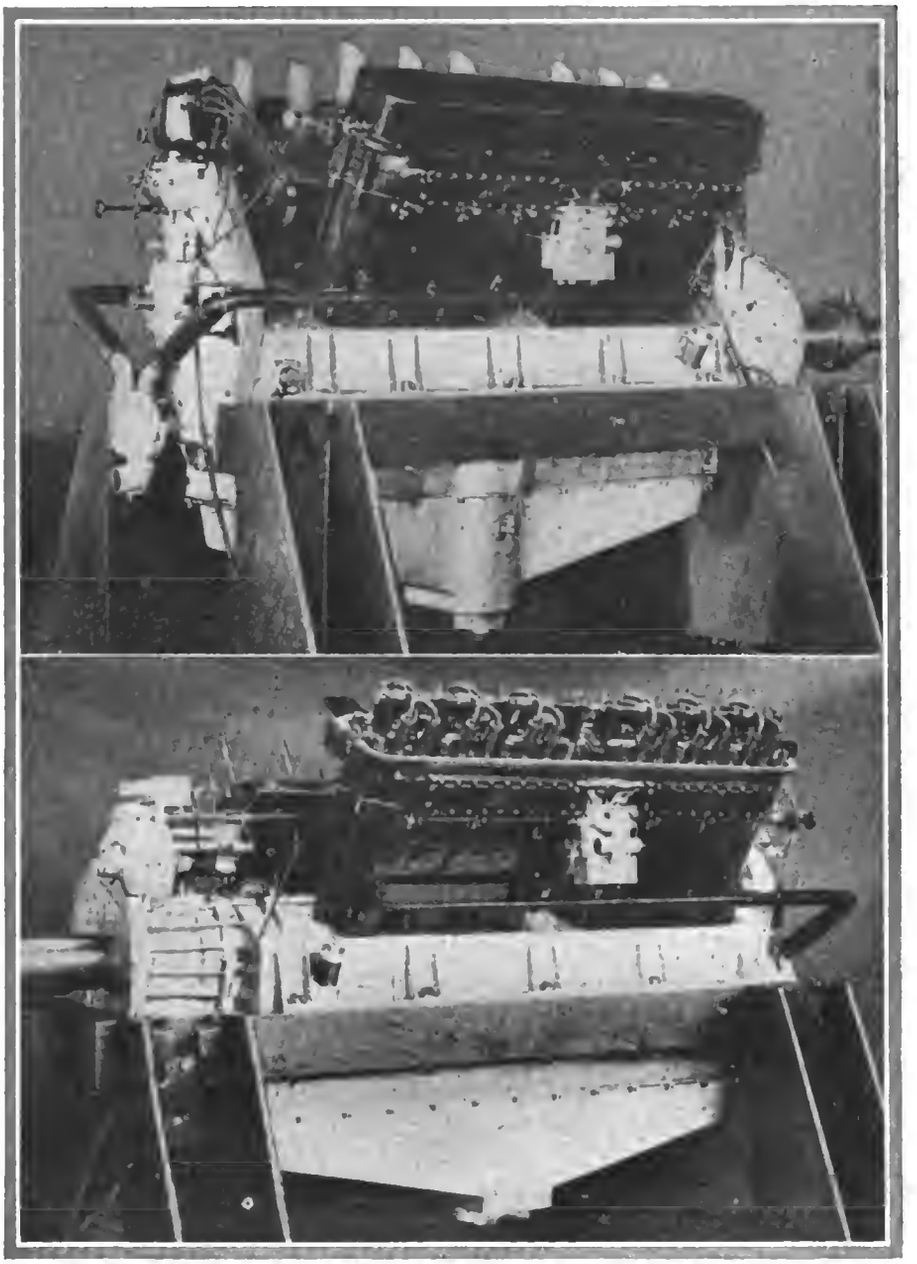
The crankcase is an aluminum alloy formed in one piece and extending 7 in. below the center lines of crankshaft in order to give a barrel section for strength. The lower half is a one-piece aluminum casting bolting to the upper half and not containing any of the motor mechanism.

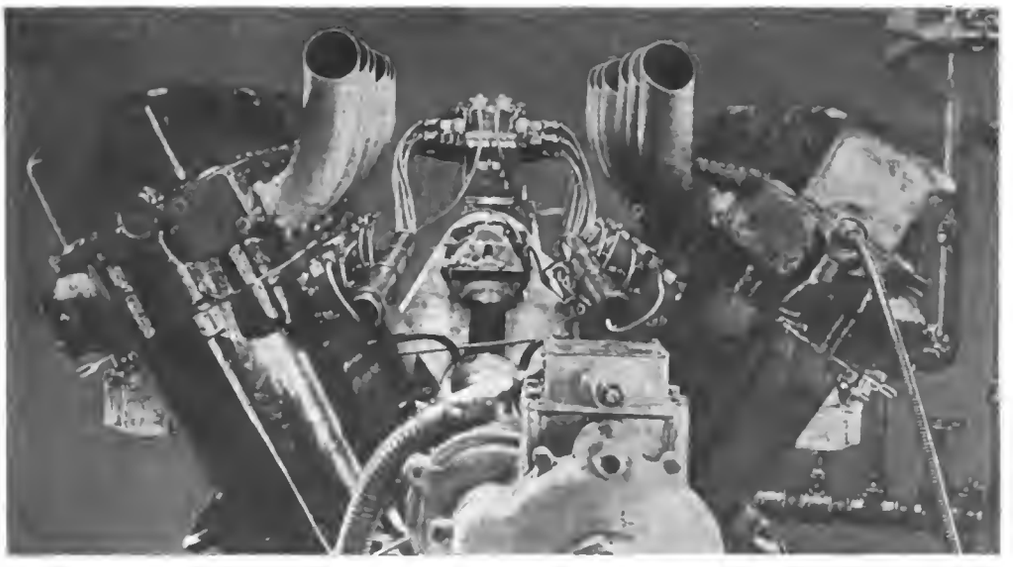
For attachment into the framework of the aeroplane supporting legs are not used but support is through a shelf extending the full length of the crankcase on each side and on which the motor rests. Five bolts anchor each shelf into the framework of the aeroplane and to add rigidity a rib is cast on each side of each bolt. With this support the motor is kept very narrow at this point and rests in a frame 15 in. wide inside and with bolt centers 17 in. apart.

Valves at an Angle

The valve mechanism operating four valves in each cylinder is operated through a camshaft lying along the head of each cylinder block, thus mounting the valves at a slight angle to the cylinder bore. The camshaft and rocker arms are supported in the head, the camshaft having eight bearings. The arc-shaped rocker arms are supported above it as the end section shows. Forced feed lubrication with necessary drainage back to the crankcase is at the center of the motor when the motor is in normal condition and at each end when the motor tips up or down.

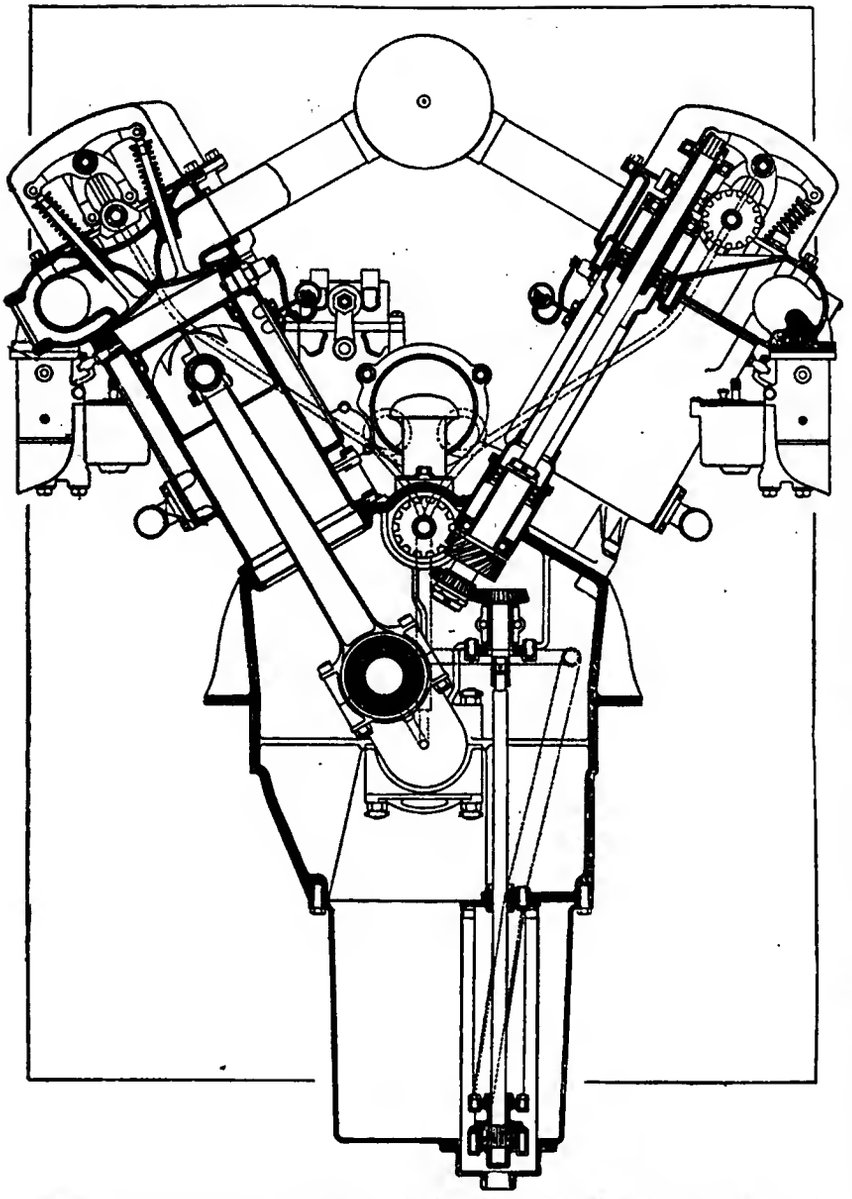
On one end of the engine is an





Above — Both sides of the Knox aviation engine, the upper one showing the arrangement of the ignition and water pump below. The lower picture shows the starting motor with its switch mounted immediately above a casing which contains the reduction gear for driving the propeller

Left—Looking along the V space between the cylinders showing the open exhausts, central location of the ignition unit and starting motor switch in front



Section through the Knox twelve-cylinder 4¾ by 7 in. aviation engine, showing the camshaft drive for the overhead valve rockers. The pump drive is also shown

aluminum housing for the timing gears and the support of the water pump, air pump, ignition apparatus and lighting generator.

On the other end of the motor is a heavy special aluminum casting to support the propeller shaft with its bearings in which the ball bearing holes are lined with steel bushing to prevent wearing the aluminum. This casting with its cover provides for the large starting gear on the propeller shaft as well as for supports for the starting motor, switch, etc.

Drive of Engine Accessories

The method of driving the different motor accessories is through a longitudinal drive shaft above the crankshaft and driven by the timing gears. This drive shaft has two integral spiral gears which are at the center of the motor for driving two vertical shafts, which extend up through tubes into the cylinder heads and on through short hollow shafts. Each vertical shaft terminates in a splined end with a splined cap piece which bolts to the short hollow shaft. This arrangement permits of changing the relationship of the camshaft to the vertical shaft for valve timing. The oil drainage from the cylinder head passes down through the ball bearings on the vertical shaft and thence through the tubes to the crankcase.

Motor lubrication embraces all of the moving parts of the engine. Oil flow originates in a pump supported from the upper half of the crankcase so that there is no pump connection between the pump and the motor. Steel pipes cast integrally with the crankcase register with the oil pump to make the necessary connections. Oil holes drilled in the case for lubrication are lined with steel tubes to insure against leakage. The main oil lead extends the entire length of the crankcase and has holes drilled to the crankshaft bearings, these also being steel lined.

The oil is taken in the crankshaft bearing at the timing gear and led to the horizontal driveshaft bearing immediately above it, and thence is led through the hollow driveshaft to the center or either end of the shaft, whence it flows through copper tubes to the cylinder heads. In each head it passes through the camshaft supporting brackets into the hollow camshaft, thence to all its bearings and to the hollow rocker arm shafts and to each rocker arm. The result of this oil circulation is that valve-stems, springs, rocker arms, rollers, camshafts and other moving parts are saturated at all times.

Timing gears are oiled by the throw-off of the crankshaft bearing at that end. The propeller gears are oiled in the same manner at the other end. Oil pressure is from 40 to 70 lb., there being an adjustable regulator on the side of the tank. A large oil screen is carried in the lower half of the crankcase and covers the oil pump clear up to the upper half of the case. This screen may be withdrawn for cleaning without disturbing any mechanism. On the outside of the crankcase is an oil gage.

Double Zenith carbureters are placed in each side of the engine, outside of the cylinder blocks, thus using a separate carbureter for each three cylinders. There is nothing on the outside of the engine excepting these carbureters; and there is nothing in the V between the blocks excepting the two breathers rising from the top of the crankcase.

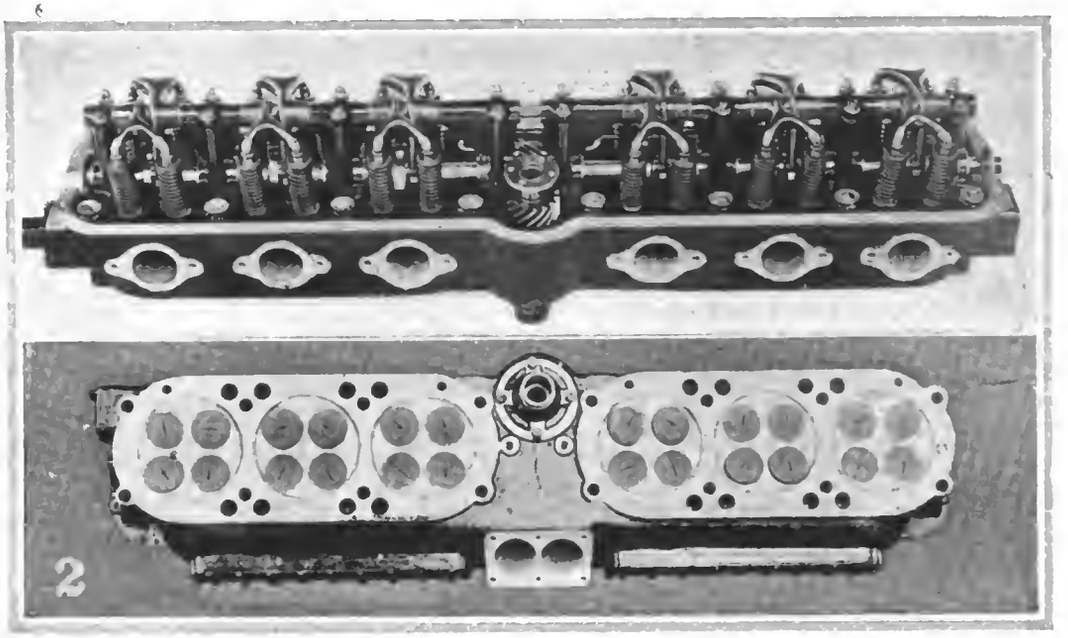
The electric starting motor and the lighting generator are built into the engine, the former so that starting is by pressing a button which throws the switch.

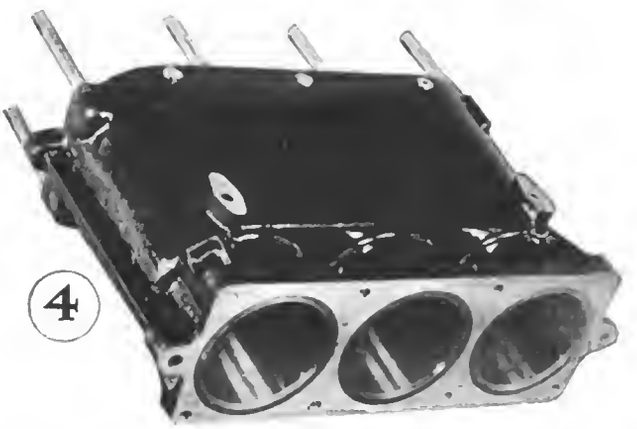
Ignition is by battery type with the current furnished by a battery for starting, but with the running current from the generator. There is one spark plug in each cylinder. All six priming cocks on each side of the motor can be operated at once by a pull-handle. Gasoline feed is by pressure furnished by a two-cycle type of air pump furnishing pressure of 4 to 7 lb. An adjustable regulator is attached.

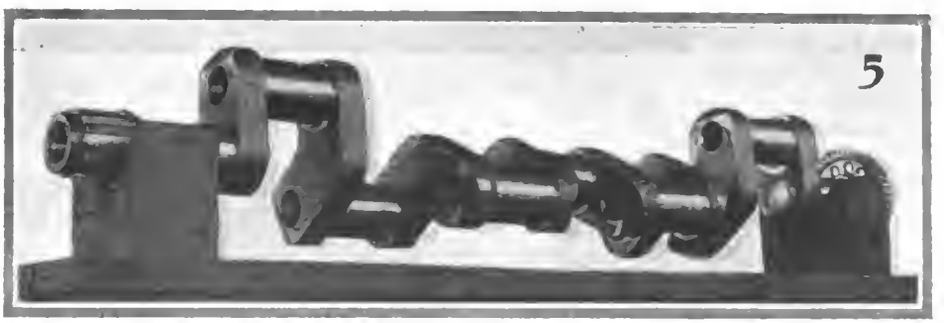
The water pump, a double impeller type, with water on each side of the impeller to avoid thrust, is made in one assembly and driven through a flexible coupling at the end of the crankshaft. The pump has one intake and two discharge pipes, which lead to brass taper tubes extending alongside of the engine on either side, and supplying the cylinder blocks with water at two points each. The water rises through the cylinder jackets, passing directly into the heads through registering holes and flows out at either end of the heads as desired.

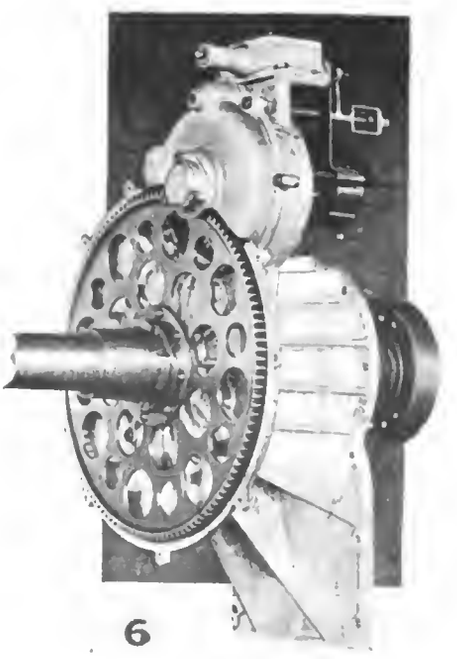
The propeller shaft is supported on a heavy double-row, self-aligning, ball bearing, with a thrust taken in either direction by a double ball thrust, with a load capacity of 2650 lb. in either direction. The propeller shaft is 3⅝ in.

(*Continued on page* 862)









1—The aluminum alloy piston is provided with three rings and a series of small oil holes is drilled through it below the lowest ring groove. The connecting-rod is a drop forging

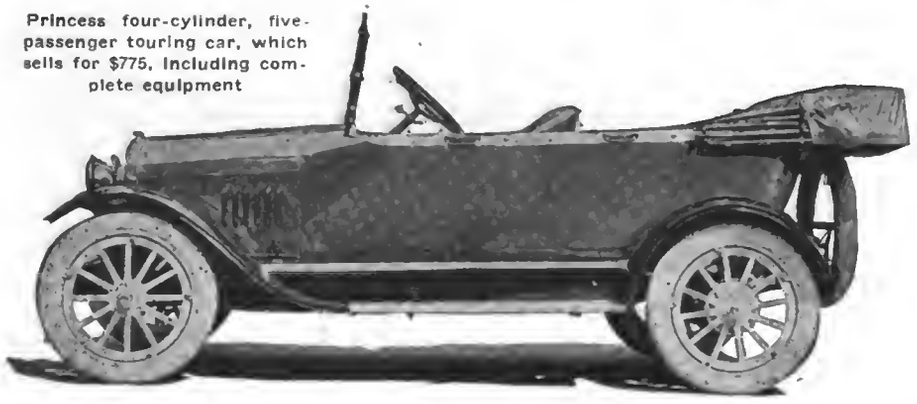
2—Two views of the cylinder head, which is of aluminum alloy cast in one piece with cast-iron valve seats. Note the four valves in each cylinder

3—Detail of the valve rockers which operate from a camshaft located immediately above the cylinder heads

4—The aluminum cylinders are cast in blocks of three and have cast-iron liners pressed in place

5—The crankshaft is a chrome-nickel forging 3 in. in diameter and has large bearing surfaces

6—Mounting of the starting motor, which has a single reduction gear to the crankshaft



Princess four-cylinder, five-passenger touring car, which sells for $775, including complete equipment

1917 Princess Is Larger

Wheelbase Increased 4 in.—Rear Axle Now Floating—Two-Unit Electric System

FOR 1917 the Princess Motor Car Corp. of Detroit is presenting a very much refined product as compared with the previous model. The factory is now pushing production and deliveries.

The car is larger, roomier and better equipped. The wheelbase has been increased from 104 to 108 in. the additional 4 in. being used for body space. This is the main factor in making the car larger and the difference is immediately apparent when last year's car and this year's are side by side.

Floating Rear Axle

In addition there have been numerous mechanical alterations. The rear axle design is entirely different, being floating instead of semi-floating. The starting and lighting system is a two-unit device instead of a single-unit one. It is Disco, as formerly. With the new installation a Bendix gear is used for the starting motor whereas the motor-generator outfiit previously used had a silent chain reduction of 3 to 1.

To take care of the larger car, bigger brakes are installed. they are 12 by 2¼ in., instead of 12 by 1¾. The tires are larger, being 32 by 3½ instead of 30 by 3½.

In the engine no changes of importance are made although there are perhaps a dozen alterations of minor consequence. The position of the magneto is new, and the oiling system changed in detail. This is a detachable head unit.

The speedometer drive is from the transmission gears. Appearance has also been given attention in other details, particularly in the overhauling of the fenders and running boards. The running boards are now linoleum on wood, aluminum-bound, instead of aluminum on sheet metal. This is better construction right through, and besides being more sightly it is also stronger and does away with rattles. The front fenders are so formed that they are virtually sill boards also, this removes all the cracks and prevents the entrance of any dirt or water.

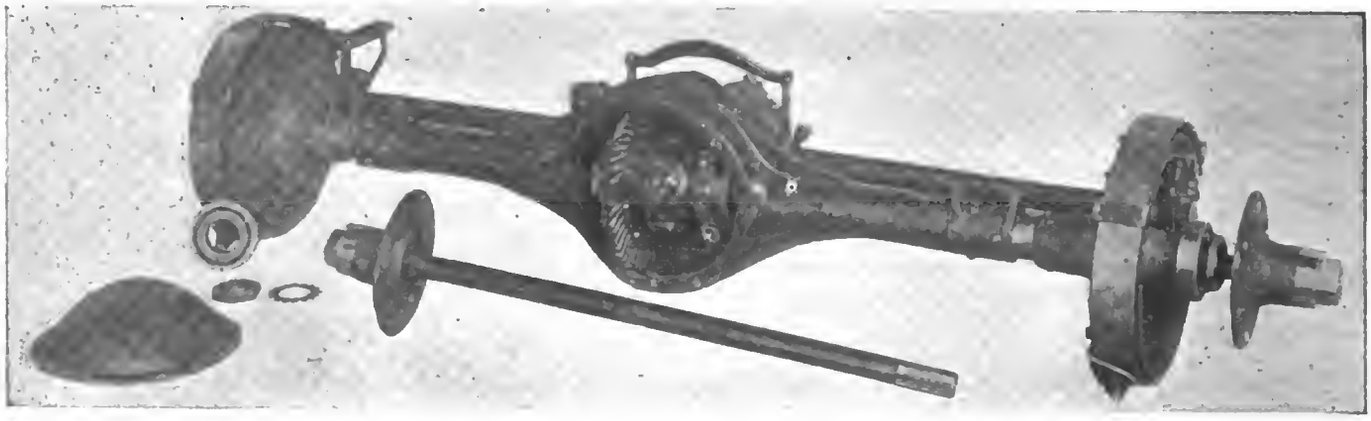
A sloping windshield instead of a vertical one makes not only for appearance but also for strength in taking the strains imposed by the one-person top. The side curtains are now easier to adjust.

On the instrument board the Van Sicklen speedometer, speedometer light, ammeter, oil gage, King lock, and fuse box with spring-attached cover, are grouped integrally. By taking out four screws the entire instrument assembly can be lifted out for repair or inspection.

Unit Power Plant

The engine is a unit with the clutch and gearset, and is a four-cylinder, L-head block design with valves on the left. The cylinder dimensions are 3¾ by 4¼ in., giving a formula rating of 22.5 hp., and a piston displacement of 187.9 cu. in. Conventional practice is followed in the engine design. It is a three-bearing crankshaft type. The valves are com-

Driver's compartment and new metal instrument board on the 1917 Princess. All wiring is integral. Board is of dull black enamel with instructions of nickel set flush



Floating rear axle design used in the 1917 Princess, supplanting a semi-floating construction in the previous model. Housing is of pressed steel and a four-pinion differential is used with six-spline side gears

posite, having cast-iron heads and nickel steel stems, and have an opening in the clear of 1⅝ in. and a lift of 7/37 in. The outside diameter is 1 13/16. They are adjustable by removing the side plates and turning a nut on the end of the push rod.

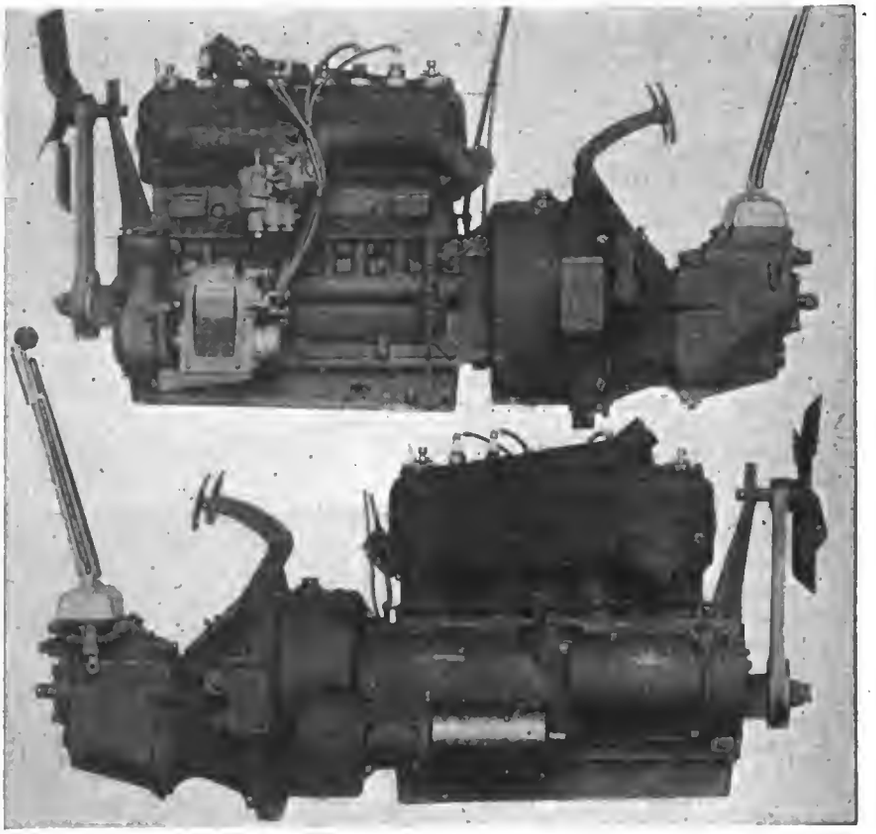
The silent chain drive for the timing gears and magneto runs in oil and has provision for adjustment. The lighting generator is also driven by silent chain.

Materials Standard

As far as materials are concerned, the engine is in line with usual practice, the connecting-rods being 0.30 to 0.36 carbon steel, drop forged and heat treated, the crankshafts are 0.35 to 0.40 carbon steel, and the cylinders and pistons of cast gray iron. The detachable cylinder head, is also of cast gray iron.

Oil is delivered by plunger pump driven from the No. 4 exhaust cam, to a dash sight feed and thence to the main bearings and thence to the splash troughs where the cylinders and other internal engine bearings are taken care of by the dip of the rods. The silent chain drive for the auxiliary devices is also cared for in this system by a separate lead which keeps the chain submerged in lubricant.

Ignition is by a Splitdorf Dixie type of magneto and carburetion by a Schebler.

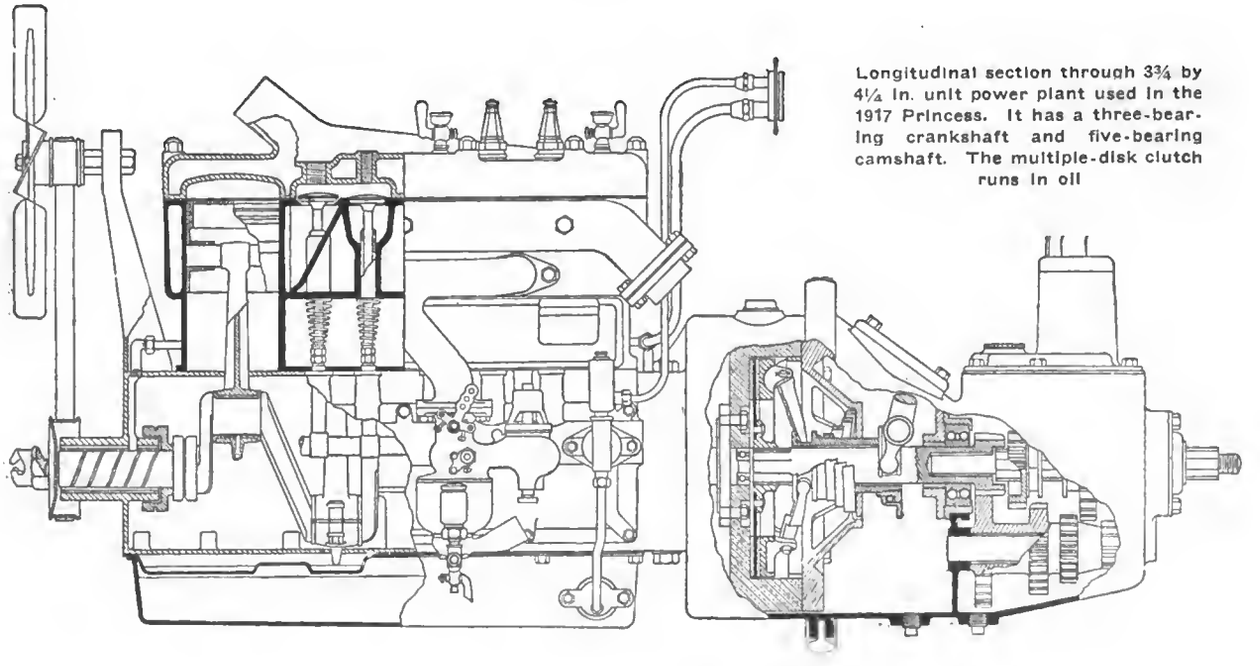


Both sides of the four-cylinder L-head unit power plant used in the 1917 Princess. The engine has a bore of 3¾ and a stroke of 4¼ in., giving a piston displacement of 187.9 cu. in. and a formula rating of 22.5 hp.

From the engine the drive is transmitted through a single steel dry-plate clutch to the Grant-Lees three-speed gearbox. The drive is the customary shaft with two universals. The rear axle is floating and the rear springs are three-quarter with the main leaf of vanadium steel. A guarantee against breakage of the main leaf is given for 2 years. The wheels are of hickory fitted in the rear with the 12-in. brake drums. The service brake is external contracting and emergency internal expanding on rear wheel drums, as shown in the view of the axle on page 860.

The new floating rear axle is amply strong, the housing being of pressed steel with a double lap on the differential housing; wall thickness is 5/32 in. A four-pinion differential is employed with six-spline side gears, gear ratio being 4 to 1, with twelve-tooth pinion and the gears are spirally cut. There is an independent adjustment on the bearings. Axle shafts are heat-treated chrome-nickel steel and 1¼ in. in diameter. Spokes are 1⅜ in. in diameter.

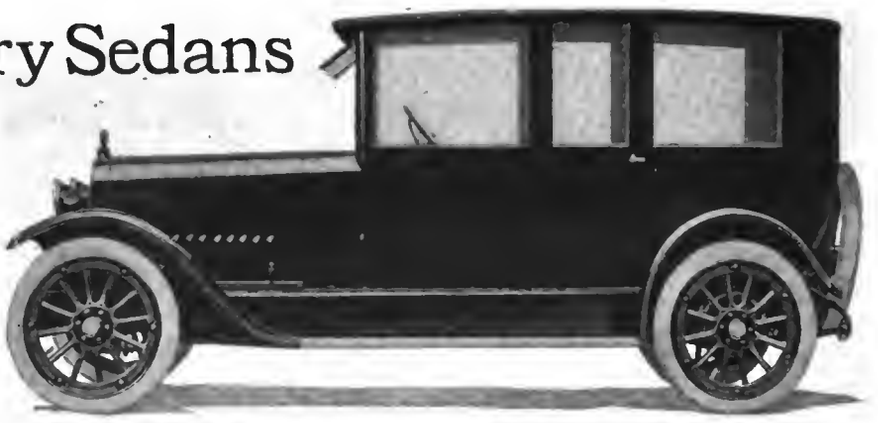
Fully equipped the car sells for $775, f.o.b. Detroit. The standard equipment includes electric starting and lighting, speedometer, Neverleak one-man top, two-piece, rain-vision windshield, two electric lights with dimmer, dash lamp, number bracket, robe rail, tire holder, extra rim, tool kit and electric horn.



Longitudinal section through 3¾ by 4¼ in. unit power plant used in the 1917 Princess. It has a three-bearing crankshaft and five-bearing camshaft. The multiple-disk clutch runs in oil

Two New Jeffery Sedans

Four and Six-Cylinder Types with Removable Tops for Summer Touring Brought Out By Nash Motors Co.



New seven-passenger sedan body mounted on Jeffery six-cylinder chassis and selling for $1,530. The extreme simplicity and severe lines are characteristic of the design. Note how closely the fenders follow the wheel contours

AS announced recently in the news columns of THE AUTOMOBILE, the Nash Motors Co., Kenosha, Wis., has brought out two new sedan models to meet the increasing demand for inclosed cars for Winter service. The new bodies, however, which are mounted on both the four- and the six-cylinder chassis, have removable tops which widen the scope of their usefulness throughout all seasons of the year. Both models have seating accommodations for seven passengers, the two folding seats being neatly concealed when not in use in the backs of the front seats, which are divided, as shown at the right.

The four-cylinder Jeffery chassis has a wheelbase of 116 in. and the block engine is 3¾ by 5¼. A three-speed-and-reverse gearset is used in connection with a disk clutch and semi-floating axle. The six has a 125 in. wheelbase and the engine is 3½ by 4⅝. Rear axle is semi-floating.

Interior of the new Jeffery sedan body, showing the divided front seats, wide door and dome light in the ceiling

Both bodies are two-door constructions, a feature which enabled the designers to provide unusually wide doors, while the aisle between the front seats, which makes this arrangement possible is of ample width to permit the passage of the occupants of the front seats to the rear and *vice versa* without inconvenience. Like the doors, the windows, which are of the French plate type, are of noticeably liberal dimensions, the rear window being 31 in. wide and 19½ in. in height. These windows drop 5 in. to give adequate ventilation in warm weather, providing a good circulation of air without permitting a draft on the heads of the passengers.

Upholstery is of gray whipcord and roll curtains on the windows, with numerous other touches of luxurious refinement aid the work of the Nash engineers in giving the new sedans all the comforts of a standard high-priced limousine. To insure entirely weatherproof qualities in the top, in all conditions of wind, rain, snow or sleet, a series of painstaking experiments were made. As a final touch, the large dome light in the center of the top was provided for light and warmth.

Knox Aviation Twelve Tested

(*Continued from page* 858)

diameter bored out to leave ½-in. wall. On this shaft is located the starting gear which through a train of gears connects with a starting motor by roller clutch.

Propeller Hub Mounting

The propeller end of the shaft is tapered to take the propeller hub which it drives through four heavy integral jaws. The propeller hub is drawn onto this shaft by right-hand nut and locked by a left-hand plug. The propeller hub with its inside flange is in one piece, incorporating the jaws to engage the corresponding jaws on the propeller shaft. The propeller hub is splined on the outboard end to take the splined flange, thus giving an allowable thickness of propeller of from 5 to 9 in. The propeller is clamped into place by eight bolts passing through both flanges. The propeller shaft, as well as the crankshaft at this end, is splined to take the propeller gears. Spline construction is very general throughout the motor.

Tachometer Driven from Camshaft

A tachometer is provided and driven from one end of the camshaft. It indicates propeller speed from 500 to 1500 r.p.m.

The horizontal driveshaft projects through the gearcase cover, so that the pulley may be added to drive a wireless generator if necessary.

At a test of this motor made at the Knox factory Saturday, Nov. 11, a run of 8 hr. was made. During the first 7 hr. the engine speed was from 1400 to 1600 r.p.m., pulling a load of 200 to 245 hp. For the last, or eighth, hour the speed was 1600 r.p.m., pulling a load of 300 hp. The average horsepower for the 8 hr. was 243, giving a total of 1948 hp. hr. with a gasoline consumption of 198.4 gal. This is 0.612 lb. per hp. hr., which could scarcely be taken as a fair test, as you cannot expect to get a true test with one-quarter and one-half throttle conditions.

No Air Blown on Plugs

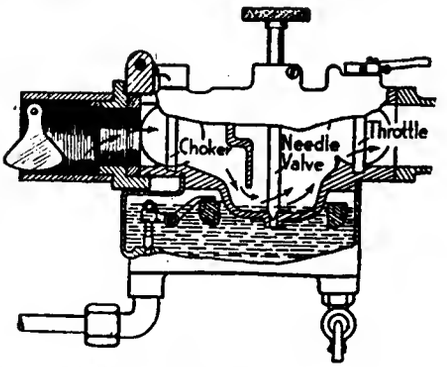
After the test had been under way for 40 min. a stop of 2 min. was made to change a spark plug, but after this no spark plugs were changed and no air of any kind blown upon the plugs. The water temperature was 108 deg. Fahr. at the entrance and 140 Fahr. at the discharge. Air temperature was 62 Fahr. at the start and 78 Fahr. at the finish, in the testing room.

The test was made with a Sprague electric dynamometer, as shown in the illustration at the top of page 856.

ACCESSORIES

Myle-Maker for Fords

THE Myle-Maker is an automatic auxiliary air adjustment for the standard Ford carbureter. A pendulum valve, actuated by the incoming air, hangs in a housing bolted to the air intake. It is secured by a set-screw, and may be fastened on by the owner in a very short time. When starting and at low speeds the valve restricts the air supply and causes a rich mixture to be sent to the engine; but at high speeds it is swung open, admitting more air. It is claimed that the device gives an easy starting mixture, as well as an economical mixture at normal speeds. Price, $5.—Myle-Maker Co., 323 East Twenty-third Street, Chicago.



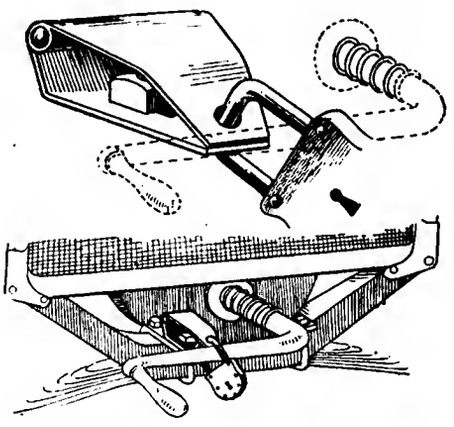
Myle-Maker air adjustment for Ford cars

Corning Conaphore

The Corning Conaphore is a device for preventing glare from headlights or spotlights. It is made either of yellow tinted glass, styled "Novoil," or of clear glass, having a smooth outer surface and a series of horizontal corrugations on the inner surface. These corrugations are said to bend the light rays down, until at no point are they more than 42 in. above the road. The yellow tinted glass is claimed to absorb the violet and blue rays, prevent glare, and transmit a ray that penetrates fog or dust. The sizes vary by ⅛ in. steps from 3 in. diameter to 11½ in. Price, Novoil, or yellow tinted glass, 3 to 4⅞ in., $1.30 per pair. Clear glass, 80 cents per pair. Other sizes in proportion.—E. A. Cassidy Co., 30 East Forty-second Street, New York.

Paramount Snubbers for Fords

These snubbers retard the upward motion of the body when recovering from a shock. One is installed on each end of the rear spring and consists of a resilient compression spring anchored in castings that are held in place by two cantilever springs. A strong webbing strap which buckles around the axle is fastened to the casting at the top of the compression spring. The lower casting is attached to the car spring by means of a tie-plate and two bolts. The installation only requires that the snubber be bolted to the rear spring, and the strap fastened around the axle, all of which may be done by the owner in a few minutes. Price, $6.—Detroit Engineering Products Co., Detroit, Mich.


Warner crank lock attached to Ford

Warner Lock for Fords

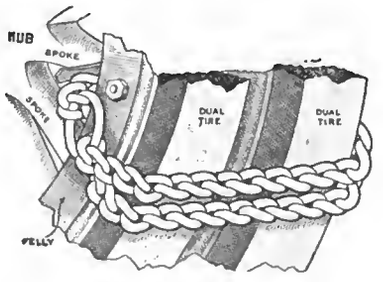
The crank of the Ford is locked in mesh with the crankshaft and the motor may not be turned over until the lock is released. A hinged metal member is bolted over the front spring clip and carries a heavy padlock that permits the crank to be held in mesh with the crankshaft. Price, $1.50.—G. H. Warner Co., 318 Century Building, Indianapolis, Ind.

Campbell Radiator Cover

The unlined covers are made of waterproof fleece-lined material with adjustable doors. The two-ply is imitation leather, waterproof, and the outside is lined with kersey blanket material quilted. Price, Ford unlined radiator cover, $1.38; Ford unlined engine cover, $1.14; Ford lined two-ply radiator cover, $1.58; Ford lined two-ply engine cover, $1.46. All other cars in proportion.—Perkins-Campbell Co., 622 Broadway, Cincinnati, Ohio.

Herman Truck Tire Chains

This device provides increased traction by means of three double cross-chains locked to each of the rear wheels. Each cross-chain is double, hence smaller than the equivalent single chain and said to reduce vibration. Price, per set of six double chains, 3 to 3½ in., $5; 4 to 4½ in., $6.50. Dual tires, 5 in., $13; 6 in., $15; 7 in., $17.—Herman Mfg. Co., 1420 Pennsylvania Avenue, Washington, D. C.

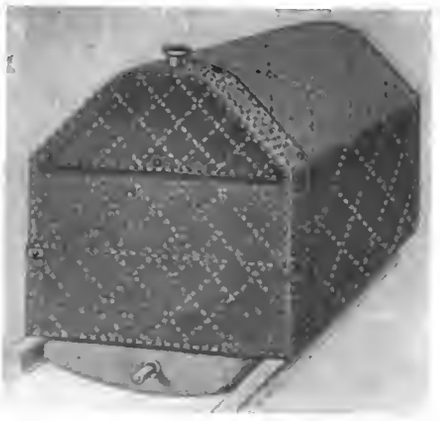


Herman tire chain for trucks

Allen Gloves

These are heavy, warm gloves for automobiling in winter. Over a detachable


Corning Conaphore glare preventer


Campbell radiator and hood cover


Paramount snubber for Ford cars

Genolite lighting system installed on a Ford engine

woolen glove is the leather glove proper, that may be worn separately if desired. These gloves are made in mitten, one-finger and glove shapes, finished either in black or tan leather. One of the many styles the company makes is illustrated herewith. They sell for $5 per pair.—Allen Glove Co., Gloversville, N. Y.

Stevens Valve Stem Reamer

By the use of the valve stem reamer guide and the special reamer, the worn valve guides of the Ford motor may be reamed 1/64 in. and fitted with the special valves having an oversized stem. The reamer guide is held in the valve seat by means of a clamp bolted in an adjacent cylinder-head bolt hole, holding the reamer in alignment and insuring an accurate job. The special valves supplied are of good quality, having the head electrically welded to the stem, which is 1/64 in. oversize. Price, valve stem reamer, $1.50; valve stem reamer guide, $1.50; oversize valves, 20 cents each.—Stevens & Co., 375 Broadway, New York.

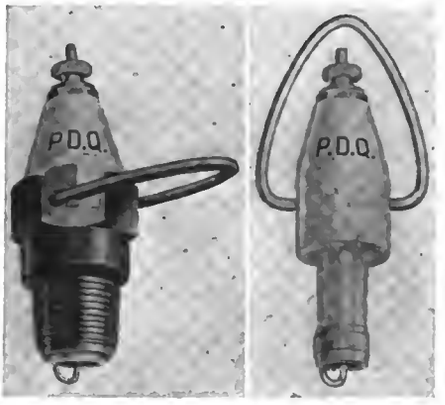
Amazon Tire

The Amazon is a reinforced non-skid tire, as shown in the illustration. Just below the outer edges of the tread heavy breaker strips are placed above the fabric body. It is claimed that these strips absorb the shocks and strains that otherwise would be transmitted direct to the tire carcass, and thus increase the life of the tire. Price, 30 by 3½, $14.75; 32 by 3½, $17; 34 by 4, $24.50, and 36 by 4½, $35.50.—Amazon Tire & Rubber Co., Akron, Ohio.

Genolite Lighting System

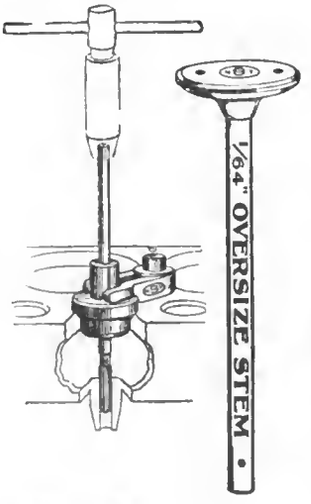
This lighting system for Ford cars includes a 2-volt generator, a single-cell storage battery, two side lights, a tail light and a switch, together with all brackets and wiring necessary to make the installation. The generator is mounted on a bracket secured by the two hose-coupling bolts to the forward end of the motor. The cut-out mounted on this bracket automatically connects and disconnects the generator and the battery at the varying engine speeds. The generator is driven by a spiral wire belt from a split pulley attached to the fan.

Genolite lighting system complete outfit



P. D. Q. spark plug which operates on the bayonet lock principle to simplify cleaning and priming

Allen gloves are made in several styles. This has a detachable inner glove



Stevens valve stem reamer for Fords

The wiring is of the grounded system, the wires being of various colors and properly labeled to eliminate wrong connections. The battery is of 40-amp.-hr. capacity and guaranteed for 15 months. The generator will generate from 8 to 10 watts, and is said to be more than ample to take care of the complete lamp load. No machine work is required in the installation, and it is claimed that the work may be done in 2 hr. Price, $19.85, f.o.b. Detroit.—Detroit Starter Co., Detroit, Mich.

P. D. Q. Spark Plug

The P. D. Q. is a two-pieced plug having a detachable porcelain. The union between the porcelain and the shell is made tight by accurately machining the joint, and is held by means of a bayonet catch. The construction is claimed to be durable, to permit easy inspection and cleaning, and to offer a ready means of priming. The plug is made either with the ½-in. standard S. A. E. or metric thread. Price, $1; extra porcelain, 75 cents.—Wolverine Spark Plug Co., Detroit.

Universal Master Wrench

A new principle is employed in this wrench, which may be used for turning square or hexagonal nuts, or for pipe. It has a non-adjustable V-shaped jaw, one side of which has fine, sharp teeth and the other is provided with a transverse V-block which slides on this member of the jaw. This block is so shaped that it will receive a square nut, a hexagonal nut or a pipe or rod and as soon as pressure is applied to the handle, will jam the work firmly against the other jaw. Quick adjustment is provided because it is only necessary to move the V-block along the jaw and there is nothing to hinder this motion.—Shepard-Prince Co., 18 East Forty-first St., New York City.

A section of the Amazon reinforced non-skid tire, showing strong inner structure

Industrial Miscellany

Factory

Goodyear Tire & Rubber Co., Akron, Ohio, has leased 10,000 acres of cotton land near Chandler, Tex., and has engaged E. W. Hudson, formerly government cotton expert, to take charge of the plantation. The company will engage in the raising of long staple Egyptian cotton for the manufacture of automobile tires, it is stated.

Shortage of skilled labor grows more acute each day, and the condition is general throughout Wisconsin. The motor car and truck industry is feeling the result. The Four Wheel Drive Auto Co., Clintonville, Wis., is advertising heavily in Milwaukee and Chicago newspapers for fifty turret and engine lathe, milling machine and drill press operators; ten bench hands; ten assemblers, and two inspectors, but has been able to get only a very small number of men. From 800 to 1200 skilled machinists would be given immediate employment if they were available.

At the present rate of rubber plant growth and activity in Akron it looks as if 15,000 more men would be needed in that city by March of the coming year.

The Firestone Tire & Rubber Co. is now employing 7000 men as against 3500 last year. This company now has four new buildings under construction, Goodyear has eleven, Goodrich five, and Miller two.

The Miller company used to employ 500 men. It now has 1750 on its payroll. The Goodrich factory, biggest of all, now has 14,000 employees and is unable to obtain the 2000 additional which are needed.

Production at the plant of the Westcott Motor Car Co., Springfield, Ohio, has increased about two and one-half times that of a year ago and a further increase is expected within the next half year. The present output is twenty-five cars a day.

Last July the factory was removed from Richmond, Ind., to its present location. The company was organized in Richmond in 1869 and became prominent as a manufacturer of horse-drawn vehicles. The increased demand for its automobile necessitated the removal to larger quarters, which are used entirely for the manufacture of the car.

The new plant consists of a three-story building, consisting of 176,000 sq. ft. of manufacturing space.

Macon Motor Car Sales Co., St. Louis, will be organized at once to sell The Macon, a car assembled at the factory of The All Steel Automobile Co., Macon, Mo. Salesrooms at 2206 Locust Street have been leased.

"Efficient Methods in Making Brake Lining Renewals" is the title of a folder recently issued by General Asbestos & Rubber Co., Charleston, S. C., manufacturer of the Garco brand of brake lining. This folder is written in plain, understandable style, and is designed to enable the inexperienced motorist to reline his brakes with perfect success.

Anger Engineering Co., 301-305 Sixteenth Street, Milwaukee, which manufactures the A. E. C. custom-built cars and operates a large service shop, has completed arrangements for the establishment of a large new plant at Twenty-sixth and State Streets, Milwaukee. The building will be of fireproof construction, 130 by 120 ft., one-story and basement, and contain the machine shop, factory, service shop and a public garage, together with offices and salesroom for the Ford agency recently acquired by the Anger company, and now conducted in separate quarters at 1517-1519 State Street.

Monarch Tractor Co., Chicago, has taken over the John Dornfeld Iron Works, Watertown, Wis., which in recent months have been devoted to the manufacture of farm tractors and sugar cane harvesting machinery. The Monarch company, a South Dakota corporation, is capitalized at $250,000 and now has more than $400,000 worth of orders booked. The tractor is styled the Never-Slip and is built in sizes from 6 to 50 hp. The 45-hp. type is used as the motive power of the Luce sugar cane harvester, an 11-ton machine which does the work of forty to sixty men on sugar plantations.

Maxwell Motor Co. at Kansas City, Mo., has already started work on the new assembling plant there, which will be ready for occupancy about the first of the year and which will cost $300,000. Bids are in for the erection of a large assembly plant at Windsor, Canada, where the Maxwell company plans to erect a building 100 by 300 ft., four stories high. It is planned to establish a chain of assembly plants throughout the country, and a site has already been secured at Minneapolis.

The Automobile Calendar

ASSOCIATIONS

Nov. 22—Boston, Mass., National Assn. of Automobile and Accessory Jobbers' Meeting.
Dec. 2-9—Electricians' Country-wide Celebration.
Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.
Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.
Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.
Nov. 16—New York City, S. A. E. Meeting.
Nov. 23—Philadelphia, Pa., S. A. E. Meeting.
Dec. 7—Baltimore, Md., Safety First Convention of Safety First Federation of America.

CONTESTS

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.
Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race. Arizona State Fair.
Nov. 24 and 25—Newark, N. J., 24-Hr. Endurance Run of N. J. Automobile and Motor Club.
Nov. 30—Uniontown, Pa., Speedway Race.
Nov. 30—Los Angeles, Cal., Ascot Speedway 200-mile Championship Race.

1917

April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23—Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 14—Des Moines, Iowa, Speedway Race, Championship.
July 28—Tacoma, Wash., Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15—Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race, Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13—Chicago Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Nov. 10-18—Providence, R. I., Show, Rhode Island Automobile Dealers' Assn.
Nov. 20-25—Worcester, Mass., Show, Worcester Casino; Worcester Automobile Dealers' Assn.
Dec. 2-9—Springfield, Mass., Show, Auditorium. H. W. Stacey, Mgr.
Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel I. R. Gates, Mgr.
Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.
Jan. 6-13—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 9-10—Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.
Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.
Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 23-27—Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.
Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.
Feb. 19-24—Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.
Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.
Feb. 26-March 3—Omaha, Neb., Show: Auditorium, Omaha Automobile Show Assn.
March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co., Armory of the University of Ill.
March 6-10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 14-17—Davenport, Ia., Show, Coliseum Bldg., Tri-City Automobile Trade.

Personal

Charles Drum has been made the superintendent of production for the Springfield Body Co. Mr. Drum was formerly connected with the Haynes Mfg. Co.

The Springfield Body Co. will move to its new plant at Springwells, near Detroit, by Feb. 15 and will have a capacity of 100 bodies per day. At present the company has a capacity for thirty-five bodies daily.

Calvin Dunlap has become the vice-president of the International Commercial Corp. of New York. Mr. Dunlap was formerly the export manager for the Hupp Motor Car Co.

J. E. Turk, formerly connected with the Thomas B. Jeffery Co., Kenosha, Wis., has been appointed sales representative of the Chalmers Motor Corp. in Central West territory.

C. F. Barth has been appointed works manager for the C. F. Wilson Body Co. Mr. Barth was formerly the factory and production manager for the Murphy Chair Co.

A. E. Gluck, purchasing agent for the Packard Motor Car Co., New York City, has resigned. He has become president and general manager of the Abbott Motor Equipment Co., this city, distributor for the Warner lens, Block mirrorscopes, Amsco jacks and Twombly foot pumps. S. S. Frankenstyne remains as treasurer and sales manager. H. T. Stevenson succeeds Mr. Gluck as Packard purchasing agent, while W. C. Lyons takes up his work as head of the accessory department.

A. S. Gilchrist has been appointed manager of the Maxwell Motor Sales Corp., Baltimore, Md. He succeeds L. A. Tilley, who resigned. E. A. McKee, of the efficiency sales promotion department of the Maxwell company, has been attached to the local office indefinitely. Mr. Gilchrist is a former newspaper man, but has been with the Maxwell company for more than three years. He has been attached to the sales department and was also southwestern manager with headquarters at Houston, Tex.

J. R. Blocher, formerly branch manager of the Prest-O-Lite Co., in Baltimore has been appointed division manager and will make his headquarters here. E. W. Carpenter, who has been with the company for a long time becomes branch manager in Baltimore.

J. A. Muir, who was with the D. E. Truck Co. in Baltimore and for a number of years with the Mar-Del-Mobile Co., Packard and Saxon agents, has been appointed sales manager of the Monumental Motor Car Co., Kisselkar representative.

A. E. Hertzig, manager of the Baltimore branch of the Goodyear Tire & Rubber Co., Akron, O., has been appointed manager of the Washington branch of the company and will take care of the territory in both sections. L. J. Gemmil, who was manager of the Washington hranch will look after all of the government business exclusively.

E. T. Cole, manager of the Akron Tire & Rubber Co., Baltimore, Md., Ajax distributor, has taken the state agency for the Cleveland Standard Tire & Rubber Co. Charles E. Brooks will be in charge of the wholesale business throughout the state.

Harry Lowenstein has become manager of the R. M. Stein Co., Baltimore, Md. F. M. Sandy has become sales manager, and Charles Foutz, factory superintendent. The company operates two separate lines and handles the Moon and Ford.

A. E. Dixon has been made a member of the advertising department of the Chalmers Motor Co., Detroit. Before joining the staff of the Chalmers he was connected with the advertising departments of the Hupp Motor Car Corp. and the Packard Motor Car Co. Mr. Dixon will edit Chalmers Shop and Service, and will prepare pamphlets and other literature. The Chalmers Illustrated News has recently made its appearance.

A. H. Bailey has entered the Chemi Co., Richmond, Va., and has been elected vice-president.

M. A. Steele, late manager of the Henney Buggy and Stephens Motor branches of the Moline Plow Co., at Freeport, Ill., has been appointed general sales manager of the Stephens Motor branch with headquarters at Moline, Ill., H. J. Leonard, who has been assistant manager, succeeds Steele at Freeport.

F. C. Herschbach, of St. Louis, has resigned as assistant sales-manager for the Commercial Auto Body Co. of that city, for a similar position with the R. Haas Electric & Mfg. Co., Springfield, Ill.

G. O. Smalley has been elected first vice-president and general manager of the Bound Brook Oilless Bearing Co., Bound Brook, N. J. He succeeds the late Leigh Stanley Bache.

F. H. Whitman, formerly of Dodge Brothers, Detroit, has been appointed production engineer of the National Motor Vehicle Co., Indianapolis.

H. H. Brooks has been appointed superintendent of agencies at the Madison plant, Anderson, Ind. Brooks was one of the original incorporators of the Marathon Motor Works, Nashville, Tenn., where he served several years as sales and advertising manager. He was later connected with the Wayne Works, Richmond, Ind., and still later with R. A. Palmer in the Pontiac Chassis Co., Pontiac, Mich., in the same capacity.

Alvan T. Fuller, who handles the Packard line in Eastern New England from Portland, Me., to Providence, R. I., has been elected to Congress from Massachusetts. He entered the fight at the last minute as an independent against Congressman Ernest Roberts.

Dealer

Studebaker line has been dropped by the Corson-Berry Co., Springfield, Mass., and the Paige taken on its place. The Becker-Stutz Co., has taken on the Studebaker and moved to new salesrooms. W. F. Cassidy, who has the Grant Six, has moved into new quarters. The Western Massachusetts Longford Co. has shifted to 453 Worthington Street. The Harrington-Gifford Co. handling the Hudson Six, has also moved.

National Sales Co. has been organized at Providence, R. I., to handle the National line for Rhode Island.

Studebaker Corp., Worcester, Mass., has moved to temporary quarters on Main Street until its new building is finished.

Auto Trading Co., Pittsburgh, Pa., has taken over the Metz interests in that part of the State.

The Chevrolet Motor Co., of New York, has just opened a branch in Worcester, Mass.

The Springfield Body Co. has opened a branch at New York City in the Locomobile building, 16 West 61st Street, and has sent Charles Baasch on from the factory to take personal charge of it.

W. L. Patterson, St. Louis, has added Whitemore's automobile grease to the line handled by him at 3218 Locust Street.

Newsome Valve Co., St. Louis, has been organized to manufacture a tire tube invented by J. M. Newsome.

Auto-Devices Co., St. Louis, has taken the agency for the Hi-Comp piston ring. Salesrooms are at 3212-14 Locust Street.

Geller, Ward & Hasner Hardware Co., St. Louis, is territorial distributor of Prismolite lens.

Auto Sales Co., St. Louis, has removed into larger quarters at 908-10 Chestnut Street and becomes agent for the Wesco garage heating systems.

J. T. Conaghan has opened a garage and sales agency in Pekin, Ill., and will handle the Ford car, succeeding the Pinkerton Co., which retires from the Pekin field.

Bosch Magneto Co. has appointed the following new service stations: A. L. Ebbeson, Bangor, Me.; Auto Service Co., Bridgeport; Connel Wilson Electric Co., Jacksonville, Fla.; Harrington Motor Co., Mobile, Ala.; Garlock & Haynes, New London, Connel Auto Ignition Co., San Jose, Cal.; Essanell Electric Co., St. Paul; Tonopah Electric & Tire Co., Tonopah, Nev.; Tri-State Garage Co., Uniontown, Pa.; Tourist Garage & Motor Repair Co., Wilmington, Del.

Willys-Overland, Inc., selling organization has opened a direct branch at 33 Allyn Street Hartford, Conn., and succeeds in business The Overland-Hartford Co., at the corner of Allyn and High Streets. E. C. Bowman is manager of the new branch and associated with him is F. C. Brown, also a factory man. I. F. Maxson, manager of the Overland Hartford Co. will represent the Toledo factory in another capacity.

G. H. Grabb, Haynes and Auburn distributor, Hartford, Conn., has removed his salesroom to 289 High Street.

Keeney Truck Sales Co., 120 Allyn Street, Hartford, Conn., has taken over a portion of the Mattison building at the corner of Albany and Center Streets, and will use it as a service department for Selden and Vim commercial vehicles.

Adams-Bagnall Electric Co., Cleveland, Ohio, is now completing an addition to its factory with the installation of a complete vitreous or porcelain enameling plant.

Norton Monsarrat and Captain I. I. Morrison have organized the Stewart Motor Sales Co. for the purpose of handling Stewart trucks in central Ohio territory. They have opened sales room and a service station at 103 North Front Street, Columbus.

The Automobile

Vol. XXXV
No. 21

NEW YORK, NOVEMBER 23, 1916

Ten cents a copy
Three dollars a year

NO DULL-WINTER-SEASON FOR

Stewart Products

Stewart Products have a sale the whole year 'round—365 days in the year. A dull-Winter-business period is unknown to Stewart Products.

A Stewart Speedometer is just as necessary in winter as in summer.

A Stewart Warning Signal is absolutely indispensable for winter driving, when cars are enclosed.

The Stewart Vacuum System facilitates starting in cold weather—provides the only satisfactory gasoline feed.

A Stewart Tire Pump is certainly needed in the winter time.

Every engine needs a set of Stewart V-Ray Spark Plugs. A big, fat spark—intense and unfailing—is assured. Makes starting easier and insures smoother running of the motor.

Motoring is rapidly losing its seasonable aspect. No longer is the automobile for summer use only. This winter at least 75% of the automobiles will be in use most of the time. Comparatively few cars will be put up for the winter.

Can't you see the possibilities for a big winter business on Stewart products?

Stewart PRODUCTS

PRESTIGE QUALITY SERVICE SATISFACTION MADE IN U.S.A.

STEWART-WARNER SPEEDOMETER CORP.
Chicago, U. S. A.

Stewart Speedometer for Fords $10

Stewart Motor Driven Warning Signals $6

Stewart Tire Pump $12

Stewart Hand Operated Warning Signal $3.50

Stewart Speedometer $25

Stewart Spark Plug $1

Warner Auto-Meter $50

Stewart Vacuum System $10

The Automobile

Vol. XXXV New York—Thursday, November 23, 1916—Chicago No. 21

G. M. C.—$2,250,000 Per Month

37,884 Cars Sold in 3 Months—Co. Does 17% of Car Export Business

G. M. C. FINANCIAL FEATURES

Monthly earnings	$2,250,000
Cash on hand	20,302,682
Drafts outstanding	2,643,445
Inventory	30,000 000
1917 plant expansions	2,055,000

NEW YORK, Nov. 22—General Motors Co. earnings are averaging $2,250,000 per month, according to President W. C. Durant, who also reported to the stockholders' annual meeting in Jersey City yesterday that cash and drafts on hand Nov. 15 amounted to $22,946,000, as compared with $11,311,000 on the same day last year. Mr. Durant stated that the company is doing 17 per cent of the entire export business in passenger cars, and that production for the 3 months ending Oct. 31 was 37,884 cars, a gain of 7612, as compared with the 30,272 manufactured in the same period of 1915.

The stockholders re-elected Mr. Durant president, and made Pierre S. du Pont chairman of the board. A. G. Bishop and C. S. Mott were elected vice-presidents. H. H. Rice is treasurer; T. S. Merrill, secretary; M. L. Prensky, comptroller; Standish Backus, general counsel; L. J. Kaufman, Charles H. Sabin and J. J. Raskob were elected members of the finance committee; and W. C. Durant, A. G. Bishop, C. S. Mott, Weston-Mott; W. E. Chrysler, Buick; W. C. Leland, Cadillac; F. W. Warner, Oakland; W. L. Day and R. H. Collins, General Motors Truck, are members of the executive committee.

Large blocks of material have been acquired by all the General Motors' subsidiaries to take advantage of low priced contracts to provide for increased output. The inventory is now about $30,000,000, or 25 per cent greater than required in normal times. A 20 per cent increase in output by all subsidiaries was predicted by Mr. Durant for the 1917 fiscal year of the company. Cadillac had dealers' orders for 24,000 cars, while at the present rate of production output will reach only 16,500 to 18,000 cars for this season.

Expenditures for improvements and extensions to the plants of the General Motors subsidiaries during the coming year will amount to $2,055,000.

The stockholders passed a resolution reducing the board of directors from seventeen to fifteen members. The retiring board was re-elected with the exception of A. H. Wiggin, president of the Chase National Bank, who declined re-election. One vacancy remained unfilled, so the board is now made up as follows: Pierre S. duPont, chairman; F. L. Belin, A. G. Bishop, W. P. Chrysler, R. H. Collins, W. L. Day, W. C. Durant, J. A. Haskell, L. G. Kaufman, W. C. Leland, J. H. McClement, C. S. Mott, J. J. Raskob, C. H. Sabin and F. W. Warner.

Chapin and Coffin Return from Mexican Border

DETROIT, MICH., Nov. 20—Roy D. Chapin, president of the Hudson Motor Car Co. and Howard E. Coffin, vice-president, have returned to Detroit from the Mexican border where they made a study of motor car conditions and of the use of the motor truck and the aeroplane.

Herman with Bour-Davis

DETROIT, MICH., Nov. 20—L. G. Herman has been appointed production and factory manager of the Bour-Davis Motor Car Co. Mr. Herman was formerly with the Rutenber Motor Co.

Alter Erecting Plant in Grand Haven

GRAND HAVEN, MICH., Nov. 22—The Alter Motor Car Co. is erecting a plant in this city consisting of four buildings which will be ready Dec. 15.

$20,000,000 Cord Tire Co.

Fabricord Tire Co. Absorbs Knight Tire Co.—To Add Other Units

CANTON, OHIO, Nov. 21—*Special Telegram*—As the first step in a merger of tire manufacturing concerns to represent a total capitalization of $20,000,000, the Knight Tire & Rubber Co., this city, has been absorbed by the Fabricord Tire Co., of which N. W. McLeod of St. Louis is president. The Fabricord Tire Co. is being formed for the purpose of welding together into one great organization several rubber manufacturing units and will devote particular attention to the production of cord tires under the McLeod patents. Capitalists of New York, Chicago and St. Louis are interested.

Cordin Leaves Packard

DETROIT, MICH., Nov. 20—A. E. Cordin has resigned from the Packard Motor Car to join the Pluyn-Ochs Co., importer into Russia of automobiles and accessories. Mr. Cordin, who has been Packard assistant sales manager for 6 years, will go to Petrograd to organize a branch for the Pluyn-Ochs company who plans a large expansion following the present war.

Packard Adjusts Organization

DETROIT, MICH., Nov. 20—H. H. Hills, sales manager of the Packard Motor Car Co., has been appointed to the position of assistant general manager. C. R. Norton, manager of truck sales, has been made the general sales manager. G. R. Bury, manager of carriage sales, has been promoted to the position of assistant general sales manager. These promotions are made to adjust the organization following the resignation of A. E. Cordin.

700,000 Ford Cars for 1917

Big Export Trade Planned—Factory in England—Dodge Suit Hearing Adjourned

DETROIT, Nov. 16.—The Ford Motor Co. plans to build 700,000 cars in 1917, entering automobile markets in every corner of the earth, and has investigators now seeking complete information in Russia, South America, France, England, other European countries, and the various English colonies. The company employs 50,000 men, is under a daily expense of $800,000, and is 150,000 cars in arrears. Ford stockholders have received $4,000,000 in dividends since July 31, when the fiscal year ended, and another large cash dividend is being contemplated for Jan. 1, 1917. On Nov. 9, stockholders were voted a 100 per cent dividend on the $2,000,000 capital stock. The company purchased material between July 31 and Nov. 11 amounting to $7,304,345.89, and had a bank balance in cash of $37,938,528.21 in various banks on Nov. 13, 1916. These and many other sums and plans of magnitude were revealed at the hearing of the suit instituted by Dodge Bros. against the Ford Motor Co. to restrain Mr. Ford from spending undivided profits in factory expansion. Other points determined by the hearing show Mr Ford's salary to be $150,000, and that of C. H. Wills, factory manager, to be $80,000 yearly.

Mr. Ford said that in addition to the Manchester plant in England, with a capacity for assembling 18,000 cars yearly, and the Canadian Ford plant with a capacity of 30,000 to 35,000 cars per year, the company will erect a plant in Southampton, England, with a capacity for the complete manufacture of 40,000 cars yearly. This, he said, is done to meet the plan of the allied nations to get together after the war and buy only in those countries favored by the allies.

Mr. Ford defended his policy of price reduction, and said the last reduction of the touring-car price to $360 was made to insure a 500,000 production, and that this mark was reached with a profit of about $6,000,000 to the company.

He admitted plans for the erection of blast furnaces at a cost of $11,000,000, and declared that he had samples of the iron made by the old cupola method and by the new method to be used in his plant, and that the difference was so great that its advantages could be easily observed by an inexperienced person. He estimated the saving effected by the new method to be between $10 and $15 per car, and thought it would take about 1 year to make up the expenditure of $11,000,000 for the new blast furnaces.

F. L. Klingensmith, vice-president of the Ford Motor Co., testified that the dividends for the year ending July 31, 1915, were $13,000,000, special, in addition to the regular 60 per cent dividend of $1,200,000. The next year the special was $5,000,000, in addition to the regular $1,200,000, or 60 per cent dividend. The company's cash balance on July 31, 1916, was approximately $52,000,000.

Owing to the refusal of W. L. Dunn, vice-president of the Highland State Bank to testify, the case has been adjourned until Friday.

Detroit's 1916 Output 960,000

DETROIT, MICH., Nov. 17—The value of automobiles produced in Detroit for 1916 amounts to $650,000,000 as compared with $330,000,000 in 1915. Automobile makers produced 960,000 cars during the present year, a gain of over 100 per cent, as compared with the 450,000 cars built in 1915. The report, given by the Bradstreet company, also shows that the automobile makers have erected four individual plants, each costing more than $100,000, and include the structures built by Chalmers, Packard and Continental Motors.

Woodard President of Gillette Tire

EAU CLAIRE, WIS., Nov. 18—S. P. Woodard has become president of the Gillette Safety Tire Co., this city, maker of the Gillette tire. Mr. Woodard recently resigned as general sales manager of the New Jersey Car Spring & Rubber Co., Jersey City, N. J. His office as president of the Gillette company will be in New York.

Myers with General Engineering Co.

DETROIT, MICH., Nov. 17—T. P. Myers has joined the staff of the General Engineering Co. and will have charge of the Doble steam power plant development in the truck field. Mr. Myers was formerly manager of the truck division of the Packard Motor Car Co. in New York.

Pettit J. I. Case Vice-President

RACINE, WIS., Nov. 21—F. R. Pettit, has been appointed vice-president of the J. I. Case Plow Works, Racine, to take effect Jan. 1. He is now general purchasing agent of the J. I. Case T. M. Co.

Hastings Holley Chief Engineer

DETROIT, MICH., Nov. 16—D. T. Hastings has become chief engineer of the Holley Brothers Co., maker of the Holley carbureter.

Gloetzner Covert Chief Engineer

DETROIT, MICH., Nov. 22—A. A. Gloetzner, has become chief engineer and manager of sales of the Covert Gear Co. He was formerly chief engineer of the Bour Davis Co.

Velie Companies Merge

More Efficient and Economical Operation—Capital Increased to $2,000,000

MOLINE, ILL., Nov. 20—The Velie Motors Corp. has been formed as a result of the merger of the Velie Motor Vehicle Co., maker of the Velie automobile and the Velie Engineering Co., maker of the Velie truck. The merger does not affect the Velie Carriage Co. which will continue to be operated as a separate institution manufacturing a full line of horse-drawn vehicles.

The capital stock of the Velie Motors Corp. has been increased to $2,000,000, accomplished without the introduction of new capital. Velie stock is not available on the open market.

The personnel of the directorate remains unchanged.

Gaulois Tire Changed to Bergougnan—To Manufacture in United States

NEW YORK CITY, Nov. 21—The Etablissements Bergougnan of Clermont-Ferrand, France, maker of the Gaulois tire, has changed the name of its product to Bergougnan, in both solid and pneumatic types, and will build tires in this country.

The works of the company in France have been taken over almost entirely by the French War Department and the working force is kept busy day and night turning out solid tires for the quartermasters of the army for use on the ammunition and other trucks.

This has seriously interfered with the shipment of tires to this country until now the company proposes to manfacture all of its straight side tires here.

Although this is announced as a temporary measure imposed by the necessities of the war, it is not at all unlikely that it may result in the establishing of a Bergougnan factory in this country.

The American made tire will be offered to the public Dec. 1.

Take Up Woodard's Sales Duties

JERSEY CITY, N. J., Nov. 20—J. W. Paul and L. K. Rittenhouse will have charge of the sales of the mechanical goods and tire department, respectively, of the New Jersey Car Spring & Rubber Co., this city, thus taking up the duties vacated by the recent retirement of S. P. Woodard as general sales manager. Mr. Paul has been assistant sales manager of the company, and was formerly manager of the Diamond Rubber Co.'s Pittsburgh branch. Mr. Rittenhouse comes from the Norwalk Tire & Rubber Co.

Standard Parts Co. Formed

Perfection Spring and Standard Welding Consolidated in $35,000,000 Merger

CLEVELAND, OHIO, Nov. 22—*Special Telegram*—The Standard Parts Co. of Cleveland has been formed by the consolidation of the Perfection Spring Co. and the Standard Welding Co. of this city. The new company is capitalized at $35,000,000, consisting of $10,000,000 in 7 per cent cumulative preferred stock, of which half is issued now, and $25,000,000 common stock, of which $8,000,000 is issued now. Borton & Borton are offering $4,000,000 preferred to the public at par. The common stock to be issued has been underwritten by a syndicate and will not be publicly offered.

Officers for the new company have not yet been determined, but the board of directors includes J. H. P. McIntosh, Sr., F. F. Prentiss, H. P. McIntosh, Jr., T. E. Borton, Christian Girl and E. W. Farr, all of Cleveland, and A. H. Goss of New York.

The consolidation eliminates friction regarding the Perlman Rim patents as the Standard Parts Co. has contracts with the Perlman interests, permitting manufacture of demountable rims at a fair profit.

Holders of Perfection Spring preferred stock will receive Standard Parts Co. stock share for share. With Perfection preferred figured at $110 a share, they may, if they desire, take one share of Standard Parts preferred plus $10 cash or $110 a share cash for each share of Perfection preferred. Holders of Perfection common are offered two shares of Standard Parts common for one of Perfection. As Standard Parts common is underwritten at $85 a share, this is equivalent to $170 a share for Perfection.

Holders of Standard Welding stock receive $250 a share cash with the privilege of joining the syndicate underwriting Standard Parts common to the extent that they may underwrite half as many shares of Standard Parts common as they owned of Standard Welding.

The consolidation will constitute the largest maker of automobile springs in the world and one of the largest producers of automobile rims, bands and facings for solid tires, bicycle and motorcycle formed parts and light gage steel tubing. Both companies have a vast amount of business on hand and are covered for the future on raw material.

Sun to Market Single Chassis

ELKHART, IND., Nov. 20—The Sun Motor Car Co. will market a single chassis for 1917 and this will carry five-passenger touring, seven-passenger touring, four-passenger roadster and five-passenger sedan bodies, the prices remaining $1,095 to $1,295. The standard finish of all bodies is royal blue with cream wheels, and equipment includes the newest type of slanting windshield. The car is powered with a 3⅛ by 5 detachable-head, block-cast motor, and power is transmitted through Borg & Beck plate clutch to a three-speed gearset; the axle is floating. Other specifications include Remy starting, lighting and ignition, Rayfield carbureter, Stewart vacuum fuel system, and Jacox steering gear. The wheelbase is 116 in. and the tires are 34 by 4, non-skid in rear.

Moyer Resigns from Champion Ignition

DETROIT, MICH., Nov. 17—Arthur W. Moyer has resigned his position with the Champion Ignition Co., where he handled the factory business. Mr. Moyer was formerly with A. R. Mosler & Co. He will return to his original business, the Moyer-Shaw Mfg. Co.

Merrill Purchasing Agent for Hood

DETROIT, MICH., Nov. 16—Instead of R. B. Newell, as announced last week, it was R. B. Merrill who was appointed as purchasing agent for the Wallace C. Hood Service Bureau. Mr. Merrill was formerly connected with the Packard Motor Car Co.

Macey Harroun Sales Manager

DETROIT, MICH., Nov. 20—J. W. Macey has been appointed sales manager of the Harroun Motors Corp. Mr. Macey was formerly connected with the Ford Motor Co.

Taylor with White Star Refining

DETROIT, MICH., Nov. 20—Kirk Taylor has been appointed sales manager for the White Star Refining Co. Mr. Taylor was formerly with the Evapco Mfg. Co.

Collins to Join Parker Rust Proof

DETROIT, MICH., Nov. 17—B. W. Collins, formerly assistant to Walter Fry, president of the Springfield Body Co. has joined the staff of the Parker Rust Proof Co.

Cornelius with Parker Rust Proof

DETROIT, MICH., Nov. 20—W. M. Cornelius has been appointed as assistant to the president of the Parker Rust Proof Co. Mr. Cornelius was formerly the secretary of the Security Commission at Lansing.

Selden Truck Co. Advances Dupuy

ATLANTA, GA., Nov. 21—C. L. DuPuy, who for the past 5 years has been representing Selden trucks in the local territory, will, on Dec. 1, become southern division sales manager of the Selden Truck Co., Rochester, N. Y.

Five Cos. Raise Car Prices

Packard, Kissel, Marmon, Empire and Paige Feel High Production Costs

DETROIT, MICH., Nov. 20—Packard Motor Car Co. has increased the price of the model 225, the smaller Twin-Six, $185, and the larger Twin-Six, model 235, $235, making the new prices, $3,050, and $3,500 respectively on all open cars. This applies to all deliveries after Feb. 1 and before that date to any cars built after 4500 of the new models have been produced. Increased cost of manufacture is the reason for the raise.

Kissel Price Advance Determined

HARTFORD, WIS., Nov. 21—The Kissel Motor Car Co. will increase the prices of the Hundred Point Six models on Dec. 1, 1916. The five-passenger touring and three-passenger roadster, not built for the All-Year top will be $1,195, an increase of $100. The four- and five-passenger Gibraltar models, built for the All-Year top will advance from $1,195 to $1,285; the five-passenger Victoria, with the detachable town car top will be $1,950, an increase of $100; the five-passenger All-Year Sedan and the four-passenger All-Year Coupé, both including the summer tops will advance from $1,520 to $1,635. Wire wheels will be supplied for $100 extra.

Marmon Prices Will Advance $150

INDIANAPOLIS, IND., Nov. 20—Nordyke & Marmon Co., will advance its prices $150 on Jan. 1, 1917. The new prices will affect cars purchased from this date for delivery after the first day of the coming year. Cars ordered, however, for delivery before Jan. 1, will be sold at the old prices. The Marmon touring car is now selling at $2,950.

Empire to Advance Prices

INDIANAPOLIS, IND., Nov. 20—The Empire Automobile Co. will advance prices on all its models soon after Dec. 20. Dealers are guaranteed present prices only until that date. The advance probably will be between $70 and $100.

Paige to Increase Prices

DETROIT, MICH., Nov. 20—The Paige-Detroit Motor Car Co. will increase the prices of its cars on Jan. 1, 1917.

Doak Joins Ohio Electric

TOLEDO, Nov. 22—R. R. Doak has become assistant sales manager of the Ohio Electric Car Co., this city. Mr. Doak was formerly manager of the St. Louis branch of the Woods Motor Vehicle Co., Chicago.

Akron—The Miracle Tire City

$203,100,000 Worth of Rubber Products Manufactured—54,000 Tires a Day

AKRON, OHIO, Nov. 17—More than 11,522,650 tires will mark the total production from Akron for 1916. Business for the year will amount to $203,100,000 gaged by the output of the past 11 months, an increase of 65 per cent over the preceding year. Some idea of the vast and stupendous industry may be had from the fact that 158,315 freight cars are necessary to carry the year's production to the various destinations. The City, which in 1910 had a population of only 69,000, now has 51,150 people employed in rubber manufacture. Floorspace covering 88 acres and machinery costing more than $2,500,000 have been added in 1916 and 12,005,000 sq. ft. of floorspace is now devoted to the rubber industry. Present capacity as increased by recent additions allows a daily total output of 54,000 tires.—19,837,750 for 12 months. This is approximately equal to existing demand and it is a safe prediction to state that Akron will manufacture more than 20,000,000 tires in 1917.

Every factory is operating to full capacity, erecting still more buildings, planning on a greater increase of machinery, and bending every effort to meet the constantly growing demands. Goodrich has added 21 acres of floorspace and hundreds of intricate and expensive machines to its plant, and at present is erecting new structures as quickly as men and materials can be secured. The company has a total floorspace exceeding 100 acres. The numerous buildings stretch over many of Akron's streets and are connected by a tunnel system more than 5 miles long. Over 20,000 men are employed, who work in three 8 hr. shifts. Business for this year, judged by a report of the first 8 months, will total $77,000,000 as compared with $55,416,000 in 1915. The daily capacity at the Goodrich plant is 20,000 tires.

Goodyear announces a total business of $63,000,000 for this year as against $37,000,000 in 1915, an increase of 85 per cent. The company employs 15,000 men, occupies 75 acres of floorspace and has a daily capacity of 17,000 tires. Factory additions totaling more than 30 acres have been made in the past year. The company manufactured 2,000,000 tires in 1915, approximately 3,500,000 for 1916, and plans to produce 6,000,000 next year.

Firestone has increased the number of men employed from 3900 in 1915 to 8000 in 1916, an excellent gage to the growth of the institution. Factory additions total 11 acres for the past year and give the company 37 acres of floorspace. The company handles approximately sixty-five freight cars daily for shipment of its products. The factories are unique in construction, manufactured with brick, steel and glass, and consisting of four sections, each 700 ft. long and five stories high, but practically under one roof. Business for 1916 amounts to $33,250,000 as compared with $25,000,000 in 1915. Machinery and other equipment costing $1,500,000 has been added and has increased the daily capacity to 12,500 tires.

Miller, General and Kelly-Springfield, have each enjoyed a remarkable growth. Additions of 24 acres of floorspace have been added to the Miller plant and the capacity has been increased from 1000 to 3000 tires per day. The company manufactured 125,000 tires in 1915, 300,000 in 1916, and plans to produce 500,000 next year.

Swinehart occupies 80,000 sq. ft. of floorspace and increased their business from $1,250,000 in 1915 to $1,500,000 in 1916. It employs 400 men and has a daily capacity for about 500 tires.

General has added 35,000 sq. ft. of floorspace and more than doubled its business in the past year.

An eight-story building is in process of erection on the Miller company's grounds to replace several old structures. When this is completed the concern will have approximately four times as much floor space as they occupied 10 months ago.

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Gillette Tire Installing Machinery

EAU CLAIRE, WIS., Nov. 18—The first shipments of machinery and other equipment for the new plant of the Gillette Safety Tire Co., Eau Claire, Wis., have arrived and are now being installed. It is possible that first operations will be possible shortly after Dec. 1, with the entire works operating by Jan. 1.

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Bukolt Tire Protector in New Plant

STEVENS POINT, WIS., Nov. 18—The Bukolt Tire Protector Co., Stevens Point, Wis., is taking occupancy of its new factory. The output of steel tire protectors will be increased from 50 pairs a day to 300 pairs. The tire protector business will be incorporated as soon as possible and will have a capitalization of about $200,000.

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Auto Body Co. Increases Floor Space

LANSING, MICH., Nov. 17—The Auto Body Co. is erecting ten additional dry kilns which will make a total floor space of 10 acres occupied by the company for the manufacture of their products. The kilns will cover ground 99 by 165 ft. which the company recently purchased.

Briscoe Plant on West Coast

Will Cost $500,000—Mr. Briscoe on Coast to Determine Station

DETROIT, MICH., Nov. 17—The Briscoe Motor Corp., Jackson, Mich., will erect an assembly plant at a cost of approximately $500,000 at one of the larger cities on the Pacific Coast. Benjamin Briscoe, president and L. E. Wilson, vice-president, of the corporation will leave for California in the next few days and will determine the location. The Briscoe factory is reaching out after business on the western coast of South America, as well as Australia, New Zealand, Japan and Russia, and plans to have a plant with a capacity for assembling 20,000 cars a year.

The company has recently completed the factory at Jackson and at the present time occupies 48 acres of floor space in ten separate buildings.

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Dann Products Opens Cleveland Plant

CLEVELAND, OHIO, Nov. 20—The Dann Products Co., maker of Dann spring lubricating inserts, has opened its new plant here. The building is of modern brick and steel construction with ample lighting and ventilation provisions. In spite of the 30,000 sq. ft. of floorspace which the new plant contains, the company is already planning to enlarge it and additional land has been secured for this purpose.

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Fire Damages Saxon Plant

DETROIT, MICH., Nov. 20—Fire at the plant of the Saxon Motor Car Corp., to-day, damaged a structure used for truck production, and a part of the building used for offices, to an extent estimated at $60,000. The loss is covered by insurance and will in no way hinder the productive facilities of the concern. In fact, production was in process within 1 hr. after the fire had been overcome. The fire was started by an employee who held a lantern while he poured gasoline into the truck tanks.

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Anderson Electric Expands Cleveland Plant

DETROIT, MICH., Nov. 17—W. C. Anderson, president; William Lock, treasurer, and Wilson Critzer, auditor of the Anderson Electric Car Co., are in Cleveland, arranging final details for extensions to the company's Cleveland plant, where motors and other parts of Detroit Electric cars are manufactured.

Carl Fisher in Tractor Co.

To Build One-Wheel Machine in Indianapolis—New Factory Being Built

INDIANAPOLIS, Nov. 20—Carl G. Fisher, president of the Prest-O-Lite Co. and also the motor speedway here, has taken another step in the automobile trade following closely upon the announcement of the vacuum brake by his concern a few weeks ago. The latest Fisher activity is in the farm tractor field. For some time it has been known that Mr. Fisher has been in Detroit examining a one-wheel tractor design developed there some months ago. Plans have progressed rapidly for the manufacture of this tractor and to-day a factory is being built here for its manufacture. Concrete for the factory is being poured and the building will be complete in 90 days.

The organization of the company is not entirely completed as yet, but C. B. McCutcheon, president of the Ross Automobile Co., Detroit, will be president. The other officials are not yet known. The services of one of the best known men in the trade has been secured as factory manager.

The one-wheel tractor to be built has been examined by many in the industry during the last year and has been very favorably considered. It has given convincing demonstrations of its ability to work on all kinds of soil.

Ford Tractor Co. Formed in Del.

DETROIT, MICH., Nov. 17—The Ford Tractor Co. has been incorporated under the laws of Delaware to manufacture tractors and other machinery. The capital stock is $1,000,000. Incorporators are W. Baer Ewing and C. M. Hertig, of Minneapolis, and F. D. Buck, of Wilmington, Del.

Lane Here from Australia

NEW YORK CITY, Nov. 22—R. T. Lane, representing the Chevrolet in Melbourne, has arrived in this city. Mr. Lane states that since the outbreak of the war there has been an increasing demand in the Antipodes for goods of American manufacture. Business conditions are prospering in Australia.

Compensating Driving Axle on Market

PHILADELPHIA, PA., Nov. 16—A new device to prevent skidding called a compensating driving axle to take the place of the differential will be put on the automobile market by the A. C. Axle Mfg. Co., this city, formed this year with a capital of $1,000,000 to manufacture this invention for use on old and new cars. This new driving mechanism is equipped with ratchet clutches in the axle, instead of the gear wheel system of the differential. A feature is a positive drive on both wheels. In turning a corner the wheel on the short curve drives the car, the wheel on the long curve compensates the difference.

J. D. Allen, the inventor, has estimated the cost of equipping a car with this invention at $175.

The officers of the company are: J. D. Allen, president; A. P. Fisk, vice-president; A. C. Bunnell, secretary; and H. W. Savage, treasurer.

Cocorda and Giaugue, Peugeot Engineers, Here Visiting Factories

NEW YORK, Nov. 18—Two Peugeot engineers are at present in this country visiting several of the automobile factories. They are Messrs. Guido Cocorda, chief engineer, and Albert Giaugue, chief of the service department of the Peugeot factory in Paris. They expect to be in this country until Dec. 15. At present the Peugeot company is engaged in the manufacture of aviation engines, motor trucks, and munitions. The factory has been more than doubled since the start of the war. The manufacture of passenger cars has practically ceased, but in the near future will be taken up.

Sterns Tire & Tube Co. of Canada Formed

DETROIT, MICH., Nov. 17—The Sterns Tire & Tube Co. of Canada, Ltd., has been formed with an authorized capital of $1,000,000. It will locate at Windsor with a one-story factory, 100 by 150 ft.

Officers of the company include N. J. Morrissey, Pickering, Ont., president; Edward Sterns, St. Louis, Mo., director and consulting engineer; C. J. Gibson and A. S. Chapin, Toronto, directors; E. M. Carruthers, Toronto, secretary and treasurer.

Pirelli Sails for Italy

NEW YORK CITY, Nov. 20—G. A. Pirelli, son of the owner of the Pirelli Tire Co., Bicocca, Italy, who visited this country and South America this year, has sailed for Italy. Mr. Pirelli visited the two countries on account of a possible large sale of the Pirelli tires. While in this country Mr. Pirelli made extensive purchases of machinery for the enlargement of his plants in Bicocca, Italy, Barcelona, Spain and Southampton, England.

Assmus Goes to Cuba for Maxwell

DETROIT, MICH., Nov. 17—C. O. Assmus, in charge of sales promotion of the export department of the Maxwell Motor Co., left Detroit for Cuba, Nov. 16, where he will be stationed for a month.

Ford Cars To Use Kerosene

Holley Kerosene Carbureter On Sale in Ford Sizes in U. S. Feb. 1

NEW YORK, Nov. 18—The use of kerosene as an automobile fuel will probably be considerably forwarded by the fact that the Holley company contemplates selling kerosene carbureters for Ford equipment in this country and England. Beginning with Jan. 1 delivery in England the Holley kerosene carbureter will be sold for equipment on Ford cars; and beginning with Feb. 1 it will be for Ford equipment in the U. S. A.

Duplex Truck Co. Formed—$1,000,000 Capital

DETROIT, MICH., Nov. 20—The Duplex Truck Co., capitalized at $1,000,000, has been organized to take over the Duplex Power Car Co., Charlotte. The new company will move the business to Lansing where a site will be purchased and a factory erected.

This company was the first to build an internal gear-driven four-wheel-drive truck. The Jeffery Quad is built under its license.

Under the new organization H. M. Lee, assistant sales manager of the Reo company, is president and general manager; H. E. Bradner, vice-president; G. W. Hewitt, credit manager of the Reo company, is secretary and treasurer; Harry Harper and Elgin Miflin, directors of the new company. The officers of the old company were F. P. Town, president; Fred Murray, secretary; H. H. Bryan, treasurer, and F. L. King, vice-president.

L-M-H Development Co. to Make Tractors

DETROIT, MICH., Nov. 16—The L-M-H Development Co. has been formed as a holding company capitalized at $30,000 for the development and construction of a tractor, an invention of H. M. Leonard. Incorporators are John Hurlburt, Detroit; H. M. Leonard, who has been chief engineer of the Duplex Power Car Co., Charlotte, Mich., and Clarence Martin, Jackson, Mich. It is later planned to organize a larger company. Mr. Leonard claims that his new tractor will run equally well in either direction and has four speeds forward and also in reverse, that it will turn in a circle the radius of which is its wheelbase, and that it will pull three plows. It is a four-wheel drive, weighs 3300 lb. and will sell for $800. The larger company will probably be organized in July, 1917.

Peugeots Win Road Classics

Resta Captures Championship—Wins Vanderbilt—Aitken Wins Grand Prize

GRAND PRIZE WINNERS

Car	Driver	M.P.H.	Prize
Peugeot	Aitken-Wilcox	85.59	$4,000
Stutz	Cooper	83.74	2,000
Hudson	Patterson	78.13	1,000
Hudeon	Roads	...	500

VANDERBILT WINNERS

Peugeot	Resta	86.98	$4,000
Stutz	Cooper	83.74	2,000
Duesenberg	Weightman	79.46	1,000
Hudeon	Roade	...	500

CHAMPIONSHIP AWARDS

	One	Two	Three	Trophy
A. A. A.	$7,000	$4,000	$2,500	Cup
Boech	2,000	1,000	500	Cup
Goodrich	5,000	3,000	2,000	
Total	$14,000	$8,000	$5,000	

SANTA MONICA, Nov. 22—The two road racing classics, the Vanderbilt, won by Resta, and the Grand Prize, won by Aitken, practically closed the American racing season last Thursday and Saturday on the Santa Monica course. The two events brought forth new records and as keen a competition as has been seen this year. As both races were included in the American Automobile Assn. championship standing with but 660 points difference between the two leaders, Resta and Aitken, it was naturally expected that America's two premier road races would result in a sharp battle for the coveted position as the premier racing driver of the United States, and the championship award of $14,000 given by the A. A. A. and the Bosch and Goodrich companies. Resta had $6,000 difference between first and second position awards, the last race, the Grand Prize, brought out not only keen competition between Resta and Aitken, but also established a precedent in American racing events. As Resta had won the Vanderbilt and had 4100 points much depended on the winning of the Grand Prize by Aitken to overcome his lead in points. Aitken had 3440 points.

As Aitken had dropped out in the first lap on account of a broken piston, his chances for the coveted points were nil. It was, however, thought that if he could take Wilcox's place in his Peugeot and thereby win the race, he would be entitled to a proportionate number of championship points. As a result, quite a little controversy developed when he did win and the precedent was sustained by the A. A. A.

Resta Now Champion

Resta is now the undisputed claimant of the championship title, as Aitken, it is stated, will not race at the Ascot Speedway on Thanksgiving Day, the last championship event. Incidentally, Resta first definitely established his standing as a racing driver in this country at last year's Vanderbilt and Grand Prize by winning both events, a feat never before paralleled. This year he was on his way to repeating the former performance but was put out in the eighteenth lap.

This year the race was run only by the American Automobile Assn. and not under the joint jurisdiction with the Automobile Club of America, which controlled the Grand Prize.

1916 Speedway Champion

Dario Resta

A. A. A. 1916 CHAMPIONSHIP AWARD STANDING

Dario Resta	4100	E. O'Donell	185
*John Aitken	3440	C. J. Devlin	140
Rickenbacher	2210	Arthur A. Klein	125
Ralph De Palma	1790	Jack LeCain	120
W. D'Alene	1120	Barney Oldfield	80
Earl Cooper	1045	Earl Devore	80
Thomae Milton	690	Omar Toft	75
Pete Henderson	667	E. Pullen	70
F. Calvin	645	Ora Hable	60
Ralph Mulford	620	Mel. Stringer	55
H. Wilcox	596	George Adams	55
J. Christiaens	540	Jack Gable	45
Dave Lewie	500	Billy Chandler	40
Ira Vail	450	Bert Watson	30
P. Devigne	350	[illegible] Sorenson	35
Clyde Roads	280	Art. Johnson	30
Hughie Hughee	275	J. A. Benedict	30
A. H. Patterson	270	F. McCarthy	25
W. W'ightm'n,3d.	240	Andy Bart	25
Geo. Buzane	210	W. J. Muller	20

*No credit given by A. A. A. for winning Grand Prize ae changed care.

Wilcox-Aitken Car Winner

Aitken Relieves Team-mate in Grand Prize—Receives No Points

SANTA MONICA, CAL., Nov. 18—*Special Telegram*—A Peugeot, driven by Wilcox and Aitken, won the 403.249-mile Grand Prize road race to-day over the 8.04-mile oblong Santa Monica course, establishing a new record for that classic of 4 hr., 42 min. and 47 sec., or 85.59 m.p.h., as against 7 hr., 7 min. and 57 sec., or 57.50 m.p.h. in the 1915 race at San Francisco, made by Resta in a Peugeot. Cooper in a Stutz finished second, averaging 83.74 m.p.h. To-day's race not only established new records but it also established a precedent in the awarding of points in the championship events. Wilcox, who drove the winning car for the first twenty laps, receives 416 points, or 20.8 points for each lap. Aitken, who relieved Wilcox and drove the remaining 28 laps, according to the A. A. A. decision, receives no points. As a result, Resta retains his lead in the championship race and may be called the leading driver of 1916. The precedent established before this race was that set by Rickenbacher this year at Indianapolis when he was refused points after having taken Henderson's Maxwell as relief driver and finishing within the money. Included in the records to-day is that of a new world's non-stop road race record made by Patterson in a Hudson Supersix which finished third, averaging 78.13 m.p.h. Roads, also driving a Hudson, finished fourth, which is the same position he held in the Vanderbilt last Thursday.

Much depended upon to-day's race if Aitken was to overcome Resta's lead in

ELIMINATIONS IN GRAND PRIZE RACE

Car	Driver	Lap	Reason
Peugeot	Aitken	1	Broken pieton
Herculee	Agraz	2	Broken rod
Kissel	Anderson	5	Broken valve
Duesenberg	Moosie	6	Broken clutch
Owl Special	Carlton	6	Broken pump ehaft
Mercer	Pullen	8	Burned up
Hudson	Vail	9	Burned bearing
Omar	Toft	10	Burned clutch
Gandy	Price	10	Broken clutch
Marmon	Jackson	13	Wreck
Durant Special	Durant	17	Broken valve
Cody Special	Cody	33	Motor trouble
Peugeot	Reeta	18	Motor trouble
Duesenberg	Rickenbacher	26	Broken drive shaft
Dueeenberg	Buzane	27	Broken piston
Mercer	Ruckstell	39	Broken pressure line

ELIMINATIONS IN THE VANDERBILT CUP RACE

Car	Driver	Lap	Reason Assigned
Gandy Special	Price	4	Burned clutch
Cody Special	Cody	5	Axle trouble
Duesenberg	Rickenbacher	6	Sheared high gear
Owl Special	Carleton	6	No tires
Mercer	Ruckstell	8	Ignition
Omar	Toft	9	Connecting rod
Marmon	Jackson	10	Motor trouble
Duesenberg	Moosie	11	Sticking valves
Mercer	Thomas	12	Radiation
Duesenberg	Buzane	15	Cracked cylinder
Peugeot	Aitken	19	Broken intake valve
Mercer	Pullen	31	Motor trouble
Chowchilla	Bolden	21	Broken crank ehaft

points in the American Automobile Assn. championship race, and as a result every possible means to win the coveted points and $14,000 in prize money was resorted to. Consequently when Aitken, who was in second place, just 660 points behind Resta in the championship column, dropped out, after the first lap with a broken piston, his chances for winning the race looked slim.

However, when Wilcox was signalled to stop in the fifth lap, it was soon apparent that Aitken would attempt to win the race in Wilcox's car. Wilcox stopped in the ninth lap, stating that he was tired and asked to be excused, but was refused permission. He was in second position at the time of his stopping when he lost 2 min. On the fifteenth lap he took the lead, his average at that time being 87 m.p.h.

Resta to the Pits

On the sixteenth lap Resta went into the pits and changed two spark plugs, came in again on the seventeenth lap and on the eighteenth dropped to fifth position. At this time he was running on three cylinders and came in again, took down the motor and worked 2 hr. changing the wiring and installing another magneto.

With Resta out of the race, Wilcox again stopped in the twentieth lap when holding first position and asked to be relieved on account of sickness, which was permitted. His average up to this time was 87.14 m.p.h.

Aitken then took Wilcox's place, driving at top speed, his average at thirty laps being 86.6 m.p.h.; forty laps, 86.4 m.p.h, and forty-five laps, 86.08 m.p.h. In his forty-sixth lap he ran out of gas in the back stretch. He took on more gasoline in the forty-seventh lap and finished the forty-eighth lap at an average speed of 84.59 m.p.h., a new record for the Grand Prize.

After Aitken took Wilcox's place, Resta offered to buy Cooper's Stutz to get back into the race but the proposition was not made. Cooper drove a very consistent race. Resta, Aitken, Wilcox, Pullen and Ruckstell in Mercers and Rickenbacher in a Duesenberg passed him but he never varied the pace.

Rickenbacher relieved Weightman, taking his Duesenberg in the thirtieth lap, but failed to finish, although this was the only car running after the four winners had finished. Twenty-one cars started the race. Only three tire changes were made throughout the race, although the pit stops numbered thirty-three.

Fourteen starters in the Vanderbilt cup race used Rajah plugs, as did the first six finishers except Resta and Patterson. In the Grand Prize the same number of starters used Rajah plugs, and of those finishing all except Aitken and Patterson. Goodrich Silvertown cord tires were on the first four Vanderbilt winners and Goodyear cords on the first three in the Grand Prize.

Only one of the leaders in the championship award table made any appreciable gain in the Vanderbilt and Grand Prize events last week and he was Resta, chalking up 900 points when he won the first race. This brought his score up to 4100, just 660 ahead of his rival Aitken, who had 3440. Aitken, as explained in the previous paragraphs, did not gain a point. Cooper moved from eleventh position to sixth with a total score of 1045.

Vanderbilt Record Broken

Covers 294.035 Miles in Vanderbilt at 86.98 M. P. H.

SANTA MONICA, CAL., Nov. 16—For the second successive time, Dario Resta has won the Vanderbilt cup race, breaking the previous record by 11 m.p.h. The 294.035 miles of the road race was covered in 3 hr., 22 min., 48.4 sec., an average speed of 86.98 m.p.h.; the victory giving Resta the lead in the American Automobile Assn. $13,500 prize contest.

Though the three leaders broke the previous record of 78.72 m.p.h. for this course, made by Teddy Tezlaff in 1912, it was a race unmarred by serious accidents. At sharp noon nineteen drivers started the long grind over the 8.401-mile triangular course, before an audience of thousands. To the fourteenth lap it was a battle between Aitken, Cooper and Resta, with Resta steadily pushing to the front. At the fourteenth lap he took the lead, and after Aitken dropped out in the twentieth lap with a broken crankshaft, Resta maintained a steady pace to the finish.

Cooper came in approximately 8 min. behind Resta, with William Weightman, a Virginia sportsman, and a dark horse, running third in 3:42:00.4. The only other survivors were Clyde Roads, Vail and Patterson, the latter two being flagged while still running.

Mechanical troubles caused most of the eliminations, Bolden alone suffering from the dangerous turns. He skidded and went out in the twenty-first lap, and was the thirteenth man to quit. Eddie Pullen was disqualified on his thirtieth lap, while running fourth, because of an illegitimate stop for gasoline.

The race was well attended. On the straightaway temporary bleachers were erected facing the ocean. These were packed and the race was run through a lane of spectators around practically the entire course.

Up to to-day the Vanderbilt record was held by Ralph de Palma, made over the Santa Monica course in 1914, at an average of 75.6 miles per hour, though this was not the Santa Monica course record. Resta, in addition to acquiring additional laurels, added $4,000 to his winnings. Cooper received $2,000, Weightman, $1,000, and Roads, $500.

Two views in Vanderbilt Cup Race. At the left is Death Turn and at the right a glimpse of the straight-a-way

Smith Form-A-Truck to Enlarge

Will Form Truck Corporation with Issue of New Stock—Will Enlarge Production

NEW YORK CITY, Nov. 20—The Smith Motor Truck Corp. will be incorporated in Virginia shortly for the purpose of taking over the Smith Form-A-Truck Co., a Delaware concern. Announcement of the acquisition of this company by Michaelis & Co. and associates was made last week.

The new company will have a capital of 20,000 shares of 8 per cent cumulative and convertible preferred stock, redeemable at 120, of which 14,000 shares will be issued, and 1,200,000 shares of common stock, par value $10 a share, of which 1,000,000 shares will be issued.

A sinking fund of 5 per cent per annum will be established to retire the preferred stock at $120 or better, commencing Jan. 1, 1920, and the issue also is convertible, dollar for dollar, ten shares of common for one preferred, at the option of the holder at any time after June 30 next and prior to Jan. 1, 1920. After 8 per cent per annum has been paid on the common the sinking fund for the preferred will be increased to 10 per cent.

Issue of New Stock

The 14,000 shares of preferred and 1,000,000 shares of common of the new company will be issued for the property and business of the Smith Form-A-Truck Co. and in addition $830,000 cash is to be paid into the new corporation. The concern will have no mortgage or funded indebtedness outstanding, and none can be issued without the consent of the holders of at least 75 per cent of the outstanding preferred.

The present plant has a capacity of over 200 truck units a day. From Jan. 1 to Nov. 1 last the average production was over thirty per day. Sales are now running at the rate of about fifty units daily and it is estimated that by Jan. 1 next it will be manufacturing and delivering more than 100 units per day.

Unfilled orders and open contracts on hand on the first of this month amounted to more than 6000 truck units, and new orders are coming in at the rate of 100 per day. In 1917 the production will be at the rate of at least 30,000 units.

Net earnings for this year, estimating the last 2 months, will amount to about $1,000,000 more than eight times the annual dividend on the preferred, or a surplus after the preferred dividend equal to 25 per cent on the 1,000,000 shares of common.

The new company will have net tangible assets, exclusive of good will, patents, trade marks, etc., of $1,714,587, and net current assets of $1,410,454, equal to the outstanding preferred.

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Elkhart Increases Capital

ELKHART, IND., Nov. 17—The Elkhart Carriage & Motor Car Co., this city, has increased its capital stock from $100,000 to $300,000 in order to take care of increased business. The issue is preferred stock bearing 7 per cent interest, payable semi-annually.

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Steel Prices Higher

NEW YORK CITY, Nov. 21—Prices on automobile materials last week were for the most part steady with quotations on metals higher. Steel featured activities with a jump of $2.50 per ton. Bessemer and open-hearth steels are now quoting at $52.50 per ton. Fish oil rose 6 cents a gal. to 68, while linseed oil dropped 2 cents a gal. to 96. Rubber prices were steady. Para receded to 80 and Ceylon rose to 67½. The rubber plantations in Sumatra, Dutch East Indies, are developing rapidly. They cover an area as large as the island of Manhattan. One of the large tire companies owns a total of 93,759 acres on these plantations. From land which, less than a decade ago, had not a single rubber tree, this company is now receiving every month thousands of pounds of plantation rubber.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.65	.65	.65	.65	.65	.65	...
Antimony, lb.	.12½	.12½	.12½	.12¾	.13½	.13½	+ .01
Beams and Channels, 100 lb.	2.97	2.97	2.97	2.97	2.97	2.97	...
Bessemer Steel, ton	50.00	50.00	50.00	52.50	52.50	52.50	+2.50
Copper, Elec., lb.	.33	.33	.33	.33	.33	.33	...
Copper, Lake, lb.	.33	.33	.33	.33	.33	.33	...
Cottonseed Oil, bbl.	12.72	12.85	12.55	12.75	12.65	12.75	+ .03
Fish Oil, Menhaden, Brown, gal.	.62	.62	.62	.62	.68	.68	+ .06
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.30	1.30	1.30	1.30	1.30	1.30	...
Lead, 100 lb.	7.05	7.05	7.05	7.05	7.05	7.05	...
Linseed Oil, gal.	.98	.98	.96	.96	.98	.96	— .02
Open-Hearth Steel, ton	50.00	50.00	50.00	52.50	52.50	52.50	+2.50
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.95	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb.	.82	.82	.80	.80	.80	.80	— .02
Rubber, Ceylon, First Latex, lb.	.66½	.66½	.66	.67	.67	.67½	+ .01
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	44.38	44.88	45.00	45.00	45.00	45.25	+ .87
Tire Scrap, lb.	.06⅜	.06¼	.06¼	.06¼	.06¼	.06¼	+ .00⅛

Empire Tire Refinancing

New Corporation Formed with $7,000,000 Capital—to Increase Production

NEW YORK CITY, Nov. 20—The Empire Tire & Rubber Corp. has completed negotiations for reorganization and refinancing by incorporating under the laws of the State of Virginia to take over the business of the Empire Rubber & Tire Co., established in Trenton, N. J., in 1887. The new company has a capital consisting of $1,500,000 7 per cent cumulative convertible preferred, par value $100, and $4,500,000 in common, par value $10, Of the authorized common $1,500,000 is to be reserved for the conversion of the preferred stock. The underwriting was done by Andrews & Co., this city, who are offering for public subscription $1,500,000 preferred, which is convertible into an equal amount in par value of common, ten shares of common for one share of preferred, at the option of the holder at any time after June 30, 1917, and prior to July 1, 1920. It is also offering for subscription the preferred stock with a privilege of subscribing to four shares of common at $4.50 per share, the common to be repurchased by the underwriting syndicate at $6 per share.

The company has recently increased its production to 1500 tires per day, and with a small additional expenditure this can be increased to 2000 tires per day. The sales of mechanical rubber goods now average about $800,000 per annum, and the new capital will enable a more vigorous manufacturing and sales policy so that the sales in this department should be doubled. New business of from $2,000,000 to $2,500,000, it is stated, will be had through the new affiliations, making a total, with the business it is now doing, of over $5,000,000 per annum, on which the company should show profits of $600,000 to $700,000, or approximately 12 per cent on gross sales. It is expected that the earnings of the company will approximate about six times the dividend requirements on the preferred stock issue, and about 18 per cent on the common after allowing for dividends on the preferred, amounting to $1,500,000.

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Atlas Drop Forge Increases Capital

LANSING, MICH., Nov. 17—The Atlas Drop Forge Co. has increased its capitalization from $200,000 to $500,000. A 100 per cent stock dividend is being issued to all stockholders and $100,000 will be held as treasury stock.

The company was formed in 1906 with

a capital of $100,000 which was doubled in 1911. The plant is now producing to the limits of its capacity and according to present indications will manufacture $1,250,000 worth of their products for the coming year.

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Madison Motors Stock Offered

ANDERSON, IND., Nov. 20—A part of the Madison Motor Co.'s $2,000,000 capital is to be sold in small blocks at $10 a share by H. M. Caldwell & Co., Indianapolis, sole distributors of the stock.

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Dividends Declared

The Federal Rubber Co.; regular dividend $1.75 per share on second preferred stock, payable Nov. 25.

Ajax Rubber Co., quarterly of $1.25 per share, payable Dec. 15 to stock of record of Nov. 29.

Studebaker Corp., South Bend, regular 1¾ per cent on preferred and 2½ per cent on common, payable Dec. 1 to stockholders of record at the close of business on Nov. 20.

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Truck Wheel Corp. Formed

CHICAGO, ILL., Nov. 21—The American Truck and Wheel Corp. of Chicago, which is capitalized at $1,000,000, has filed charter in Delaware to manufacture motor truck wheels, etc. The incorporators are William C. Loftus, John R. Cavanaugh and Ross J. Cavanaugh.

Motor Stocks Stronger

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General Motors, Chevrolet, Maxwell, Miller, Firestone and Chandler Higher

NEW YORK CITY, Nov. 21—Automobile and accessory issues yesterday closed with a steady demand and higher. With the interest of investors centered in copper stocks, it was only natural last week that demand for automobile and accessory stocks should have lagged. As a sequel to this recession there has been a rather sharp drop in their prices. Prices, yesterday, picked up considerably and investors and speculators netted substantial gains on the up market under the leadership of General Motors which has reached 600, just 90 points higher than last week. Firestone Tire common has also strengthened and has gone up 25 points to 1375. Maxwell common surprised investors last week by suddenly jumping 4½ points to 76 on strength of the declaration of an extra dividend. General Motors was probably strong on account of the director's meeting held to-day at which directors are to be elected and from which a financial statement will be forthcoming.

Automobile stocks were comparatively quiet during the early part of the week. United Motors after a show of firmness eased off. There was a fairly good demand for Chalmers, which moved up about a point, but on realizing turned easier.

Powerful bear operations for several weeks have made two of the principal objects of their attacks Willys-Overland and Maxwell shares. The weakness in these issues has caused much selling. The short-selling interests, it is thought, have run their course, and the general decline in prices appears near a halt.

Pierce-Arrow preferred stock has been placed privately by the syndicate headed by J. & W. Seligman & Co. at 107 and the stock has all been sold. The New York Curb Market Assn. has listed 30,000 common shares and 15,000 first preferred shares, both of par value $100 of the Manhattan Electrical Supply Co.

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Paige-Detroit Increases Capital

DETROIT, MICH., Nov. 21—The Paige-Detroit Motor Car Co. has increased its capital stock from $2,000,000 to $3,500,000 by the addition of $1,500,000 of 7 per cent cumulative preferred stock. The present capital consists wholly of common stock.

The new preferred stock is to be offered to the company's present stockholders at par and will have a par value of $100. The purpose of the new issue is to provide the company with larger working capital and enable it to carry larger stocks of working material on hand.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co	73½	74	..
J. I. Case T. M. Co. pfd	86	86¾	—1
Chalmers Motor Co. com	130	150	..
Chalmers Motor Co. pfd	110	115	—2
*Chandler Motor Car Co	106	107	+3
Chevrolet Motor Co	176	180	+3
Falls Motor	10	13	..
Fisher Body Corp	38	41	..
Fisk Rubber Co. com	80	95	..
Fisk Rubber Co. 1st pfd	109	114	..
Fisk Rubber Co. 2d pfd	95	105	..
Firestone Tire & Rubber Co. com	1375	1390	+25
Firestone Tire & Rubber Co. pfd	106	108	— ½
*General Motors Co. com	600	875	+90
*General Motors Co. pfd	120	124	—2
*B. F. Goodrich Co. com	70¼	70½	+1½
*B. F. Goodrich Co. pfd	113½	114	+ ½
Goodyear Tire & Ruhher Co. com	295	299	+1
Goodyear Tire & Rubber Co. pfd	109	110	+ ¼
Grant Motor Car Corp	7	10	..
Hupp Motor Car Corp. com	4½	5½	..
Hupp Motor Car Corp. pfd	85	100	..
International Motor Co. com	5	6½	..
International Motor Co. pfd	22	27	..
Keystone Tire & Ruhher Co. com	15¾	16	..
Keystone Tire & Rubber Co. pfd	15¾	16	..
*Kelly-Springfield Tire Co. com	77	78	+2¼
*Kelly-Springfield Tire Co. 1st pfd	96	100	..
*Lee Rubber & Tire Corp	39½	40	..
*Maxwell Motor Co. com	76	76⅛	+4¼
*Maxwell Motor Co. 1st pfd	81¼	82	— ¾
*Maxwell Motor Co. 2d pfd	50	51½	+ ½
Miller Rubher Co. com	250	260	+8
Miller Rubher Co. pfd	106	108	+ ½
Mitchell Motors Co	59	60½	..
Packard Motor Car Co. com	..	170	..
Packard Motor Car Co. pfd	94	98	..
National Auto Corp	40¾	41½	+ ¾
Paige-Detroit Motor Car Co	38½	39½	+1½
Peerless Truck & Motor Corp	23	25	+ ½
Pierce-Arrow M. C. Corp	55½	56	+ ⅛
Portage Rubber Co. com	165	167	..
Portage Ruhber Co. pfd	..	..	..
Regal Motor Car Co. pfd	20	30	..
Reo Motor Car Co	46	47	— ¼
A. O. Smith Corp. com	42½	43	— ½
A. O. Smith Corp. pfd	96½	97	..
Saxon Motor Car Corp	78¼	79	+2⅜
Spicer Mfg. Co	47⅜	48	+1⅛
Springfield Body Corp. com	90	100	—3
Springfield Body Corp. pfd	120	130	—5
Smith Motor Truck Co	6¾	7	..
Standard Motor Construction Co	7	8	..
Stewart Warner Speed. Corp. com	107	108	—2
Stewart Warner Speed Corp. pfd	..	..	..
*Studebaker Corp. com	124½	†125	+1
*Studebaker Corp. pfd	109¼	110½	—3
Stutz Motor	65	65⅛	+ ⅛
Swinehart Tire & Rubber Co	86	90	—2
United Motors Corp	62¼	62½	+1⅛
*U. S. Rubber Co. com	62	63½	+2⅛
*U. S. Rubber Co. pfd	112⅜	113	+1⅛
White Motor Co	54⅜	54½	— ⅛
Willys-Overland Co. com	37⅞	38⅛	+ ⅛
*Willys-Overland Co. pfd	95	100	—5

*At close Nov. 20, 1916. Listed New York Stock Exchange. †Ex-dividend. Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Week's Ch'ge
Auto Body Co	44½	46	+2½
Chalmers Motor Co. com	130	140	+4
Chalmers Motor Co. pfd	110	115	+1
Continental Motor Co. com	40	41	+ ¼
Continental Motor Co. pfd	9½	10¼	..
Ford Motor Co. of Canada	290	305	—3
General Motors Co. com	..	825	..
General Motors Co. pfd	123	126	..
Maxwell Motor Co. com	74½	77½	+ ½
Maxwell Motor Co. 1st pfd	80½	83½	—1⅛
Maxwell Motor Co. 2d pfd	49	51½	—1
Packard Motor Car Co. com	172	180	+12
Packard Motor Car Co. pfd	100	102	..
Paige-Detroit Motor Car Co	38½	39½	+1½
W. K. Prudden Co	49	50½	+2¼
Reo Motor Car Co	45½	46¼	— ¾
Studebaker Corp. com	125	128	+2
Studebaker Corp. pfd	108	..	+1
C. M. Hall Lamp Co	..	31	..

INACTIVE STOCKS

Atlas Drop Forge Co	..	33	..
Kelsey Wheel Co	55	60	..
Regal Motor Car Co. pfd	25	..	+5

Overland Brings Out Sport Car

Four-Passenger Country Club Roadster To Ce Mounted on 75-B Chassis

TOLEDO, Nov. 21—The Willys-Overland Co. is now making deliveries of a new sport car which it has named the Country Club model. It is a four-passenger roadster embodying many unusual designs and constructed over the chassis used for the model seventy-five B., and sells for $695 f. o. b. Toledo.

The car is furnished with a rich gray body, with long grained upholstery and mohair top to match and has black fenders and trimmings, and red wire wheels. The two front seats are convertible and move independently forward and back to lengths suitable for the driver and his companion. The doors are of a wide Z shape and front hinged with pockets for tools and accessories. Rear seats for two are close up, but allow ample leg room for the occupants, so that four adults may ride comfortably in the car. Cantilever springs and special springs under the cushions provide for smooth and easy riding. The motor is a four-cylinder en bloc type with a 3¾-in. bore and a 5-in. stroke. Ignition is created by the battery and distributer system and the Tillotson carbureter receives the fuel by vacuum feed. A 12½-gal. gasoline tank is situated under the rear dash. The car has a wheelbase of 104 in. and includes in its equipment an extra wire wheel and a spare tire bracket.

Paterson Adds "Chummy" Roadster

FLINT, MICH., Nov. 20—The W. A. Paterson Co. will have a single-chassis model for 1917 carrying two bodies, one a regular touring model and the other a newly designed "chummy" roadster. The touring model has a new body with a double cowl, and it is somewhat longer and wider. The "chummy" roadster is mounted on the same chassis, having a wheelbase of 117 in., and its capacity is four passengers.

Fight Attempt to Increase New York Truck Fees

ALBANY, N. Y., Nov. 21—The commission for creating a higher schedule of fees for motor omnibuses and motor trucks in New York State held its first public hearing in the Capitol to-day. The commission has not made public any of its recommendations as yet and the hearing here to-day was for the purpose of enabling it to obtain first-hand information and suggestions from owners and operators of motor trucks.

The commission consists of Edwin Duffey, Highway Commissioner; W. W. Wotherspoon, Superintendent of Public Works, and Frank M. Williams, State Engineer. It was formed by the last legislature to scientifically determine a new schedule of registration fees for motor trucks and omnibuses, such schedules being based on the time and extent of use, and wear and tear of public highways by such vehicles.

From the arguments presented by Charles Thaddeus Terry, representing the N. A. A. C. and the Automobile Trade Assn. of New York; Roderick Stephens, George H. Pride, Oscar W. Shadbolt and A. F. Masury of the Motor Truck Club of America, and others, it was brought out that as the State only has jurisdiction over State roads and not city, county or village roads, any fees based on the wear of public roads meant State roads and that these fees could only be placed on those trucks using State roads.

Empire Inclosed Car Ready Dec. 1

INDIANAPOLIS, IND., Nov. 20—The Empire Automobile Co. has entered the field of inclosed cars with a sedan which will be ready for delivery Dec. 1. It is a convertible inclosed type with two doors, one on each side midway of the body so that the front seats are reached by an aisle way. The upholstery is gray and black Bedford. Two cellarettes or small package compartments are behind the rear seat cushion. The body is mounted on the six-cylinder 120-in. wheelbase chassis.

Ball & Ball Co. Incorporates

DETROIT, MICH., Nov. 21—The Ball & Ball Carburetor Co. has incorporated for $20,000. Incorporators are F. H. Ball, F. O. Ball and Kate D. Ball. The concern was formerly a partnership of father and son and has been made into a corporation because of the entrance of a brother as a partner. The company sells all of its product through the Penberthy Injector Co.

$412,812 Awarded to H. S. Chapman

CLEVELAND, Nov. 21.—An award of $375,000 and interest, amounting to a total of $412,812, has been made by jury here to Henry S. Chapman in his suit for $800,000 alleged to be due him from the Peerless Motor Car Co. Mr. Chapman, who had no previous connection with the automobile industry, claimed the violation of a contract under which he went to London to sell motor trucks to the British war department.

Gillam Co. Plans Capital Increase

CANTON, OHIO, Nov. 22.—The Gillam Mfg. Co. will increase its capital Nov. 28 from $350,000 to $450,000 for the purpose of extending its factory. The Gillam company manufactures materials for Packard, Maxwell, Overland, Haynes and Oakland.

Springfield Body Sues Fisher

Charges Infringement of Two Design Patents Covering Two of Its Body Types

NEW YORK CITY, Nov. 21—The Springfield Body Corp. and the Springfield Body Co. have brought suit against the Fisher Body Corp., the Fisher Body companies and F. J. Fisher and A. Mendelson, the latter controlling interests in the Fisher Body interests, charging infringement of design patents No. 47,252 and 47,630, covering the Springfield type convertible and four-door bodies, respectively. Charges of unfair competition are also brought against the defendants, who are sued individually and collectively. Under its patents the Springfield corporation claims exclusive right to produce and market bodies of these types, and alleges that the defendants have incorporated elements of the designs covered by these patents in their product.

The Fisher Body Corp. will contest the claims of the Springfield interests, President F. J. Fisher stating, "We have been advised by the best patent counsel we can get, and they have confirmed our absolute belief that there is no infringement whatsoever. Had we ever thought we were infringing, we certainly would have abandoned that line of business, as it does not constitute over 2 per cent of our entire business."

Last February the Springfield Body Corp. of New York was formed, controlling the Springfield body patents. Since then the following twenty-three companies have taken licenses to manufacture the same on a royalty basis:

Chas. Albresch Co.	Milwaukee, Wis.
Hume Carriage Co.	Boston, Mass.
M. Armstrong Co.	New Haven, Conn.
Millspaugh & Irish.	Indianapolis, Ind.
Blue Ribbon & Carriage Co.	Bridgeport, Conn.
J. W. Mount Co.	Red Bank, N. J.
Cadillac Motor Car Co.	Detroit, Mich.
Staver Motor Car Co.	Chicago, Ill.
R. N. Collins, V. W. Co.	St. Louis, Mo.
Glascock Mfg. Co.	Muncie, Ind.
Hale & Kilburn Co.	Philadelphia, Pa.
Alexander Wolfington's Son.	Philadelphia, Pa.
Portland Body Works.	Portland, Ind.
Central Mfg. Co.	Connersville, Ind.
Racine Mfg. Co.	Racine, Wis.
Chas. S. Gaffery Co.	Camden, N. J.
W. S. Seaman Co.	Milwaukee, Wis.
Chicago Coach & Carriage Co.	Chicago, Ill.
E. J. Thompson Co.	Pittsburgh, Pa.
FitzGibbon & Crisp.	Trenton, N. J.
Victor Mfg. Co.	Detroit, Mich.
Walker-Wells Co.	Amesbury, Mass.
Willys-Overland Co.	Toledo, Ohio

Among the automobile companies which are now incorporating Springfield type bodies in their regular output are: Apperson, Abbott-Detroit, Cadillac, Chandler, Cole, Davis, Haynes, Inter-State, Jordan, King, Marmon, Mitchell, National, Oldsmobile, Overland, Paige-Detroit, Premier, Reo, Standard, Stearns-Knight, Studebaker, Velie, Westcott, Winton and Willys-Knight.

N. A. A. A. J. Meets in Boston

Final Session in New York—Action Routine Matters

BOSTON, MASS., Nov. 21—*Special Telegram*—The Ways and Means Committee of the National Assn. of Automobile Accessory Jobbers opened session to-day. The meeting will be continued to-morrow and final session will be held at the Hotel Astor in New York on Thursday. Only routine matters are being taken up and final action on the suggestions of the committee will be deferred until the meeting beginning Jan. 10. To-day's session was exclusively for members of the committee, the gathering being called by W. M. Webster. To-morrow there will be an open meeting at which New England jobber members and jobbers who are not members will attend. Non-members will be invited to join the association. Those in attendance to-day are W. K. Norris, McQuay-Norris Mfg. Co.; Wm. Sparks, Sparks-Withington Co.; S. B. Dean, Nichols, Dean & Gregg; F. B. Caswell, Champion Spark Plug Co.; George W. Shafer, W. E. Pruden Hardware Co.; W. W. Lowe, Electric Appliance Co.; Mr. Moody, Boston, and W. M. Webster.

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Inter-State Sues Rutenber

DETROIT, MICH., Nov. 20—The Inter-State Motor Co. has started suit for $700,000 against the Rutenber Motor Co., charging breach of contract. It is alleged that 3000 motors contracted for caused the purchase of $2,000,000 worth of parts and the booking of orders for 5000 cars, and the Interstate company alleges that only 379 motors were delivered.

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Brush Analyzes Crankshaft Balance Before Indiana S. A. E.

INDIANAPOLIS, Nov. 21—At a meeting of the Indiana section of the S. A. E. held here last night, A. P. Brush read a paper which was really a continuation of the one he presented at the summer meeting of the Society. Starting where the former paper ended, Brush pointed out that there are two sorts of engine vibration; that due to reciprocating and other unbalanced forces which tend to move the engine as a whole, and those which tend to oscillate internal parts without affecting the whole mass directly. In the latter class come crankshaft deformations, whether caused by bending or torsional stress.

Brush drew attention to the fact that the crankshafts of four- and eight-cylinder engines need counterbalance masses much more than do six throw shafts, and he expressed a doubt as to whether a large size of shaft was not a better solution of the vibration problem than a balanced shaft, except for four throw shafts where bending is a more important question than torsional deformation. He placed special stress on the fact that balancing a shaft does not affect the loads on any crankpin bearings or on the small end connecting rod bearings, it merely prevents vibration and lessens the load on the main bearings.

The paper was illustrated with diagrams showing the forces within an engine and Brush concluded it by a plea for his patented system of lubrication described in the summer meeting paper.

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Brooks with Madison Motors

DETROIT, MICH., Nov. 21—H. H. Brooks has been appointed superintendent of agencies for the Madison Motors Corp. Mr. Brooks was formerly sales and advertising manager for the Pontiac Chassis Co.

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General Motors Builds Plant

DETROIT, MICH., Nov. 21—The General Motors Co. is erecting a one-story factory 734 by 200 ft. The building will be used for the manufacture of motors for use of affiliated companies of the General Motors, the output of the Northway Motor & Mfg. Co. having proved insufficient.

The site was originally planned for use for the Cadillac company's new plant, but different arrangements followed the purchase of another site last week by the Cadillac company.

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Livingston Shell-and-Hood Patent Upheld

NEW YORK CITY, Nov. 21—In a decision handed down here yesterday, the Livingston patent No. 1,156,017 covering a mask for concealing the engine and radiator casing of a car was held valid and infringed by the Lawco radiator shell and hood made by the F. H. Lawson Co., Cincinnati, Ohio. The construction covered by the patent comprises a motor hood section and a separate removable radiator hood section, the assembly having streamline tendencies when mounted on a car.

The suit was brought by D. McRa Livingston and his licensee the Ospeco Mfg. Co. against the Lowe Motor Supplies Co., charging that the Lawco device sold by the Lowe Company and manufactured by the Lawson concern infringed the Livingston patent. Judge Sheppard commented that no wilful infringement was evident but that the Lawco construction was so similar to that specified in the patent that he could only hold the latter infringed. The suit was in the U. S. district court for the southern district of New York.

Synthetic Resins Discussed

Dr. Baekeland Lectures Before Detroit Chemical Society on Bakelite

DETROIT, MICH., Nov. 17—Dr. L. H. Baekeland, president of the General Bakelite Co. and a member in an advisory capacity of the Hooker Electric Chemical Co. of Niagara Falls, lectured last night on the subject of "Synthetic Resins" before a joint meeting of the Detroit Chemical Society and the Detroit Engineering Society at the club rooms of the latter organization.

He told of the application of synthetic resins in electrical and automobile engineering, stating that bakelite is a concentrated product of formaldehyde and carbolic acid, and that only one special condition can be present when it is formed, and that when this condition is not present anything but bakelite will be the result, and added that instead of using phenol, its homalogues, cresols, other phenolic bodies and various substances having the same functions may be utilized.

"It should be well understood," said Dr. Baekeland, "that formaldehyde in reacting about phenol does not necessarily give bakelite. Quite to the contrary. It is only under very special conditions, now well established by public research, that this substance can be obtained. When formaldehyde is left to react on phenol under ordinary conditions, almost anything may happen but the formation of bakelite. In some cases a resinol material is formed, but it has no especially new properties and is similar to cheap natural resinol."

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500 S. A. E. Banquet Tickets Sold

NEW YORK CITY, Nov. 20—The number of tickets for the annual banquet of the Society of Automobile Engineers on Jan. 11 at the Hotel Biltmore is becoming scarcer each day. Fifty tickets have been sold since last week, bringing the total sale up to 500. Capacity is 750.

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Stutz Wins Phoenix Race

PHOENIX, ARIZ., Nov. 18.—R. H. Delno, of Tucson, driving a Stutz, won the 100-mile free-for-all race at the Arizona State Fair here to-day, in 1 hr., 43 min. and 12 sec. E. F. Bennett, of Silver City, N. M., and also driving a Stutz, won second money in 1:45:01. A. Gladney, driving an Overland entered by the Arizona Overland Co. of Phoenix, was third in 1:45:10. Tom Brewer, of Globe, Ariz., driving a Marmon, finished fourth in 1:46:20. C. G. Miller, driving a National, finished fifth in 1:48:56 2/5.

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International Competition

THE uniting of different concerns in the same industry for promoting the use of U. S. A. goods abroad will unquestionably have to be resorted to when war days are over and all Europe takes up anew the various channels of export trade which it held previous to the war but has been forced to relinquish during the war. Such co-operation of firms in the same industry is in export circles known as international competition, a term new to many exporters in our industry.

It is only natural that those countries that have been forced to drop export trade temporarily during the war will enter the field with renewed efforts as soon as peace is declared. The war is believed by many to be almost entirely a trade war. If it is worth while these European nations expending so many billions fighting for trade privileges, it is a correct conclusion to draw that they will fight with equal vigor in trade circles to win back what has been lost.

While some export authorities contend that European nations will be so exhausted after the war that they cannot take up with vigor the export work, the general feeling is otherwise. Why fight so strenuous and costly a war for trade only to be so weak when the fray ends that you cannot take advantage of what you have been fighting for? All the energies of these countries will be thrown into foreign trade. They will only be losing their remaining business life blood if they let the thing go unchallenged that they have been fighting for.

After the war international competition will be many times more intense than before the war seems but a natural conclusion. Travelers from foreign lands constantly report that when fighting is over the buyers will turn to European countries for their goods, where they have been buying them for over a generation and, in some cases, for three generations.

Europe is many times better organized to-day than before the war. While human loss has worked a handicap, remaining resources have been so superiorly organized as to largely make up for the loss in labor. Factories have been doubled and often trebled; modern production methods have been installed, and Europe has grown in 30 months more than in 30 years of peace.

The Year in Tires

THE tire industry is keeping step with the automobile industry in production, and its experimental departments are as busy as the engineering departments of the automobile factories in improving quality and methods for increasing production. Many of our large tire concerns merit congratulation for the wide-gage policy of research they are carrying on. It is solely due to such work that tire quality has been on the increase, and the amazing results given in racing tires of the season just closing is good proof of what has been accomplished in improving the chemistry of tires.

A new movement and one that gives promise of good results is that of building a better-balanced tire, one with a fifty-fifty relationship between carcass and tread when wear is the criterion. The heavy rubber tread is useless if the carcass is not built to give approximately the same service. There is no economy in a tire with a 10,000-mile tread and a 3000-mile carcass. The ideal tire is one with a carcass so balanced in strength and endurance to give the same wear as the tread. In solving this, tire-makers have carried on a world-wide campaign of investigation. Used tires from all fields of service have been collected and experimental departments are doing all possible to arrive at the proper amount of carcass to go with the proper amount of tread and vice versa.

Tire-makers have not made as much progress as desired in reducing the number of standard tire sizes. Each year sees a wider effort to reduce the number of so-called standard sizes and also to reduce the number of so-called oversizes. The end is not yet in either case. The work has not gone forward so well as that of standardizing many parts entering into the chassis. The introduction of cord tires is greatly increasing the number of sizes, and with the field split between Q. D. clinchers and straight-side types the number of sizes to be carried is still far too large. The argument between straight-side and clincher will eventually solve itself, but a good getting together of tire makers might end it in a single year and thus make the selling of tires much easier.

The Tire Industry

¶ Increased manufacturing facilities the great spotlight of the year—Tire production keeps pace with automobile production.

¶ Cord tires now being produced in quantity by several concerns.

¶ The balanced tires now aimed at by tire makers.

¶ Fabric cost has increased 100 per cent—chemicals also are more expensive—crude rubber has been plentiful.

¶ Greater use of non-skid types.

¶ Tire companies are leaders in welfare work among employes.

HISTORY will record 1916 as being a banner year in the tire industry. Every tire factory is literally swamped with business. Output figures have increased from 50 per cent among the large producers up to 2000 per cent with some of the smaller over 1915. Factories are being built almost universally by existing tire concerns to add to their present facilities and large new concerns are entering the business on a heavy scale.

Millions of dollars' worth of new machinery has been bought to supply the hundreds of acres of increased floor space. Manufacturing schedules that reach into the millions are planned by the larger concerns, and even with this great output they are straining every resource to catch up with demand by improving methods and adding space and machinery.

With this increase in business, quality has also gone up. More secrets have been learned in the laboratories and employed with benefit to the quality of the product. Better mileage figures are being obtained by users. The difficulties of the last year in the crude rubber market have been cleared away and now no difficulties are found in obtaining the raw material.

Prices Have Not Risen

In spite of advances of 100 per cent in the prices of fabric, of increased cost in almost every item of material and manufacture, prices to the consumer have not risen. Better tires for the same money, in spite of the increased costs, tells the story of increased efficiency in factory methods and the benefit of quantity production. Several well-defined trends are apparent, and these form an interesting story of development.

Cord Tires a Growing Issue

Cord tires are a growing issue of the year in the industry. Although more expensive than the fabric, they are being used all over the country and are recognized as a desirable part of regular automobile equipment. This tendency is expected to grow, until, it is the belief among tire manufacturers, it will strike to about the $1,800 level in cars. While only two or three concerns are marketing the cord type in quantity, there are several companies experimenting with it, and it will not be surprising to have many different makes on the market during the next year.

Naturally the reason for the cord tire is its greater resiliency, longer life, possibility of standing lower inflation pressure without damage, and in general, aiding in the production of that very desirable goal always in the eye of the tire builder, the balanced tire.

Cord tires are in two general classes. There is the cable tread, such as is used in the Silvertown cords, and the thread system, such as is used in the Goodyear. The names are suggestive of the basic differences. The cable system is a card carcass built up of multi-strand cables, which have rubber cores. The thread system has the cords in the form of a fabric, for convenience in manufacture. The cords are held in place by a few very fine cross threads, which break when the tire is used, this leaving only the cords.

The Balanced Tire

By the balanced tire is meant one which maintains an even balance between carcass and tread. Samples of used tires that have failed are gathered from all parts of the world by the important tire builders, and the reasons for failure are gone into. If the carcass has perished through normal wear, and yet there remains a considerable amount of tread rubber has not been worn away, the tire is not balanced. The two should be exhausted at the same time, or nearly so, and the time-worn example of the one-horse shay represents the cynosure of the tire developer, the world over.

When it is stated that this year's tires are better balanced than previously, it means much to the manufacturer, and it also bears a very natural profit for the user, because the saving which the balance means to the manufacturer is reflected in lower cost of materials and finally in reduced price possibilities.

The reason that the cord tire is generally a superior article in the way of balance is that the carcass is the limiting factor and the cord tire is capable of withstanding a great amount of flexure in the side wall. Tire carcasses fail under flexure because in bending the side wall one part is put under compression, while the other is in tension. This tends to cause a split along the neutral axis. With the cord type the entire carcass is more of a single unit, which resists to a maximum degree any tendency toward separation of the plies.

No one in the tire world sees any prospect of cord tires prices being down around the level of fabric prices for years. In fact, unless some revolutionary method of manufacture is developed, which is not yet in sight, this state of affairs will not be altered. It is a question whether or not the cord tire

is cheaper on a per mile basis for the user. It certainly will stand a maximum amount of neglect and a lower inflation.

Two Methods of Curing

There are two general methods of curing tires; one is where the entire product is cured at once, which is known as the single cure, and the other in which the carcass is first given a partial cure, the tread then added, and the entire casing then cured together. This is the double-cure process. Both these are used extensively and there has not been any gain by either method during the year.

Straight Side vs. Clincher

Another great point is the controversy of straight side versus clincher. The clincher tire is favored abroad, and for that reason American export products have to be made in this style. For domestic trade the straight side is growing rapidly, and if Ford sizes are excluded, it is probable that the percentage of straight side, as compared with clincher, is about 75 to 25. The soft-bead clincher is rarely seen above the 3½-in. size. The Q. D. clincher, or non-extensible bead type, is seen in the larger sizes, but, as compared with the straight side the percentage is dropping annually.

The criticism leveled against the straight side on the safety basis does not seem to have justified itself in the light of development. For example, Goodyear is making straight side tires in 6, 7, 8 and 9-in. sizes, which have 100 per cent perfect record as regards resistance against fastening failure. As a manufacturing proposition, the straight side is on a par with the clincher.

The Compounding Work

One of the points which the public does not appreciate in tire manufacture is the work of the compounding room. It is here that the secrets of chemistry are studied for the purpose of improving the compounds used for various parts of the tire. A mistake in the compounding room would cost 6 months in production if it were a serious one, and naturally conservatism and care are the watchwords of the tire laboratory.

Considerable talk has been going around regarding tread colors, but the gist of the entire matter seems to be that the compounding room can furnish about any color desired. and at the same time have about the same degree of toughness. It is quite certain that the black tread is very popular just about now, and taken in conjunction with the red side wall this gives a very attractive appearing tire, which is used by many of the large manufacturers. The important result from the car drivers' standpoint is that improvements in compounding during the year have given a tougher tire tread for the same price. Truck tires, too, are better because of superior compounding methods.

In the pro and con arguments for and against the straight side type, the majority on the side of the straight side seems to sum up its arguments under four main heads.

First, the line of weakness just above the bead in a clincher tire is eliminated in the straight side, or to put it in other words, rim cutting is reduced.

Second—The straight side tire has a broader base, and is, therefore, a more stable mechanical proposition; there is less tendency for the tire to roll off the rim, although it is doubted if this were ever noticed to any great extent even in the clincher type. This broader base is included in the argument that better disposition is made of the air space with the straight side tire. There is greater air space.

Third—The radius of flexure at the rim is large. This naturally is a factor in prolonging tire life, as the smaller the radius of flexure the more severe are the stresses which tend to separate the fabric plies and hence cause the tire to disintegrate.

Fourth—The continuous non-extensible bead. This is made up generally of a core of piano wire. In some instances the piano wire is braided to give it even a stronger assembly. This piano wire binder running continuously around the bead gives the non-extensible feature, which can be employed in the straight side tire, but which, of course, is out of the question in a soft bead tire, which must be stretched over the rim, although used in a Q-D clincher.

1916 a Wonderful Year

All told, 1916 has been a wonderful year in the tire business. On every hand business is reported increased by great percentages. Firestone output increased 62 per cent. during the year. The output of Goodyear has increased 85 per cent; Goodrich has increased 40 per cent; Miller Rubber Co. reports approximate increase of 150 per cent; in the New Jersey district Ajax, Michelin, Endurance, Carspring, Howe, Thermoid and Braender have felt the reaction from the greatly increased production of automobiles, and the last-named concern alone reports an output increase of 200 per cent. Besides the unprecedented demand, the advantage of excellent crude rubber market conditions has prevailed, and although every item of manufacture has increased in cost from 20 to 300 per cent, according to one concern, and varying percentages according to others, the increased production has largely overcome the increased cost.

To meet the increased demands, acres of floor space have had to be added, and more efficient machinery substituted. There is not a concern which has not felt the necessity for increasing its floor space, machinery, labor or output facilities. Some of the increases in area are interesting. Firestone has added 11 acres, Goodrich 21 acres, General Tire & Rubber has large areas now under process of building, Braender has added 10,000 sq. ft. The story of the Jersey company is the same. Michelin, Thermoid, DeLion, Acme, Ajax, and all the others in the scattered tire territory throughout the entire United States have shown the reflection of the demand for increased production. Other examples showing the general growth throughout the country are an increase in output of the Gorden Tire Co., which increased its output 50 per cent, and added 3000 sq. ft. of floor space. The Gibson Co., Indianapolis, increased 125 per cent; the Alliance Co., Alliance, Ohio, 50 per cent; the Acme Rubber of Trenton 25 per cent.

The Multiple Calendering Process

In adding new machinery it is quite natural that a number of manufacturing processes would be improved by the use of more modern machinery. One of the points in which manufacturing has been conspicuously improved is in the multiple calendering process. In making the fabric for the fabric tires a roll of the fabric is run through the calender and another roll of rubber passes through and impregnates the fabric with the rubber. It is then reversed and impregnated from the other side after which it is run through rolls again and a surface coat of rubber applied to it. With the old method, it was necessary to run the roll of fabric through the machine three times, once for each impregnation and again for the coating. With the new method a train of three calenders, placed one after the other, allows the material to be fed continuously from one to the next so that by the time it has passed through all three it has been given the two impregnations from the first two machines and the coating from the third. This avoids two shutting down processes between each roll of fabric and avoids two restarting actions in again circulating the fabric through the calenders.

Less Reclaimed Rubber

With the advantageous crude market a less percentage of reclaimed rubber is finding its way into tires and the number of low grade tires manufactured is decreasing in proportion to the total. Also during the year there have been a great

many outlets which have sprung into being for the lower grades of tough rubber stock. These are not necessarily poor grades of rubber but are not of the same quality as is necessary for pneumatic and solid tire use. A good example is in the rubber soles of shoes. This white rubber compound has increased remarkably and a great many of the concerns manufacturing tires turn their attention to this field also.

Fabric Cost Doubles

Fabric cost has doubled during the year. Firestone reports a 100 per cent increase and others very much the same. It must be remembered in thinking of the increase in fabric prices that the cord prices have kept pace with them, so that on the whole it can be stated that cord tires are 20 to 30 per cent more expensive than the fabric type. The chemicals used in the compounding room have gone up in price, but even taking this into consideration the improvements are very noticeable in this department of the work. It is difficult to obtain access to the compounding room of a rubber factory, but there have been rumors which are quite well substantiated that several chemicals which were hitherto deemed impractical for rubber compounding work have been found available. The result has been particularly noticed in toughness and ability to resist abrasion.

Firestone has embarked in the cord tire field and is turning out daily 500 of this type. The daily production of the fabric tire is 12,000. These are all machine-made and during the year $1,500,000 has been spent in machinery. Like other companies, Firestone reports the crude market to be satisfactory and in the manufacture of tires the percentage of 70 per cent plantation against 30 per cent wild rubber is used. As one of the leading tire organizations the indorsement of this concern of the black tread tire with the red side wall has helped in putting this development among the foremost trends of the year. The non-skid tire made by this oncern is well known on account of the printing of the word Non-Skid across the tread on the fabric tire. On the cord tires the double F non-skid tread is used.

Goodrich is producing about 20,000 tires a day. All of these are, practically speaking, manufactured by machinery and during the year a great amount of money has been expended on this part of the equipment. The testing department has been given special attention in the development program.

Non-Skid Types Gain

Owing to the growing practice of car manufacturers in equipping the rear wheels of their product with non-skid tires the percentage of the total output in non-skids is increasing in all plants. During the year 1916 75 per cent of Firestone tires were non-skids. The price of these to the user is 12½ per cent higher than the plain tread, while the price of the cords is approximately 25 per cent higher. About 25 per cent of the output is straight side.

In securing the supply of crude, 60 per cent comes from the East Indies, about 30 per cent from Brazil and the remainder from scattered territories. Although minor structural changes have been made to improve the product, there have been no radical changes in design of either the fabric or the Silvertown cords. The most important improvement is the addition of straight side tires in the Silvertown cord models, thus completing the line.

Tire Companies Increase Activity

PRACTICALLY no change appears in the Michelin line this year. The company's newest model was brought out only about a year ago, this being the Universal non-skid casing which is made with both clincher and straight side bead. Additions to the factory have been going up throughout the year and a large three-story building has been started which will nearly double the capacity of the plant. Lack of manufacturing facilities has proved a considerable handicap to the company during the past year, and great difficulty was experienced in securing molds. The latter problem was solved by the Michelin company making its own molds, so that it now has a complete line, including the popular 30 by 3½ size. In the tube department a unique installation is the circular mold upon which the red rubber inner tubes are made. This conforms to the shape of the tire casing, and the company claims that the tube is thus in normal shape when inflated.

Woodworth Has New Tread

A new non-skid with diagonal depressions each side of the center of the tread has been adopted by the Leather Tire Goods Co., Niagara Falls, N. Y., maker of Woodworth Trouble-proof tires. This design replaces the non-skid in which circular depressions were used. The feature of this tire, which is also made with plain tread, is that there is a strip of leather surrounding the casing of the tire and under the tread. It is designed to be puncture and blow-out proof, and is guaranteed for 5000 miles. The leather is chrome tanned and specially prepared so that it will not interfere with the resiliency nor cause heating or other difficulties. Its purpose is to add materially to the strength of the tire. About 55 per cent of the production is non-skid tires and the rest are plain tread. Non-skids are more popular in the North and plain tread in the South. About 27 per cent have straight sides, 8 per cent Q. D. and 65 per cent clincher. Straight-side tire business has increased about 20 per cent. Trouble-proof tubes are also built, and are made of several plies of rubber with the grain of alternate plies running crosswise so that the tube has equal strength in both directions.

Carspring Increases Mileage Guarantee

The Carspring tire, made by the New Jersey Car Spring & Rubber Co., Jersey City, N. J., is improved in detail with the result that the guarantee has been increased from 3500 to 5000 miles. It is made both as a non-skid and plain tread and red tubes are manufactured. Sixty per cent of the casing production is non-skid and 80 per cent of the casings, with the exception of the Ford size, are straight side. Cord tires are not manufactured.

Republic Favors Black Tread

As a good example of the proportion of non-skid to plain tread, Republic makes 75 per cent of the total output non-skids. They are made with black tread only and a distinct advantage is claimed for this tread stock. The tires are machine made. Another Republic feature is the long guarantee basis, 5000 miles. This concern verifies the straight side trend, stating that it sells best up to the 4½-in. size. This is significant in view of the tendency toward straight sides even in tires of larger section and shows that everyone is not as yet satisfied that the straight side tire is best in the larger sizes.

Kelly-Springfield Specializes on Non-Skid

Kelly-Springfield tires are 80 per cent non-skid. It is a single-cure tire and reflects the straight side tendency, as about 75 per cent are made in this style. Kelly-Springfield adjustments are made on a 6000-mile basis on the non-skid and 5000 mile on plain treads. There are two plants,

one at Akron and one at Wooster, Ohio, the latter making Ford sizes only. The present plant has grown about to its capacity and the company has recently purchased land at Cumberland, Md., where a new factory will be erected.

Pennsylvania Makes Many Straight-Side

Three styles of Pennsylvania non-skid tread are marketed, each with a different mileage guarantee. The Vacuum Cup has 6000, the Ebony tread 5000, and the Bar Circle 4000. All three are the same in materials, but differ in the tread shape and thickness. They are all single cured. The experience of the Pennsylvania concern bears out the statement that 75 per cent of all tires for 1916 exclusive of the Ford size are straight side. The Pennsylvania tire is sold principally to dealers and hence the percentage of straight side output is significant of current demand.

Redwall Now Made on Full Mold

The National Rubber Co., Pottstown, Pa., which makes the Speedway Redwall tires, has changed from the wrapped tread to the full mold process. It claims that the full mold tire has a greater density and resistance than the wrapped method due to the higher pressure during vulcanization. To be specific, wrapped tread tires are cured at a pressure of from 750 to 900 lb., whereas the full mold tire is cured at 2250 to 2500 lb. per square inch. The entire National output is fabric tires, all being hand made. This concern is growing rapidly, the factory output having increased approximately 2000 per cent during the year. In area this amounts to about 60,000 sq. ft., and during next year 70,000 sq. ft. additional is contemplated.

Thermoid Specializes on Fabric Tires

Thermoid is specializing on fabric tires and does not contemplate the manufacture of the cord type. The company does not make any clincher tires above 32 by 3½. Both hand and machine work are used, with the machine generally on the small sizes and the hand methods on the large. On the other hand, there are several Jersey concerns which are preparing to manufacture cord types.

Fisk Factory Covers 29 Acres

Fisk tires have been slightly refined, but in the main are the same as heretofore. Non-skid pneumatics are manufactured under the trade name of Red Top, and there is also a gray non-skid. Gray smooth-tread tires are also produced. Production has been increased about 25 per cent during the year, the factory additions including a large mill building, storehouse and seven-story administration building, bringing the total floor area of the plant at Chicopee Falls to 29 acres. New machinery to the value of $425,000 has been installed during the year.

Combination Features Hold-On Tread

The Combination Rubber Mfg. Co., Bloomfield, N. J., reports the production of 130,000 tires and 145,000 tubes during the year. The Hold-On tread, a depressed type of non-skid, accounted for 90 per cent of the production; 40 per cent of the tires are straight side and the manufacture of tubes is almost equally divided between gray and red, the latter being an antimony-cured, hand-made product. All tires are wrapped tread. It is not expected that there will be any appreciable advance in the prices of the product, inasmuch as the company is protected by favorable contracts on fabric and rubber.

Braender's Many Improvements

Braender is not making any cord tires and the percentage of fabric tires manufactured by machinery is about equal to that manufactured by hand.

During the year the improvements in Braender tire manufacture run through the entire gamut of treads in tire design. A tougher tread, a better balanced product, improved fabric weave, improvements in calendering and greater strength in friction and cushion rubber are among the principal points where progress has been made. In addition, there is now special waterproofing on the inside of the tire to prevent water from getting into the fabric. The new form of breaker strip of heavier construction and basket weave increases the number of rubber rivets which hold the tread to the fabric and gives an extra tough construction which resists the danger of tread stripping. In the Braender, as well as in many other tires, the side walls have been made tougher to protect the carcass from ruts and sandy roads.

Quaker City Features Clinchers

Quaker City is now producing a single cure non-skid tire. About 75 per cent of the output is in clincher sizes. Factory buildings have been greatly increased and production accordingly put up during the year.

Converse Triple Tread

The triple tread made by the Converse Rubber Shoe Co. of Malden, Mass., is guaranteed for 6000 miles and is made in any of the popular sizes. The triple tread tires are cured by the unit wrapped method with a single cure.

The Endurance Rubber Co. manufactures all non-skids. The Rubber Insulated Metals Corp., making the Century tire, makes 75 per cent non-skids.

Guarantees vary with the different policies and with different constructions. A few of these have been mentioned varying all the way from 3000 to 6000 miles, but it cannot always be said that the guarantee gives any valuation of the data on the value of the tire. The purchaser may be spending a certain percentage of his money for guarantee and the rest for tire, which would depend on the quality of the product and its life.

Ajax Uses Single Cure

Ajax uses the single-cure process for its entire output and is producing 1700 to 1800 tires a day. It is adding new space. A significant point in relation to the straight side question is that Ajax states that 75 per cent of its business outside of the Ford sizes is straight side.

Empire Makes Cord Tires

Empire has its cord tire on the market and expects that this type will form a considerable percentage of the 1000-a-day output. Of the Empire output 60 per cent are straight side and the percentage is increasing.

Lee Has Armor-Plated Type

Another concern which has more than one style of non-skid tread is the Lee Tire & Rubber Co., which makes a puncture-proof style with metal disks forming an armor plate in the carcass beneath the tread. There is a plain rubber non-skid without the metal disks. One of the improvements is that the side cover strip is continuous and integral with the tread.

Acme, Delion and Globe Wrap Treads

Both the wrapped and molded tread are produced by Acme also, while Delion and Empire have one method solely. Delion uses all single-cure, wrapped-tread, while Empire has single-cure molded. Another concern which produces only the wrapped tread is the Globe Rubber Tire Mfg. Co. Here the single-cure process is used and some of the tires are made by hand and some by machine.

Rutherford Makes Black Ribbed Tread

The popularity of the black ribbed tread which made its appearance coincidentally with the cord tire has caused some concerns to outfit their plants to produce a tread of this sort for fabric tires. This tread is faster than a great many of

the plain treads and is also of good appearance. One of the treads brought out along these lines has been put on the market by the Rutherford Rubber Co., under the name of Sterling. The red side wall which has proved popular is also used.

Miller May Make Cord Tire

Although no definite information is available regarding the intentions of the Miller Rubber Co. on cord tires, it is probable that early announcements will be made. This concern features a non-skid known as the Geared-to-the-Road tread. The straight side business has increased and at the present time 33 per cent of the total output is devoted to this type. This concern will have turned out 300,000 casings during the year 1916, and in 1917 will manufacture, according to present expectations, 500,000. The tires are made in all sizes, including millimetric.

Hood's Arrow Tread

The Hood Rubber Co. has an Arrow tread representing 75 per cent of its output. This is a single-cured job which has not been altered during the past year. Production schedule has shown an increase toward the straight side and the total capacity of the plant has been doubled and will probably be quadrupled next year. Both red and gray tubes of equal quality are manufactured.

Knight Uses Black Side Walls

It seems to be quite true that the appearance factor has a great amount to do with the choice of color in the tread and side wall. The black tread with the colored side wall is quite a common choice this year. Another combination is illustrated by the Knight Tire & Rubber Co.'s tire which is made with a white tread and a black side.

United States Tire Business Booming

Between Jan. 1, 1916, and Aug. 15, 1916, as many tires were shipped by the United States Tire Co. as during the whole year 1915, which was a big year. To meet the increased demand, the capacity of the company's plants has been materially increased.

After extended tests, the company is now prepared to produce its new product, the Royal Cord tire in large quantities, and is stocking up its branches. This tire is of the thread cord type, being built up of from four to ten plies of cabled Sea Island cotton, laid into the shape of a tire casing. It is made with a black tread, having a white strip running around the side walls, with the balance of the side walls black. The tread has a continuous ridge at the crown, with transverse corrugations at each side, and is distinctive in appearance.

Four other types are manufactured, with Knobby, Chain, Usco and plain treads. The past year has shown a marked increase in the sale of non-skids and in straight side tires, especially above the 3 and 3½ in. sizes, where the clinchers predominate. The sale of red and gray tubes has shown the same increase as the casing business and the truck tire sales have grown to such an extent that they necessitated an increase in the factory at Providence.

Hand vs. Machine Work

Hand-built and machine-built tires are about equally numerous throughout the list of manufacturers. The New Jersey Car Spring tires are all hand made and so are those made by the Mohawk Rubber Co. The Acme Rubber Mfg. Co. uses hand manufacture exclusively. This concern manufactures only fabric tires. The Standard Tire & Rubber Co. manufactures fabric tires only and uses hand-made production.

The Hawkeye Tire & Rubber Co., Des Moines, Iowa, is parallel with these concerns as its output of fifty fabric casings a day are all made by hand.

The Mansfield Tire & Rubber Co. on this same subject reports 80 per cent of their product made by machine and 20 per cent by hand. This concern has an output of 90 per cent fabric tires and 10 per cent cord. An improvement made by the latter concern, which may be mentioned in passing, is the introduction of the cable base for the straight side tires. The Lancaster Tire & Rubber Co., which produces all fabric and no cord tires, uses only the hand method.

Many Secret Processes

Owing to the important part that chemistry plays in the tire business it is but natural that large numbers of secret processes are being developed. Hence the improvements that are made cannot be explained in detail. One of the sources of improvement, though, is in the efficient arrangement of factories, and the tire companies are learning the lessons of production very rapidly. The Gordon Tire & Rubber Co. has been able to greatly increase its output by a factory rearrangement. This concern manufactures fabric tires, of which 75 per cent are hand made and 25 per cent machine made.

There is no part of the country where tires are manufactured that does not report an increase of business. The Marathon Tire & Rubber Co., Cuyahoga Falls, Ohio, states that its business increased during the year to such an extent that it was necessary to double its working capital. The Mohawk Rubber Co. of Akron has increased during 1916 77 per cent and by the end of the year will probably reach 100 per cent. The Gibson Co. of Indianapolis, Ind., which is the general sales agent for the Falcon Tire & Rubber Co., increased its business 125 per cent. The Alliance Rubber Co. of Alliance, Ohio, increased its output 50 per cent and is trebling its floor space and adding $60,000 worth of machinery.

Best Tread Type Disputed

There is some discussion in tread forms as to whether or not the most desirable is the depressed type or the raised tread. The Mattson Rubber Co., Lodi, N. J., makes a depressed non-skid tread which it prefers because there are no projections subjected to road shocks. This is a wrapped tread, single-cure process tire.

Another concern which favors the depressed tread is the Indiana Rubber & Insulated Wire Co., which has changed so that the raised projections on the tread are now twice the width of the Traction tread, formerly manufactured. The color has been changed to white side walls and brown tread.

Newcomers in the Field

New tire concerns are coming into the business and among the best known of the newcomers is the Brunswick-Balke-Collender Co., Chicago and Muskegon, Mich., which will devote its production entirely to single-cure, wrapped-tread fabric tires. The Gryphon Rubber & Tire Corp., New York, is a new concern which will not be in operation before the first of the year.

Batavia Molded Tread Tires

Batavia is changing from wrapped tread to molded tread manufacture. It is marketing a single non-skid tread, Security, which is 75 per cent of its output. The quantity of the tread stock has been improved and now contains more natural gum. All tires are machine made and the sale of straight sides has shown a great increase. Service stations have been increased and the arrangement of the factory altered to facilitate production. Gray tubes also are made.

Goodyear Makes Millions of Tires

Goodyear is making fabric and cord types and the sale of cords has increased 75 per cent during the year. Outside of the Ford sizes, most of the fabric tires are straight sides. Goodyear advocates somewhat lower inflation pressure than

usual, due to the oversize construction of the casings which thus hold more air. A number of new factory buildings have been put up during the year.

Goodyear has increased its output during the year 78 per cent, and has added about 30 acres of floor space. At present it is producing 16,500 fabric tires a day and 1500 cord tires. The company hopes to have reached a production of 225,000 cord tires by the end of this year and to make 600,000 in 1917. Approximately 70 per cent of the original equipment supplied to car manufacturers have non-skid treads. In 1916 3,500,000 tires will have been turned out and this number is expected to reach 6,000,000 in 1917. In 1915, the total number produced was 2,000,000.

The Dayton company produces both its airless tire in which the air space is taken up by a series of piers of live rubber and a pneumatic type. The airless is largely for fire apparatus. The pneumatic has a very high non-skid tread and the company's faith in its durable qualities is evidenced by a mileage guarantee of 6000.

Swinehart's Big Gain

Swinehart reports a big increase in straight side business, the demand for this type of tire doubling during the year. Total production has increased 30 per cent and this has called for an increase in floor space of 50,000 sq. ft.

Big Four in New Plant

The Big Four Tire Co., has just completed its factory which has 18,000 sq. ft. of floor space and the entire plant will be devoted to the manufacture of Big Four tires. The tire will be constructed entirely by hand at the start though special machinery will be constructed in the course of time. About 100 tires a day will be the capacity after Jan. 1. The big Four tire differs from others in that it is virtually two half clincher tires, there being a clincher rim in the usual place and another clincher rim to which the heavy tread portion is attached. The tire is puncture proof and is made for both passenger vehicles and trucks.

Carsafe Water-Cooled Non-Freezing Brake

SYSTEMS of cooling brakes have usually been found impractical since the cooling extended also the zone of freezing in a most undesirable manner. The liquid around the brake drums is too far away from the radiator, and would freeze in cold weather when the car is left on the street. The Carsafe system is claimed to solve this problem by using a device to transfer the entire water from the brake cooling system to the radiator immediately upon the stoppage of the engine. The piping is therefore empty and hence free from freezing.

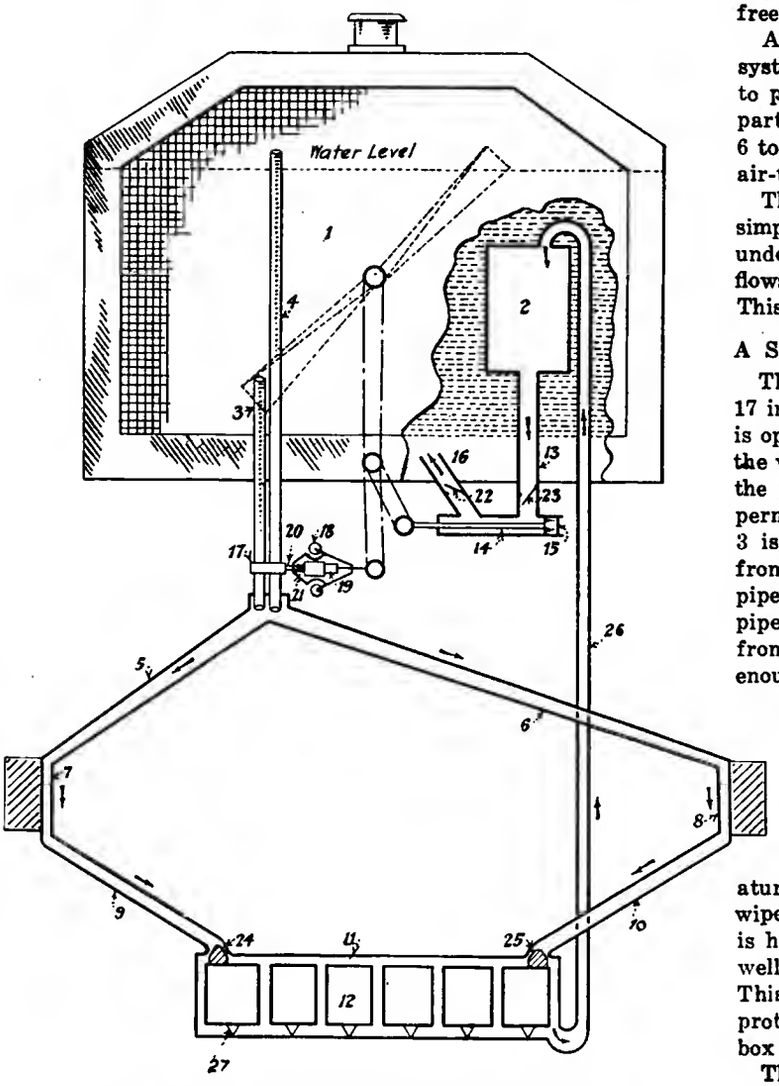


Diagram of Carsafe water-cooled non-freezing brake

As shown in the drawing, the water for the brake cooling system is taken from the radiator. It flows through pipe 3 to pipes 5 and 6, drawn by the suction pump 14, or by the partial vacuum created in the chamber 2 by the pump, from 6 to drum jackets 7 and 8, and then to a shallow water- and air-tight box 11.

Thence the water rises by pipe 26 to chamber 2 which is simply a thin-sheet-metal water- and air-tight box located under the water level of the radiator. From it the water flows to the suction pump 14 which returns it to the radiator. This completes the water circuit.

A Spring Governor

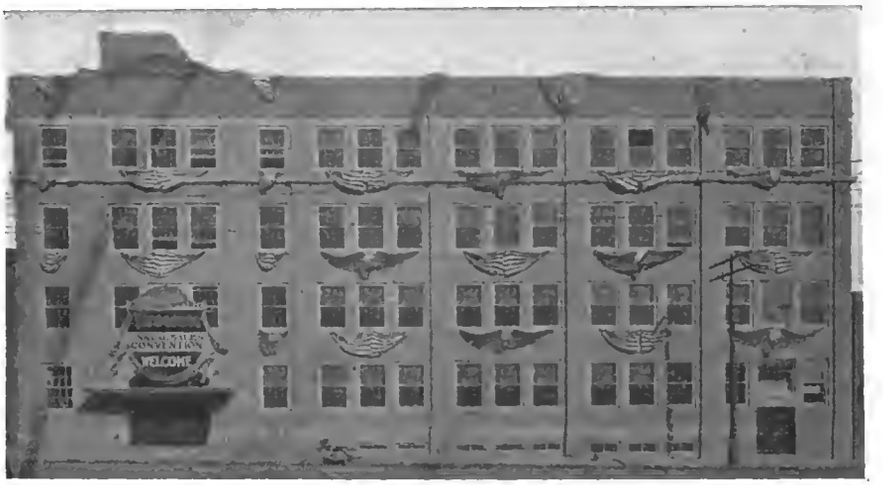
Then there is the spring governor 18 which operates valve 17 in such a manner that when the engine is running, pipe 3 is open, and pipe 4 (which has its upper orifice always above the water, and carries air) is closed. When the engine stops, the pump stops working. At the same time the governor permits the valve to shift to such a position that now pipe 3 is closed, and pipe 4 open. No more water is coming in from the radiator, but there is full atmospheric pressure in pipe 4 and partial vacuum in chamber 2. The pressure in pipe 4 drives the water through the system to box 11, and from there through tube 26 to chamber 2 which must be large enough to hold the entire water used for brake cooling. Hence, in a very little while after the stoppage of the engine there will be no more cooling water in any of the jackets or pipes of the brake cooling system, which is the reason why the latter cannot freeze.

The presence of the described system of brake cooling will not affect very materially the temperature of the radiator water. On one hand there is the heat wiped off the brake drums, which tends to heat it up, which is helped by the fact that the water in chamber 2 is not as well cooled by the fan blast as the rest of the radiator water. This is however largely compensated by the losses from unprotected metal surfaces of the pipes, brake drum jackets and box 11.

The installation of the brake cooling system does not affect the design of the fan, if it has been properly selected.

Tire Makers Active in Welfare Work

Big Producers Realize Benefits Resulting from Mental and Physical Education of Employees —Millions of Dollars for Movement



Firestone Clubhouse erected at a cost of $300,000 for the benefit of employees

AKRON, OHIO, Nov. 17—Recognizing the benefits to be derived from welfare work among employees, all of the Akron tire manufacturers are giving thought, money and time to the subject and in many instances have developed remarkable systems for the protection and uplift of the workers.

There is not one of the companies which are prominent in the manufacture of automobile tires but is providing, not only plenty of light and air and cleanliness throughout every department of its factory to a degree unimaginable only a few years ago, but also extends to the workers every advantage of equipment to raise their general physical and moral welfare and to increase the feeling of ease about the present and of happiness for both present and future, which have been found so closely allied to efficient execution of work of all kinds on the part of the employees. These features of factory welfare development include departments for reading, physical culture, modern eating facilities and means whereby the employees receive a reasonable maximum of insurance in case of illness or injury.

Firestone's Clubhouse

The Firestone Tire & Rubber Co. during this past year has erected a clubhouse consisting of four stories and a basement, 151 by 125 ft., constructed of brick, steel and glass to correspond with the various factories belonging to the company. The basement contains a swimming pool 60 by 20 ft., which holds 62,000 gal. of water. The water is passed through two charcoal filters, one alum filter and two violet ray sterilizers to insure purity. There are fourteen shower baths in connection. The basement also includes a barber shop with four chairs, and eight bowling alleys constructed in the latest and most improved style.

The first floor has a restaurant for factory employees, with a seating capacity for more than 600.

The second floor is furnished with a restaurant for office employees. It seats more than 700 at a time and has a modern kitchen equipment. All bread and pastries are baked here and are thus insured cleanliness and purity.

The third floor contains a reading room and an auditorium with a complete stage effect. Two moving-picture machines have been provided and the company gives educational and entertaining exhibits for the workers. The auditorium is so arranged that the sides may be converted into convention rooms, if desired, and these are sometimes used for conventions or dances.

The fourth floor consists of the club rooms, and contains a library and reading room in combination, and also a girls' rest room, where employees may come between working hours to rest and read.

A $1,000,000 Fund

The Firestone company has financed the clubhouse in its construction and equipment, amounting to $300,000, and intends, through a $2 fee for male employees, a $1 fee for females, and a $1 fee for non-resident members, to make the institution self-sustaining. The company has also entered into other welfare work, including a dental and medical department, and has recently voted a $1,000,000 fund for employees' welfare and insurance, besides arranging a plan to provide employees with homes at cost on a small weekly and monthly payment basis. The homes are erected on a plot known as Firestone Park, and workers are invited to occupy them without making any large deposit in advance.

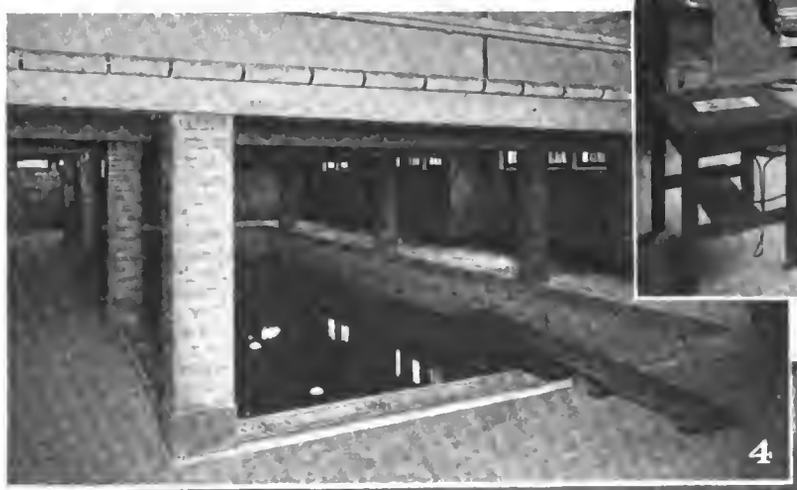
Goodrich Welfare Work

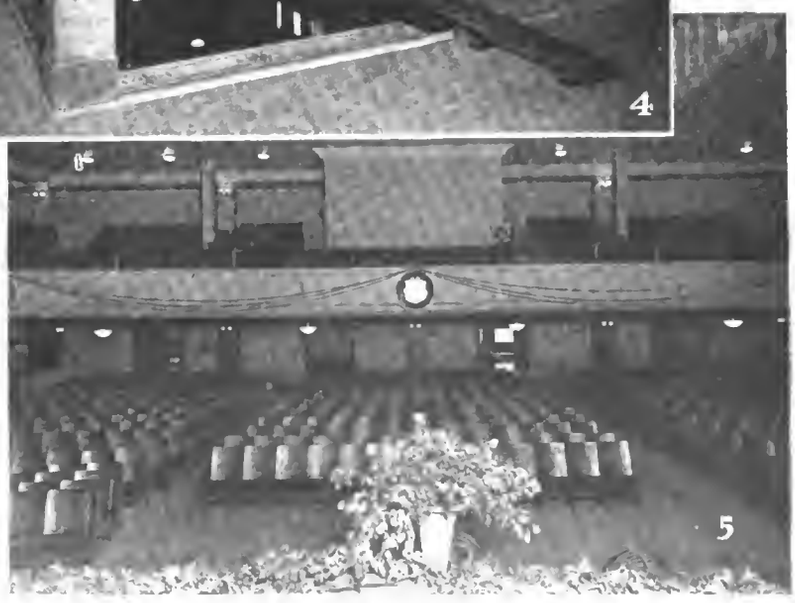
The B. F. Goodrich Co. provides social insurance, medical supervision and healthful recreation for its employees through its Department of Industrial Relations, which includes divisions of labor, health and safety. The company goes beyond the State law requirements in granting compensation to those injured in its plant and maintains health insurance providing compensation for employees detained from work more than 7 days through illness or injury occurring outside the plant. This compensation is paid from the first day of disability for a period not exceeding 1 year. Married men, single men with dependents and all women receive two-thirds of their wages, and single men without dependents one-half their wages. Other welfare features include a special maternity benefit to married women who comply with the regulations of the health department, a life insurance plan which gives employees $500 insurance, increasing to a maximum of $1,000 during the first 5 years of employ and various service annuities are paid with a minimum of $20 and a maximum of $100 per month. Employees are given a physical test when entering employment and upon return after illness. Dispensaries, medical clinics and clinics for special diseases are maintained. A corps of visiting nurses is employed.

Goodyear Factory School

The Goodyear Tire & Rubber Co. has established a factory school, which is attended by 500 students, in which common

Glimpses in the $300,000 Firestone Clubhouse





1—A corner of the dining room in the Firestone clubhouse for the use of office employees of the Firestone Tire & Rubber Co., Akron, Ohio

2—Part of the dining room provided for the use of factory employees of company. Note the clean and substantial character of the appointments

3—The barber shop of the clubhouse is fitted with up-to-date equipment and is kept scrupulously clean. Illumination is aided by the skylight forming the ceiling

4—The swimming pool contains 62,000 gal. of water, which is filtered daily. There are fourteen shower baths in connection with it which must be used before entering the pool

5—Auditorium of the Firestone clubhouse which is laid out with convention rooms around the walls. The seats are frequently removed and the space used as a dance hall

school lessons, factory work and technical studies are taught. The company has an athletic director, whose sole duties consist of providing athletic diversions for employees. An insurance plan similar to the Goodrich system is in operation, and a hospital with a factory doctor has been installed. Old age pensions are given. Playgrounds have been provided for children of Goodyear employees and the company has purchased land and erected homes, which the workers may purchase by small instalments at practically cost price. A safety first propaganda was started in the factory during the past year, which has reduced accidents almost 100 per cent.

Miller Has Adjustment Board

The Miller Rubber Co. has embodied a sort of adjustment board among the employees of the employment department and allows them to make minor adjustments of difficulties arising among workers. One American and one foreigner, who is an excellent linguist, talk to all employees and to all who apply for work. A hospital has recently been installed and equipped with every necessary facility, and has a trained nurse at its head, who makes visitations constantly to the homes of any employees who are sick or injured. The nurse and one forelady also act as a sort of clearing house for the troubles of girl employees. The company fosters all sports and purchases all essential equipment for indoor baseball, basketball, football and other games, and has provided a field at Kenmore for the use of the workers. Study clubs are now in process of organization, and a library has been started.

The study clubs include ten courses, consisting of the following: Production problems; office methods; personal efficiency; marketing problems; fundamentals of economics; accident prevention; business law; real estate, insurance and investment; elementary accounting; business English. It is planned to have small groups of eight or ten people take one course at a time, and if more than that number apply, a second group will be started. Classes will be held in the evenings from 5 p. m. to 7 p. m., and supper will be served by the labor department at actual cost.

The company has also instituted a suggestion system allowing any employee to make suggestions and submit them to the administrative offices. Slips of paper and envelopes are provided and boxes are hung from many walls in which the suggestions may be dropped. They are gathered daily and passed upon by a committee of five, appointed by the general manager. Each suggestion taken up and acted upon is paid for with a substantial sum. During the first month of the suggestion plan eighty-six suggestions were received, of which eighteen were considered worthy of adoption, and the employees entitled to reward received from $1 to $5. Such recommendations were turned in as a liner improvement, an increased record efficiency, and an improved method for handling scrap. The company issues a booklet monthly giving the authors of suggestions that won rewards.

Megow Attachment Converts Car Into Tractor

WE have become very familiar with attachments for transforming a Ford touring car into a commercial vehicle. The latest, however, is a device which makes this car a tractor. The accompanying illustrations show the device in action ploughing or breaking a timothy and clover field with two 14-in. stubble plows. The advantage claimed for this device is particularly in regard to the power, which is applied at the driving wheels.

Car, Tractor or Truck

With this device, the inventor, who is Edward J. Megow of Minneapolis, Minn., states that one can use the Ford or other make of car, to which the device is applied for ordinary purposes. He states that in 30 min. the automobile can be transformed into a farm tractor capable of pulling the two 14-in. plows. In another 10 min. a set of truck wheels can be slipped in place and the outfit can be used as a road tractor or truck capable of pulling a great weight. The attachment will probably sell for about $200.

One of the advantageous features of the invention is that all the gears are inclosed and run in oil, being thus protected from dust and dirt and rendering it possible to leave the machine out in all kinds of weather.

Drive Stresses Taken by Wheels

A spindle is attached at the rear, thus furnishing an extra bearing and relieving the axle bearing of any strain. In the driving drum it will be noted on the side of the wheel where the gears are carried the power is applied at two points opposite one another on the periphery, thus dividing the stresses and eliminating the use of special bearings to take care of undue loads. As the point of power application is several inches from the center of the wheel, good turning torque is secured. All the working stresses are taken by the tractor wheels and none by the frame structure. The only change in the power plant of the car is that it is necessary to install a circulating pump and to increase the speed of the fan. With the device the gear reduction can be altered within wide limits, thus rendering it possible to take care of widely varying conditions.

Left—Megow tractor attachment on a Ford roadster and drawing two 14-in. stubble plows. Note deep furrows and also plowed area to the right of the machine. At the right the same vehicle, in side view, gives an idea of the type of wheels used for tractor purposes

Republic Rubber Co. Protects Workers

Safety Placards Throughout Factory Buildings and Yards, Railings and Guards on Machinery Some Measures Adopted

Safety First display window situated near the main entrance to the plant of the Republic Rubber Co., where all matter pertaining to safety and welfare is displayed for attention of workers

SAFETY FIRST, that slogan of accident prevention originating in the fertile mind of a minor railroad employee several years ago, has worked itself into our national life to an extent that no other slogan has. Not even the old C. Q. D. or the more modern S. O. S. of a ship in distress at sea is so well known as these two warning words first adopted by the railroads. This slogan and the spirit back of it next became one of the principal considerations of factory management. The plant of the Republic Rubber Co., at Youngstown, Ohio, is not considered a dangerous place to work, but, as in any other establishment employing a large number of men and using various types of intricate machines, the carelessness of a few is a threat to the welfare of many.

In order to safeguard its employees from accidents which, although not actually always impending, might occur at any time, the Republic company has placed upon its staff George Hodgson, whose duty it is to sleuth about the 17 acres of floorspace of the factory with an eye ever watchful to the prevention of possible accidents with resultant injury to the men who make the tires.

The factory managers for the Republic company must have had in mind that old adage about locking the barn after the horse was stolen when they planned this policy. For it is usually too often the case that a machine is fitted with an accident preventing screen or other device after that machine has killed its man. The reverse is true in the Republic plant where the whole policy is to prevent even the first accident.

A policy of accident prevention in a manufacturing establishment has as its end the safeguarding of mechanical working parts by protective devices suited to the particular requirements. The beginning of a campaign for the prevention of accidents must appeal to the human element. Education is the first requisite of such a campaign. Without education for carefulness the policy can work to but 50 per cent of its efficiency. Money invested in protective devices will not realize the fullest possible results without education.

Republic Rubber Co. officials recognized this truth in plotting its policy for the elimination of preventable accidents. Consequently, the first step taken was an educational one. The entire factory was placarded throughout with Safety First signs and warnings designed to make the employee think first of his own welfare and of the welfare of those about him. Above the main entrance to the factory hangs a great Safety First sign. This sign, placed as it is, gives the employee the keynote of his whole day's labor as he enters the factory in the morning. In addition to being impressed by these warning words as he enters the factory for the first time, the new employee is given a little booklet as soon as he is hired. This booklet contains the factory rules and emphasizes the fact that he is always to guard himself and his fellow workmen.

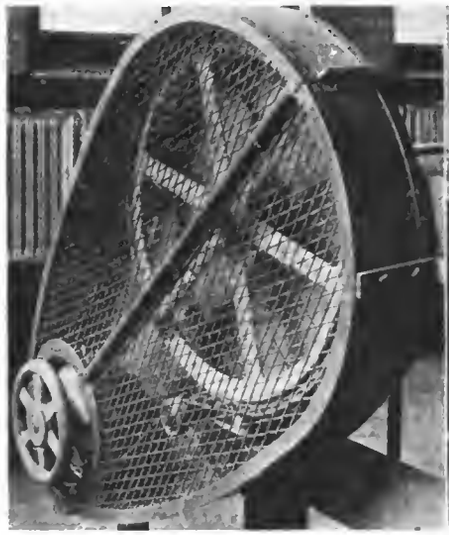
On this page appear a few of the signs and warnings which have been posted about the factory in furtherance of the educational side of the campaign. On the opposite page are shown some of the devices which inclose machinery that might otherwise be dangerous when carelessness played its part.

Another simple guard is the balcony rail guard made out of expanded metal. This guard is used all around the balcony on the second floor of the machine shop. Ordinarily this space would be open and hammers or other articles might fall through it to the injury of workmen below.

Some of the signs which are used about the factory buildings, yards, etc., of the Republic Rubber Co. plant

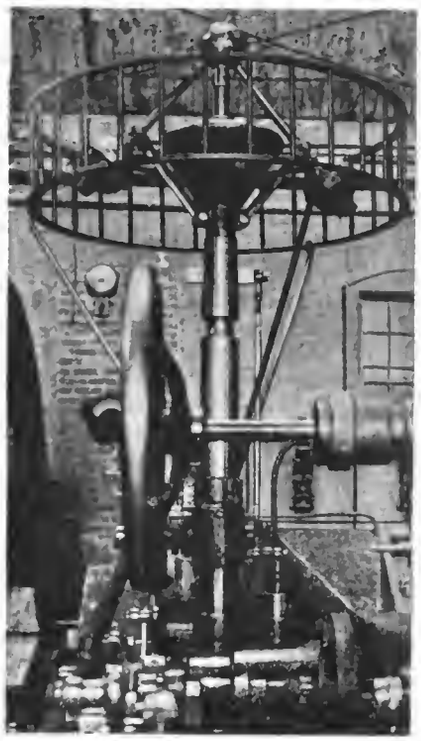
Safeguarding Devices Used for Protection of Workers in Republic Rubber Factory

A safety sign mounted at one of the entrances to the factory of the Republic Rubber Co. It is electrically lighted at night

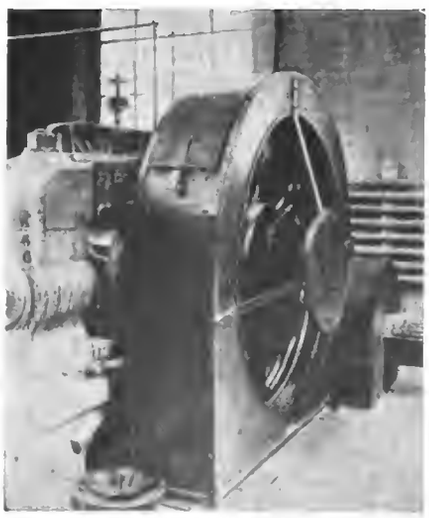


Above is illustrated the type of expanded metal and sheet iron guard employed in the Republic factory for sprocket and chain drives of the sort illustrated

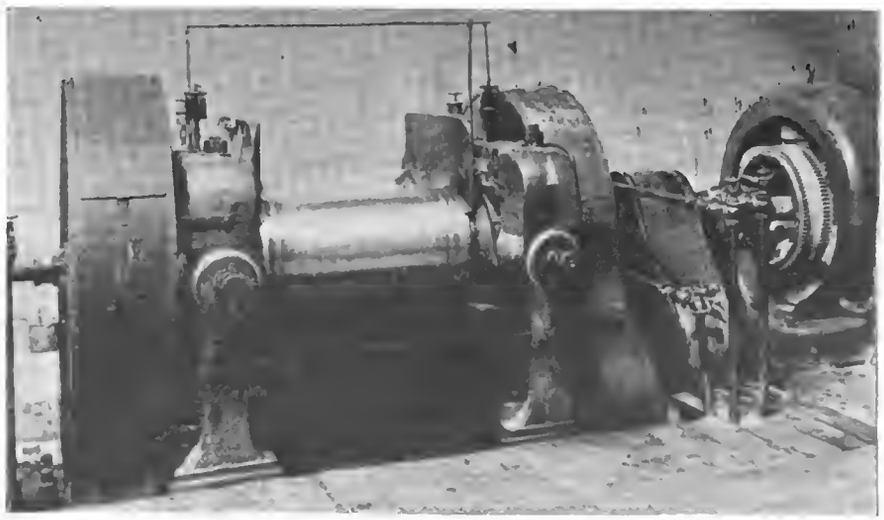
Another expanded metal and sheet iron guard for covering motors, starting boxes and switches, making it impossible for either workers or material to touch them



While not ordinarily dangerous, a fly-ball engine governor has latent possibilities, and it was considered wise to install the guard illustrated above



Guard used on rubber mills in calender room. Note the covered keyhead and hinged opening in front of guard for greasing and inspecting the gears



The rubber refining mill illustrated above is an excellent example of the thorough way in which the machinery of the Republic company is safeguarded. All gears are entirely inclosed and each mill is fitted with an electric safety stop over the rolls, which instantly stops the machinery of the mill in case of an accident

The Determination of Headlight Glare

Present Chaotic Condition of Legislation Throughout Country Largely Due to Lack of Definition of Glare, J. B. Replogle Tells Detroit Section of S. A. E.—Rules in Various Cities

DETROIT, MICH., Nov. 16—When an automobile headlight is so powerful as to be dangerous in its blinding effect it is a glare.

Glare cannot be regulated either by a bulb or a reflector but must be determined by reaching a certain unit standard of light beyond that which is considered glare, this unit to be discovered by the effect on the vision of an approaching driver.

These were the principal details on the subject of glare discussed by J. B. Replogle, director of research of the Remy Electric Co., before members of the Detroit section of the Society of Automobile Engineers last night.

What Constitutes Glare?

In his address Mr. Replogle confined himself entirely to the question of what constitutes glare and how it can be measured, thus precluding any discussion as to the merits of the various methods of eliminating glare. He told of his investigation of the ordinances of the different cities and States and read a number of them showing how futile and in many instances ridiculous all attempts have been in the effort to define or regulate glare.

"When I got through with this mass of correspondence," said Mr. Replogle, "I found myself in about as puzzled a condition as I was at the beginning. The only reference made to a unit was where the candlepower of the bulb was specified. Inasmuch as it is a matter of common knowledge that the effect produced by a lamp of a definite candlepower varies many hundred per cent according to the way it is reflected or condensed, the candlepower unit is a meaningless one.

"The glaring effect of a headlight is to a very great extent a function of its environment. For instance, in broad daylight the brightest headlight does not cause inconvenience, while on a very dark night on a country road a headlight which is ordinarily considered to be well dimmed often produces extreme discomfort and constitutes a real menace. Suppose you are looking in subdued light at an object which is sufficiently illuminated to be plainly visible. The pupil is dilated so that the eye can receive as much light as possible from the object to be viewed. If now a bright light is thrown in your eye, the pupil contracts so that while the same amount of light is coming from the viewed object as before, but a small portion of it can reach the retina of the eye and produce vision. This reduction of vision the ophthalmologist calls 'depression in vision function.'

Glare Quantitatively Defined

"A qualitative definition of glare is that it is depression in visual function due to contrast between the direct illumination of the eye from a source of illumination and the illumination of an object it is desired to view. This glare is prohibitive when the object of vision is difficult to discern. Accepting this as a working hypothesis, we next approach the question as to a unit of glare and how to measure it.

"In technical photometry, a source of illumination is known by four characteristics. 1. Its luminous intensity or the rate at which it is emitting light in a given direction: its unit is the candlepower. 2. Luminous flux or the total amount of light emitted in unit time: its unit is the mean of the spherical candlepower. 3. Illumination or the illuminating effect produced at a given distance: the unit is expressed in candle feet or foot candles. 4. Intrinsic brilliancy which is expressed in mean spherical candlepower produced by the source in question and an arbitrarily selected standard.

"The candlepower or the unit of luminous intensity has been defined as the light produced by a standard sperm candle which consumes speraceti at the rate of 120 grains per hour and the candlepower of the source under consideration is measured by placing a screen between a standard source such as a standard candle and the source under investigation and adjusting its relative distance from each until it is equally illumined by each.

"Luminous flux is measured by placing the source of illumination within a dead white sphere and comparing the illumination produced on the interior surface of the sphere by that of a standard source.

"Intrinsic brilliancy is obtained by dividing the luminous flux by the superficial area of the source of light. The unit of illumination, the foot candle, is defined as the illumination produced by a standard candle at a distance of 1 ft. from the object.

"Let us see if the unit of headlight glare cannot be successfully adapted from the standpoint of the unit of illumination, or the foot candle. It is wise to establish our units so as to apply to the most perilous situations with the feeling that the other situations will be thereby satisfactorily taken care of."

A Psychological Peril

Here, Mr. Replogle pointed out that there is a psychological peril when animate intelligence is confronted by a powerful swift-moving machine and that bright lights tend to increase the danger and stated that if conditions are so arranged that it will be safe for the animate intelligence, horse or man, provided it retains its self-control, that that is all that can reasonably be expected. In short, any headlight that causes a dangerous situation, even though the animate intelligence retains its self-control, is a glare.

The thing most interesting to the approaching driver, stated Mr. Replogle, is the ability to see the road and to avoid the ditch, and to do this there must be a minimum relation between the light shining in his face and eyes from the approaching headlights and the illumination on the roadway.

Pointing out that it is a superstition to believe that a driver can overcome the dazzling effect of an approaching car by turning on his own lights, Mr. Replogle applied this detail to the problem of glare by an example, using two principal points: A—the roadway which the approaching driver endeavors to see in order to steer correctly; B—the eyes of the approaching driver. Placing point A 5 ft. to the left of the fenders of the car carrying the headlights and about 4 ft. in front of it as the point on the roadway which the driver is trying to see, and placing point B, the eyes of the driver approaching, not less than 3 ft. from the ground and between 25 and 50 ft. from the headlight, he showed that the eyes at point B will be dazzled by the glare if the light striking

them is much greater than the light from the headlight that strikes point A. Experiments, he stated had proven that when the illumination at point B is more than 4½ times that at point A, the light constitutes a menace and should be termed glare.

To prove these remarks, Mr. Replogle used a headlight, a 15-candlepower light and a piece of steel ending in a circle and attached to a rheostat, asking several members present to peer through the circle at the object before and below the headlight until they could distinctly distinguish it. The light was made more and less powerful until found correct. Later in the evening these tests were checked and found to correspond to previous ones that produced the estimate of 4½. Mr. Replogle also introduced an instrument he has devised and which he calls a glaremeter, a device which may be used in conjunction with his estimates to discover glare.

Several Brief Discussions

Others followed the address by short discussions. Dr. Louis Bell, of Boston, associate of Thomas A. Edison in the Edison laboratories, objected to the distance of 25 ft. specified by Mr. Replogle, and pointed out that when two automobiles operating at 30 m.p.h. are close to one another they must pass at a speed of 88 ft. a second, which would not allow sufficient time if the drivers had to wait until they were so close to determine their movements. E. C. Patterson, president of the Warner-Lenz Co. of Chicago, made a short address, telling of the numerous communications his concern receives constantly that inquire for means of eliminating glare. E. F. Wackwitz, of Gray & Davis, Inc., objected to Mr. Replogle's ideas and stated his belief in the ability to regulate glare by regulation of filaments and reflectors, and said that insufficient light caused more harm than glare. W. E. McKechnie, of the Cadillac Motor Car Co., and chairman of the committee on headlight glare, gave a brief description of the work of the committee and declined to announce results of tests pending their completion. J. Caldwell, of the National Lamp Works, recommended parabolic lamps arranged with high and low-power bulbs for city and country driving. He also stated that various experiments made by his company led them to believe that most devices that cut the intensity of beam tend to limit the view of action and that the best plan would be to eliminate the light from the upper angles by tilting it downward to an angle one-half of the angle equal to the spread of the beam.

Mr. Replogle in a short summary answered the various criticisms, stating "Glare as I used it is only jargon and not at all scientific and I mean by glare merely the headlight proposition we discussed here to-night. If 25 ft. is safe it is also safe when the distance is 200 ft. Contrary to Mr. Wackwitz, I believe that it is glare and not insufficient light that causes the hazard. Decrease the light in the eyes of an approaching man or increase the light on the road and you eliminate the danger."

Over 400 in Attendance

More than 400 people attended the meeting, including members and guests. Among those present were Joseph Bijur of the Bijur Motor Lighting Co., Hoboken, N. J., Alden L. McMurty, consulting engineer, of New York, R. H. Wells of the Badger Brass Co., Kenosha, Wis., and K. W. Zimmerschied of the General Motors Co.

To secure data on the ways in which the various cities are dealing with the glare problem Mr. Replogle sent letters to fifty-eight cities. Ordinances were received from twenty-three cities, sixteen of which follow:

Boise—Blinding or searchlights prohibited.

Buffalo—Dazzling or blinding light—or a lamp or light exceeding 20 candlepower with or without reflector—prohibited.

Cheyenne—Should not give forth a blinding glare, but should shed a rather subdued light.

Chicago—Unlawful to use acetylene, electric or other bright headlight or any headlight the rays of which shall be intensified by any parabolic or condensing reflector, unless such headlight shall be properly shaded so as not to blind, dazzle or confuse other users of the highway or make it difficult or unsafe for them to ride, drive or walk thereon: Inspection Board provided.

Cincinnati—Similar to Chicago, but shading or dimming upon half of lens is deemed compliance.

Cleveland—A lighting device is prohibited which concentrates and projects any part of the light into a beam, unless the said lighting device is so adjusted that at a point, a distance of 75 ft. or more in front of the vehicle, no part of the reflected beams of light shall be visible more than 3 ft. above the surface of the roadway.

Denver—Same as Chicago.

Grand Rapids—Same as Chicago, with the addition that the use of amber glass (so-called) as a screen shall be deemed a compliance when effective.

Louisville—Dazzling or glaring headlights prohibited.

Milwaukee—Lamps prohibited which project main light rays above a plane which shall strike the roadway more than 200 ft. forward from base of vehicle on a horizontal roadway.

Omaha—Headlights must be so focused and directed that the uppermost rays shall not be elevated more than 6 ft. above the surface of a level roadway at a point 100 feet ahead of the lamps. Must be dimmed by being suitably shaded or covered that there shall not be a glaring or dazzling effect therefrom.

Portland, Ore.—Headlight shall be so controlled that it will not blind, dazzle or confuse other users of the streets or make it difficult or unsafe for them to ride, drive or walk thereon.

San Francisco—Must be so dimmed or covered that the glaring effect of headlights shall be done away with.

Salt Lake City—Light prohibited of such power or strength as to dazzle pedestrians or drivers of vehicles moving in opposite directions.

Toledo—Same as Chicago.

Baltimore's Elaborate Provisions

"The city of Baltimore has gone into the matter very much more thoroughly than any other city from which we received returns and I shall read their ordinance almost in its entirety as being representative of the most painstaking attempt to cover the situation," said Mr. Replogle.

Definitions—The term "headlight" shall be taken to embrace any lighting device designed to display a light on a motor vehicle in the direction in which said motor vehicle is designed to proceed, the term including what are commonly denominated as "side lights" when the same are fitted with reflectors and equipped with electric bulbs or other means of illumination of more than 4 candlepower.

Maximum Standards—No motor vehicle in use in Baltimore City (including motorcycles) shall be equipped with any electric bulb or other lighting device of a greater rated capacity than 30 candlepower, no matter how the same may be shaded, covered or obscured.

No "side light" shall be equipped with any electric bulb or other lighting device of a greater rated capacity than 4 candlepower unless shaded, covered or obscured as hereinafter provided.

Operation and Control—No motor vehicle, including motorcycle, shall be operated within the limits of Baltimore City equipped with any device by which the headlights can be switched or cut off or on, covered, shaded, deflected, dimmed or lowered from the seat, unless the headlight itself is equipped with some means of preventing glare which has been

approved by this Board. In short, the ordinary "dimmer" or auxiliary light operated by a switch from the seat will not be permitted unless the headlight so operated is itself so shaded or constructed that, even when cut in from the seat, it will not produce glare.

Oil Lamps—Unless an oil lamp of exceptional brilliancy be used, no device to prevent dazzle or glare will be required. Where, however, oil lamps of great brilliancy are used, some anti-glare device as hereinafter prescribed shall be used with the same.

Gas Lamps—All gas headlights (or sidelights of over 4 candlepower) shall be equipped with some anti-glare device as hereinafter prescribed, this provision to apply to motorcycles as well as all other motor vehicles.

Electric Lamps—All electric headlights (or sidelights of over 4 candlepower) shall be equipped with some anti-glare device as hereinafter prescribed, this provision to apply to motorcycles as well as all other motor vehicles.

Anti-Glare Devices—The use of any headlight of not over 30 candlepower shall be lawful where the glass in front of the same shall have been covered or coated with tissue paper, paint, frosting or any other substance or material of sufficient opacity to prevent the outlines of the flame or electric light being visible when looking through the glass from the front. If desired, a circular space not over two inches in diameter may be left clear in the center of the front glass or a space not over 25 per cent of the entire area below the level of the bottom of the flame or bulb. If these latter options come to be abused by motorists to such an extent as to defeat the purpose of the ordinance under which these rules are adopted, this portion of this rule permitting any portion of the front glass to be clear will be revoked by the Board without notice.

(Where the use of non-blinding devices of any kind cut down the light too much the new nitrogen electric bulb recently put on the market will be found to give additional light even when of the same candlepower as the ordinary bulb.)

Acting under the authority conferred by Section 5 of Ordinance No. 630, approved May 27, 1915, the Board of Motor Vehicle Headlight Inspection has heretofore approved, and will from time to time hereafter approve certain special devices designed for the prevention of glare. Motorists are authorized to use any such device, and upon purchasing the same are given a certificate from the dealer to the effect that the same has been duly approved by this Board. The ordinance provides in effect that said certificate when displayed to any police officer will render the motorists immune from arrest under said ordinance.

Proper Adjustment Necessary

No certificate issued by the Board as to any special anti-glare or non-blinding device is effective, according to its terms, unless such device is properly adjusted as directed by the maker. Motorists should therefore be careful in the first instance to see that such devices are properly adjusted, and, in the case of those apt to get out of adjustment, thereafter to see that they remain in proper adjustment. Most of the devices approved by the Board are not susceptible of improper adjustments, and such type of device is preferable.

In view of the dangers attending driving at night without adequate light, the Board does not approve the extinguishment of headlights outright. The devices above described all yield sufficient light to make night driving safe, but at the same time overcome the dangers attendant upon the use of glaring headlights.

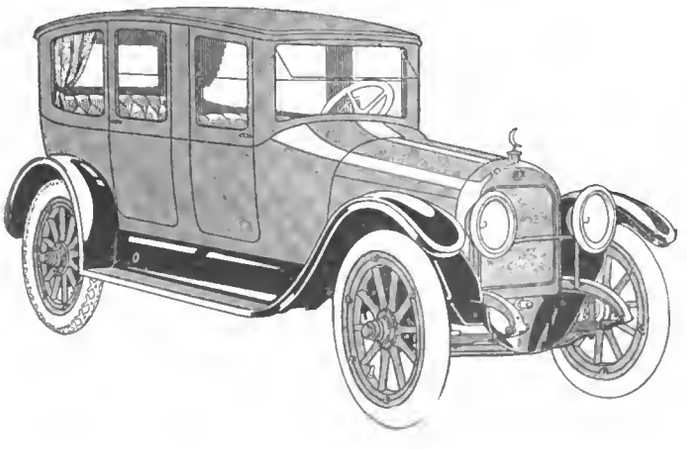
Moon Coupé and Convertible Sedan

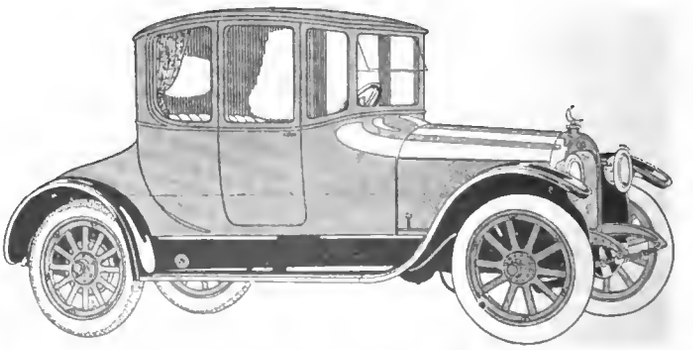
THE Moon Motor Car Co., St. Louis, Mo., has included a four-passenger coupé and a convertible sedan in its line of closed cars for the coming season. These are illustrated herewith. In the coupé the three-passenger main seat is staggered and set back from the driver's seat, which has a glove box behind it. There is an auxiliary folding seat in the right front corner for the fourth passenger. Plate glass windows without sash and fitted with anti-rattlers are used, all dropping in metal channels lined with felt. A split type ventilating adjustable windshield is employed and there is an electric dome lamp. The coupé is fitted only to the 6-66 chassis, this model selling for $2,150.

The convertible sedan is a five-passenger type, the top being of aluminoid steel and upholstery similar to that for the coupé. This model is made for the 6-43 chassis, selling for $1,450. It has a dome light in the center of the top and an integral limousine windshield.

The other closed models which the Moon company is furnishing for the coming season consist of four-passenger cabriolet types, seating three abreast and one on a folding drop seat, and selling for $1,850 on the 6-43 chassis and for $2,150 on the 6-66; and a seven-passenger sedan with a large door at each side and a slanting windshield. This sedan is fitted to the 6-66 chassis and lists at $2,250. It is a Springfield metal body type with pillar partitions between the windows.

Upholstery on all models is in black or Spanish leather with dark blue or green broadcloth above the belt line, although either broadcloth or whipcord may be used throughout.





Above is illustrated the Moon convertible sedan top mounted on a Moon chassis. This top is easily and quickly removed At the left is the new Moon four-passenger coupe. The sashless door windows of heavy French plate glass drop and are fitted with patented window lifts. There is a dome light in the center of the top and the windshield is made in three pieces

Successful Business and the Trade Press

Industrial Changes in This Country and in Europe of Greatest Importance to Our Business Interests Best Brought Out and Discussed in the Trade Journals

By Edward N. Hurley
Chairman Federal Trade Commission

¶ EDITOR'S NOTE:—*This article consists of extracts from the address delivered by Mr. Hurley on the subject before the recent meeting of the Associated Business Papers in New York.*

UNDER present industrial conditions both in this country and in Europe it is especially desirable, and in fact, actually necessary that we keep in touch with the changes and developments taking place throughout the world. With this idea in mind, Edward N. Hurley, chairman of the Federal Trade Commission, has been keeping in close touch with the business papers and the following observations are based on his experience with these publications as indexes to the world of successful business.

Industrial Changes in Europe

When we think of Europe we think of a continent engulfed in war, devastated and disordered, but I want to say to you gentlemen, that we must correct that conception. While in many respects we know little of what is going on in the warring nations, we do know that within sound of the guns, almost within reach of the falling shells, Europe is reorganizing her industries. Under the stress of a life and death struggle every effort is being made to obtain the highest efficiency in the production, the distribution and the use of commodities of all kinds. Conservatism in industrial ideals and methods has been blasted and shattered to pieces in the shock of war, old systems that normally would have hung on for years have been discarded in a day; old equipment that would have been retained for years has been scrapped as fast as possible for new installations of the most advanced types. New processes are being discovered, new inventions are being made, and new forms of organization are being created. Let me illustrate. Industrially, France has been preeminently the land of small-scale, highly individualized production, but she now lacks human hands. In France, little farms that for generations have been farmed practically by hand or with the aid of a horse or two, are being thrown together and farmed cooperatively by tractors, gangplows and modern agricultural implements. France must rely on machinery. Her business men are studying and are applying American systems of manufacture in factory construction, in equipment, and in large-scale, highly systematized production.

England industrially has been preeminently the land of yesterday. Conservatism was the dominant characteristic of British business. While Massachusetts was making textiles with automatic looms under conditions that permitted one operator to tend from sixteen to twenty-four machines, Lancashire clung to old equipment and conditions under which one operator could tend but four machines. But at last England is aroused, and to-day American books on efficiency and scientific management are being bought by the hundred and studied all over England. The war has compelled Great Britain to make 30 years of industrial progress in 30 months.

Before the war Germany was probably the most highly organized and efficient manufacturing nation in the world, but in Germany organization and efficiency have been still further developed and, no matter whether victorious or defeated, the Germany that emerges from the war will be years ahead of the Germany we knew in 1914.

We Must Keep Step

These changes are of great concern to us. We may not realize this to-day, because things are coming our way now, but we must look ahead to the future conditions we must prepare to meet. Within 5 years we shall find a new Europe competing against us, with war-sharpened brains and war-hardened muscles, not only in our foreign markets but also right here at home. If our industries are not to be caught slow of mind and flabby of muscle we must improve our business organization, must increase our manufacturing and merchandising efficiency and must keep pace with every step in Europe's industrial progress.

Individuality Plus Efficiency

It is my belief that if the smaller merchant and manufacturer who has no adequate cost accounting system will practice the fundamentals of business and will take the first step toward improving his present methods, he is bound to succeed, and it will be possible for him to succeed on a scale that will mean expansion and development. If he does adopt sound business methods it will be easy for him to compete with the large merchandising and manufacturing firms of the country, as individuality plus efficiency will take care of itself under any and all conditions.

Banker Helping Sound Business

The man who does not know his true costs is the man who prices his goods foolishly, and thereby impairs the business of his sound competitors at the same time that he ruins his own. Too low price making, based on guesswork or on partial costs, is a menace to sound business. Please understand me, the menace is not in underselling, for a business concern must expect to face the low prices that are due to efficiency. But even the most efficient concern is not always able to meet cut-throat prices based on ignorance.

It is time for the business men of this country to get their house in order if they desire to improve their standing at their banks. I predict that within 5 years there will be very little money loaned by any banker in the United States, to any merchant or manufacturer who does not present a statement showing detailed information, not only regarding his true assets and liabilities, but also indicating that he is conducting his business in an efficient manner and that he knows his true costs.

Trade Associations

Much can be accomplished through trade associations.

The trade association has a wide field of useful and proper activities. Concerns in the same industry may take common action looking toward improving their processes of manufacture, standardizing their products, improving their systems of ascertaining costs, and obtaining credit information. The

welfare of employees is one of the important matters which can be best developed by cooperating in associations. The smaller manufacturer who has not the laboratories and the experts to work out his many problems by himself is especially benefited by being a member of these trade organizations. The present tendency of the larger firms to think of the smaller man in the proper spirit and to assist him in arriving at some practical method of meeting his many problems—in short, to live and let live—is to be particularly commended.

Price-Fixing Bogey

An underlying fear lingers in the minds of some people that trade associations, if allowed to exist at all, will go too far. They assume that where competitors are allowed to meet and discuss the main facts of their business, they will inevitably discuss, perhaps in secret, those activities which are illegal. It is true that there have been associations which have violated the law and attempted to fix prices. The great majority of our associations, however, have undoubtedly been occupied in necessary and proper work.

Suppose that there are 500 trade associations organized for the purpose of improving the conditions of their industry, such as standardizing their products, improving their cost accounting methods, and discussing their common problems. Suppose that ten of them take advantage of this opportunity and fix prices, which of course is illegal. Is there any reason why the Government should condemn for this reason the 490 who are endeavoring to work out their managerial problems in such a way as to bring benefits to their business and to the country as a whole? It was once the policy of the Government to devote most of its efforts to opposing and ferreting out the methods of the ten and to neglect or condemn, without a hearing, the 490. The Federal Trade Commission is opposed to the ten who are violating the law and will start proceedings against them if their acts fall within its jurisdiction; but it feels that its attention should be given especially to the 490 and that it should assist and co-operate with them in improving their business.

I am heartily in favor of competitors meeting in trade associations when they meet for the purpose of improving their cost accounting methods, discussing better systems of standardizing their products and materials, and working out more efficient methods of producing their products at the lowest possible cost, or any other questions that go to develop efficiency.

When trade associations meet for these purposes every member profits by it; every stockholder and employee is benefited. It is also helpful to our country as a whole. The Government should encourage and assist the development of trade associations of this kind.

The Broad View of Business

It is my belief that the business men of the country in trade associations are going to profit materially by coming in contact with each other, but I realize that possibly some associations through ignorance or design may take advantage and do things directly or indirectly that violate the law. I am not in sympathy with the class which knowingly resorts to these methods, and it is my hope that cases of this kind will be few and far between. Organizations of this kind which violate the law are doing a great injustice to the honest trade associations and business men of this country.

We cannot develop efficient methods of manufacturing and improve the conditions in our respective industries, which are needed so badly, if, when we meet in trade associations, our thoughts are not on improving our manufacturing methods and ascertaining our true costs, but on the question of fixing prices.

One of the great needs among American business men to-day is a broad view of business in general and a comprehensive grasp of the needs of industry as a whole. Too many American manufacturers and merchants center all their energy and attention upon their particular establishment and the work of making profits for it. Men at the head of factories need the point of view of what might be termed the statesmanship of business. They need to appreciate the fact that their plant is a part of a great industry; that their individual welfare depends very largely upon the welfare and progress of the industry as a whole, and of industry in general. Whatever promotes the welfare of other concerns in industry and the welfare of that broad group of people which we call the public is bound to react favorably on individual concerns.

Government and Business

Government and business, more than anything else, need, as it were, to sit down together and consider the problem of our business and industrial welfare, not from the point of view of the law books, but from the point of view of economic development. If Government and business for once understand each other, one-half of the problem of successful cooperation among American business men for legitimate and necessary ends will be solved.

If Congress has been suspicious of business, business men are in a measure to blame for this condition. Too frequently they have neglected and refrained from coming in contact with members of Congress. If the business men of this country would take an interest in the work of their Senators and Congressmen and endeavor to confer with them frequently on the many problems with which they have to contend, I am sure they will find that the Senators and Congressmen will be willing and anxious to learn the facts about business. If business men will do their part by taking an interest in public affairs, they may rest assured that the Senators and Representatives will be only too glad to do theirs.

When I went to Washington I thought, in common with many other business men of the country, that Senators and Representatives were in Washington to do as they pleased, frequently ignoring the wishes of their constituents, particularly those who happened to be business men. My practical experience in Washington satisfies me that I was mistaken. The members of Congress wish to do the right thing by the people of the country. We cannot expect them, however, to be familiar with business problems unless we take an active interest in bringing the facts of business to their attention. It does not create a good impression if the only time Congressmen hear from business men is when some question comes up before Congress to be voted on. We must do something more than respond to the request of the secretary of some association to send a wire. We must take an active interest in public affairs.

Labor has accomplished a great deal in the way of legislation because labor is organized and thinks collectively of its problems. The same is true of the farmers in their work to secure legislation. Business men, however, have received very little in the way of helpful legislation, and the reason in part for this is that they have not approached their Congressmen in a proper spirit and because they have not put themselves out to co-operate in a sympathetic, cordial way with them.

It is my belief that the business men of the country now fully appreciate that Government wants to help them. We must, however, lay aside our former critical attitude. We must face the problems practically and sympathetically. We must not allow our prejudice to affect and bias our better judgment. We must be business men first. If we do this, I am sure that we will receive what we are entitled to.

Trade Journal's Part

Many suggestions have been made by writers and lawyers, of note, by captains of industry and legislators, prescribing different remedies for improving business conditions. There

is no one remedy that will give relief to all our ills. What will help one industry may injure or kill another. But there are a few fundamental principles upon which may be based the diagnosis and treatment of ailments of business.

Breadth of Outlook Essential

In last analysis success in business depends upon the intelligence of the individual manufacturer. If he does not understand both the details and the broad aspects of the industry of which he is a part, he cannot expect to be successful. American business men do not realize the value which trade journals and technical magazines may be to them in increasing the efficiency of their factories and in giving them a broad and comprehensive view of their business. Our foreign competitors read almost every article published upon their business with great care and thoroughness. Many of them have duplicate copies of their favorite trade papers sent to their homes so that they may read them away from their business without being disturbed. Many foreign manufacturers contribute articles to these journals on phases of the business with which they are most familiar. Such articles are bound to be helpful and have a constructive effect. Our trade journals and technical papers are the best in the world and they should be encouraged and supported by our business men. Copies should be placed where employees can see them and they should be urged to read and study them. These papers are preaching the gospel of sound business on practical lines and are helpful not only to business but to the country as a whole. If the suggestions made by them in the past had been followed by our business men it would not be necessary at this time to point out some of the fundamental weaknesses in American business.

Millington Converter Makes 2-Ton G. M. C. Into a Four-Wheel-Drive Truck

THE Millington Auto Engineering Co., Chicago, is putting on the market a standard set of parts for converting a G. M. C. 2-ton truck into a four-wheel-drive machine. In rearranging the car to take this new form of drive, 90 per cent of the standard parts are maintained without interference. The front axle, however, is largely reconstructed.

The Special Axle

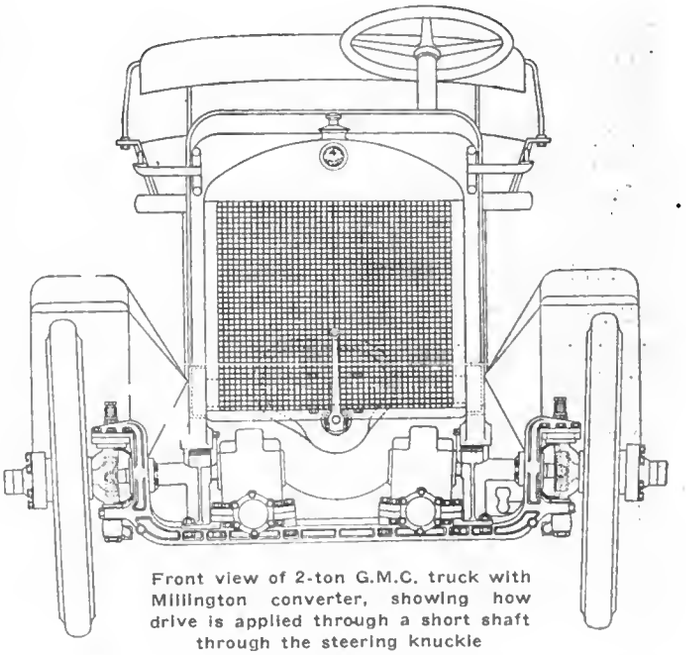
The new axle is drop-forged nickel steel fitted with a hollow spindle of the same material and stub shafts of chrome vanadium steel. Timken driving plates, hubs and bearings are used and the drive is by Timken-David-Brown worms.

The accompanying drawings illustrate the method of applying the Millington four-wheel-drive to the truck. It will be noted there are two parallel shafts running forward on either side of the engine carrying the drive to the front axle at two points. From each of these points the propulsion is transmitted by a short shaft through the steering knuckle, which contains a bearing, to the wheels. There is also a chain case containing two differentials, one which compensates between the right and left wheels and the other between the front and rear drive. M. & S. differentials are used and the chain is a Whitney silent type working on case-hardened sprockets. The two parallel shafts which carry the drive forward are nickel steel.

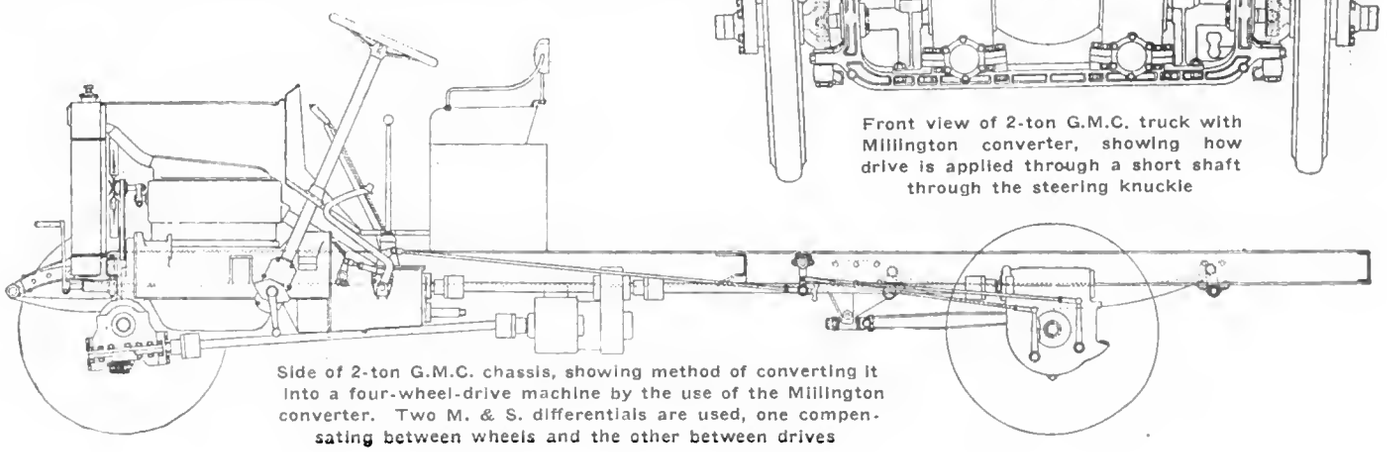
Advantages of the Construction

Some of the advantages which are claimed for the construction are the low center of gravity; location of engine under a hood and low in the vehicle, as well as in the center of the tread; the use of 90 per cent of the standard parts of the machine; perfectly balanced weight, both sprung and unsprung; use of direct drive to the rear axle resulting in the delivery of the greater percentage of power where the greater percentage of load is carried; and the general conformation to standard practice in the design and appearance of modern motor trucks.

A tensile strength of 120,000 lb. is claimed for the axle, and the same strength obtains for the hollow spindle and the stub shafts.



Front view of 2-ton G.M.C. truck with Millington converter, showing how drive is applied through a short shaft through the steering knuckle



Side of 2-ton G.M.C. chassis, showing method of converting it into a four-wheel-drive machine by the use of the Millington converter. Two M. & S. differentials are used, one compensating between wheels and the other between drives

Gasoline from Natural Gas—II

Gas Consists Almost Entirely of Paraffin Hydrocarbons—Only Gas Rich in Gasoline-Yielding Members Suitable for Use in Compression and Condensation Process

By Bernard N. Glick

¶ EDITOR'S NOTE:—According to government reports the casing head gasoline industry, or production of raw gasoline from natural gas, increased 53 per cent in 1915 over 1914, an average price of 7.9 cents per gallon being received for the unblended product. The same authority estimated that 24,000,000,000 cu ft. of natural gas was utilized, with an average recovery of 2.57 gal. of gasoline per 1000 cu. ft. Mr. Glick has made an exhaustive study of this growing industry with a view to its possibilities as a relief to the situation caused by the ever-increasing demand for gasoline. First part of this article appeared in THE AUTOMOBILE *for Nov. 2.*

THE question of the origin of the mineral substances petroleum and natural gas has long engaged the attention of chemists and naturalists. The theories propounded are divisible into two classes, firstly, those ascribing to them an inorganic origin and secondly, those which believe them to be organic decomposition products. It is well known that when water acts on carbides, *i.e.*, compounds of metals and carbon, various hydrocarbons are liberated, the best known example being the formation of acetylene from calcium carbide. Chemists like Berthelot and Mendelieff were staunch supporters of the inorganic theories founded on observations of the nature of the preceding example. On the other hand, there is an extensive and overwhelming mass of evidence which seems to prove that petroleum and natural gas are produced by the decomposition under natural conditions of matter of both vegetable and animal origin. As examples of this sort of evidence it is known that on distilling menhaden (fish) oil a petroleum-like liquid is obtained, while on the Swedish coasts petroleum is found as a decomposition product of seaweed under ordinary atmospheric conditions. In what state the product we know as natural gas exists in the earth is a point not yet definitely settled, but from a consideration of the temperatures and pressures of liquefaction of its constituents it seems highly probable that it exists in the earth's strata in the gaseous state, as the temperatures prevailing there are not low enough nor the pressures high enough to keep it liquefied.

Gas Consists of Paraffin Hydrocarbons

Chemical analysis has shown this gas to consist almost entirely of a mixture of the paraffin series of hydrocarbons, the lowest members methane and ethane predominating. Both these compounds are gases at the ordinary temperatures, methane having a boiling point of —160 deg. C. and ethane —93 deg. C. Associated with these are varying amounts of the higher members propane and butane, gases with boiling points of —45 deg. C. and 1 deg. C. and pentane, hexane and heptane, liquids with boiling points of 36.4, 68.9 and 98.4 deg. C. These higher liquid members are retained in the gas just as moisture is retained in the atmosphere and the amounts present depend on the same factors, temperature, pressure, and the intimateness of contact between gas and liquid. In the case of natural gas there is an added factor due to the varying composition of the liquid phase of the system, namely the percentage of low boiling fractions in the oil with which it is associated, for if the oil is high in these it is natural that the gas in contact with it should abstract a relatively larger amount of them. According to its composition natural gas is divided into two varieties, "wet" or casing head gas, and "dry" gas.

By wet gas is meant gas rich in the higher gasoline-yielding members, pentanes, hexanes, etc., usually a gas occurring along with oil and containing from 60 per cent and upward of these compounds. Dry gas consists mainly of methane, varying in amount from 50 to 95 per cent. This variety of gas is very rare in oil fields but common enough in gas fields, the Hogshooter field in Oklahoma yielding a gas which is almost entirely methane. The interest in this distinction lies in the fact that only wet gas is suitable for the production of gasoline by compression and condensation methods.

The manufacture of gasoline by compression and condensation is essentially a physical process. The paraffin hydrocarbons, as their name implies (parum, little, affinis, affinity), are very inert substances and as they are fully saturated compounds, the likelihood of chemical action merely on the application of pressure and cooling is exceedingly remote.

Physical Properties

In order to understand the methods of manufacturing gasoline from natural gas under consideration, one should have some idea of the physical properties of gases. The gaseous, liquid and solid states are common with few exceptions to all substances, the particular state in which they exist at any time being determined by the temperature and pressure then prevailing. Thus at atmospheric pressure we know that ice, water and steam are different states of the same substance, the particular state depending on the temperature. All known gases when exposed to certain conditions will pass from the gaseous to the liquid state and vice versa. These conditions, however, must be observed before liquefaction can be brought about.

For example, take the case of methane, the main constituent of dry gas. If we attempt to liquefy this gas by compression at any ordinary temperature no amount of pressure will succeed in doing so, and this is true for all temperatures above —82 deg. C. At this point a pressure of 55.8 atmospheres of 837 lb. to the square inch will liquefy it. This temperature above which it is impossible to liquefy a gas is called the critical temperature and the pressure necessary to liquefy it at that temperature is the critical pressure. Every gas has its own particular critical constants and if we wish to liquefy any gas by compression we must make sure the temperature is below the critical point. Once below this critical point the pressure necessary for liquefaction depends on the vapor pressure exerted by the gas at the temperature used, and this becomes less and less the further we get below the critical temperature.

Another theoretical consideration has to be taken into account also. If we exert a pressure on a mixture of gases the pressure on any individual gas in it is proportional to its

percentage of the whole. Thus if a natural gas contains 20 per cent of gasoline vapors and we exert on it a pressure of 250 lb. per square inch, only 20 per cent of that pressure, namely 50 lb., is being exerted on the gasoline vapors themselves.

Bearing these principles in mind, let us apply them to natural gas and see what are the possibilities of liquefying its constituents.

Vapor Pressure a Determining Factor

The critical temperatures of all except methane are above atmospheric temperature, so methane is ruled out with all the others as possibilities, the vapor pressures at the temperature of cold water around 10 deg. C. being the determining factors now. These are as follows:

Vapor pressure (lb. per sq. in.), approximate—Ethane, 250; propane, 104.4; butane, no figures available; pentane, 5.4; hexane, 1.5; heptane, 0.4.
Temperature—Ethane, 10°C.; propane, 12.5°C.; pentane, 10°C.; hexane, 10°C.; heptane, 10°C.

Thus with a gas composed of 100 per cent ethane it would be possible at a temperature of 10 deg. C. to liquefy it by a pressure of around 250 lb. With a gas containing the more normal amount of 50 per cent, a pressure of 500 lb. would be necessary and as such pressures are never used, ethane is not liquefied. With 30 per cent propane, around 350 lb. would be necessary and as this pressure is sometimes attained, some propane will be liquefied. With the higher members even 5 per cent of pentane only requires 108 lb. for liquefaction and 2 per cent of hexane and heptane require only 75 lb. and 20 lb. respectively. Thus using cold water as the cooling agent and pressures up to around 350 lb. per square inch we may expect to find in the condensate propane and the higher members in liquid form. Dissolved in the liquid will be quantities of the gases methane and ethane as they are soluble in the liquid hydrocarbons in amounts varying directly with the pressure employed. Now, suppose one had condensed such a liquid at 350 lb. pressure, what would be the effect of exposing it to atmospheric conditions? The boiling points of the various liquefied paraffins are as follows:

Propane—45°C.; butane, 1°C.; pentane, 36.4°C.; hexane, 68.9°C.; heptane, 98.4°C.

The average temperature of the atmosphere may be taken as 20 deg. C. (32 deg. C. in summer and 4 deg. C. in winter.)

Pressure Must Not Be Too High

Since propane and butane are gases under atmospheric conditions they would volatilize immediately from the liquid and in doing so would carry along with them part of the liquefied hydrocarbons, pentane, hexane, and heptane, just as on boiling water, the air escaping takes water vapor with it. Moreover, the methane and ethane dissolved in the liquid at 350 lb. could not be held in solution at atmospheric pressure (15 lb.) and they would therefore escape taking with them more of the true condensate. From this we see that by using too high a pressure in condensing we get a very unstable condensate. We realize then that the conditions to aim for in working are such that the liquid condensate produced should contain just as much of the lower members as can be retained by them under ordinary atmospheric conditions.

Since the composition of the gas used is the most important factor in the success or failure of a gasoline condensation plant, the testing of its suitability for this purpose is highly important. An ordinary eudiometric analysis such as is usually given is of little value in determining the amount of condensable vapors present, for it is impossible by this means to identify the amounts of each individual constituent.

Interesting work along these lines, however, has been done by the Bureau of Mines by liquefying the gas with liquid air and fractionally distilling the liquid in vacuo at different temperatures. One of the most valuable tests employed is based on the fact that natural gases are soluble in various solvents in volumes directly proportional to the amounts of higher gasoline producing hydrocarbons present. The solvents generally employed are claroline oil (a mineral oil distillate, specific gravity 0.8667 flash point by Pensky Martens closed test 152 deg. C., ignition point 270 deg. C.) or alcohol, and the gas should be soluble to the extent of 30 per cent or more by volume as determined by agitating 100 cm. of the gas with 35 c.c. of the former or 50 c.c. of the latter. In a further test advantage is taken of the wide variation in specific gravity of the constituent members of the gas. Methane has a specific gravity of 0.554 (air = 1), ethane 1.049, propane 1.520, butane 2.01, the still higher homologues increasing rapidly.

SPECIFIC GRAVITIES AND ABSORPTION NUMBERS OF SAMPLES OF NATURAL GAS USED FOR MAKING GASOLINE

Situation	Specific Gravity Air = 1	Absorption No.
Follansbee, W. Va.	1.46	86
Follansbee, W. Va.	1.41	84
McDonald, Pa.	1.03	39
McDonald, Pa.	1.59	43
Klefer, Okla.	.83	28
Follansbee, W. Va.	1.38	65
Riverside, W. Va.	1.37	48
Riverside, W. Va.	1.38	44
Steubenville, Ohio	1.21	54
Steubenville, Ohio	1.00	37
Glen Pool, Okla.	1.15	55
Glen Pool, Okla.	1.43	78

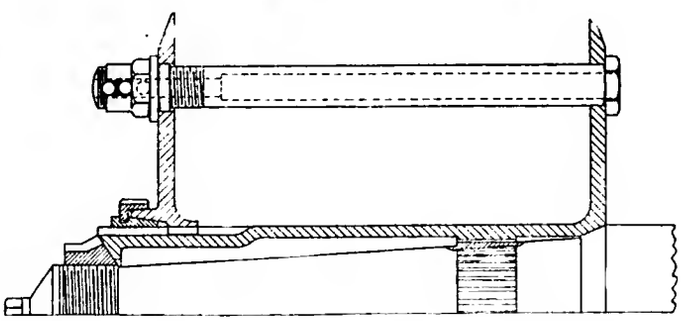
0.80 Lowest Gravity Limit

From these figures it will be seen that just as in the case of the absorption number, the specific gravity of the gas increases directly with the percentage of gasoline producing constituents, and it has been found advisable to fix 0.80 as the lowest limit for a gas to be used on a commercial scale. The determination itself is simple, a glass bulb being weighed full of air, when exhausted, and full of the gas to be tested, the ratio of the weights of these equal volumes of gas and air giving the specific gravity. While these two tests give a fair line on the value of the gas, it has become customary to amplify them by trying out the gas practically with a small compression apparatus put up for the purpose by many of the firms supplying compressors for the actual plants.

These gases give on condensation from 1 to 4 gal. of gasoline per 1000 cu. ft., any gas giving less than ¾ gal. per 1000 cu. ft. not being considered rich enough for commercial exploitation.

This industry will certainly produce during 1916 well over 100,000,000 gal. of "casing head" gasoline and will come on the market as a blend with various petroleum distillates. The total volume sold as a motor fuel will be in the neighborhood of 200,000,000 gal., which at 20 cents a gallon will be worth $40,000,000.

Detachable Aeroplane Propeller Hub



At the first meeting of the Aeronautic Engine Division of the Society of Automobile Engineers Standards Committee, Howard E. Coffin suggested that a quick-detachable propeller hub could easily be made on the principle of the detachable automobile wheel. The illustration at the right shows a British patent recently granted to the Rolls-Royce Co. It will be seen that the hub is closely similar to that used for the Rudge-Whitworth detachable wire wheel.

The FORUM

Wants Lower Second Gear

By O. B. Parkinson.

THE writer has driven automobiles of various makes in California mountains for 14 years, and over every condition of road which can be found in California, and from his own experience, and that of hundreds of others whom he has met in his travels, is thoroughly convinced that 90 per cent or more of the cars manufactured in the East, and sold in California, are not as well adapted to use in California as they could be with the proper understanding on the part of the makers of gear ratios as applied to road conditions here. If this is true, then the fact that California is well up to the top of automobiles registered, should interest the car makers to the extent of giving the subject due consideration. A few have done so. Many of the makers have changed their low speed gear ratio for lower ratios, and there stopped, with the idea that having geared the car low enough to climb the California mountains on low gear, that is all that is necessary.

A few years ago for an average four-cylinder touring car of 30 hp., the high speed ratio was 3.5, the second was 6.25, and the low, 11.2 to 1. This produced at a maximum engine speed of 1200 to 1500 r.p.m., a car speed on high gear of from 50 to 60 m.p.h. on second, about 20 to 25 m.p.h., and on low, from 10 to 15 m.p.h.

Low Gear Too High

For grades exceeding 25 per cent on rough mountain roads, of which there are many in California, the low gear was not sufficiently low. In order to negotiate such hills sucessfully, a maximum engine speed must be developed which resulted in damage to the car, and discomfort to its occupants.

The modern cars have a high speed gear ratio for ordinary stock cars, ranging from 3¾ to 4½, with a second gear of from 6 to 7, and a low gear of about 13 to 14 to 1; one light car having a ratio of 16.8. These low gear ratios should be ample for any car. Take the average car with the 4½ : 1 high gear, its maximum car speed is about 45 to 50 m.p.h.; on its second speed it will develop a car speed at a maximum of about 30 m.p.h.; with its slow speed it has a maximum car speed of approximately 10 to 12 m.p.h.

No Real Intermediate Speed.

Now, it will be noted that in these cars the second gear, is only about 2 or 3 ratios lower than the high speed gear, while the gap between this intermediate gear and the low is 6 to 8 gear ratios. This, on the face of it, looks strange, and unless there is a good reason for it, is absurd. If there is a good reason, we have failed to find it, on the contrary, from the writer's own experience and the experience of others with different makes of cars, it is a fact that on rough mountain roads with many of the popular makes of cars, that a grade which cannot be negotiated on high speed, cannot be negotiated on second, and the operator is obliged to drop back to low gear.

Could Easily Be Changed

With a reasonably low second speed, he should negotiate all grades up to 18 or 20 per cent on second, and at a car speed of 10 to 12 m.p.h. (which is as fast as the average mountain road should be traveled).

It is not only in ascending hills in which a lower second speed is required, but in descending them as well. We have many California roads where the hill is from 5 to 10 miles long with grades ranging from 5 to 15 per cent, where the conditions are such that to travel down hill on high gear is dangerous, to use the usual second speed is but little better, and to travel on low gear is too slow. A lower second gear, which is really an intermediate, that is midway or nearly so between the high and the low, is a great advantage.

If there is anyone who can advance any good reason why a car should be geared in the proportion 4, 6, and 16, for the use of the average tourist, I should like to hear it. There is no question but that many cars which have failed to make good in the mountains of California with the resultant loss of sales, could be changed easily to fit all the requirements of the drivers in mountain work.

What Is 100 Per Cent Grade?

By Chas. E. Manierre

THERE is quite generally a confusion of terms in describing road grades. Occasionally one makes use of the angular difference between the horizontal and the grade correctly describing it as 3 or 5 or other degrees, in which case he means 3 or 5 or other degrees of arc, as shown in the first of the small diagrams.

Unfortunately the word "degree" in its wider meaning can be applied in connection with the other two modes of indicating grade, although of course erroneously. The surveyor's and engineer's method of describing grade is so many feet in 100, the hundred being measured along the level and the amount of elevation at right angles thereto.

Automobile vs. Surveying Terms

In each of the small diagrams the distance from *A* to *C* is the grade of the road and the line or distance between *A* and *B* is horizontal. In the second diagram the road grade is not drawn, so that the lines used by the surveyor may stand out more prominently. The base, *A* — *B* is generally taken at 100 ft. and the perpendicular, *B* — *C* is the number of feet of rise in the hundred. The surveyor's expression is 5 ft. in 100, 10 ft. in 100, etc. When the rise reaches 50 in 100 it may be described as 50 in 100 or 1 in 2, and similarly, when it reaches 100, it may be described as 1 in 1. A still steeper grade would be represented by 2 in 1. Those who have had anything to do with land matters know that practically all of the surveyor's work is reduced to the horizontal, and in fact even when he is chaining up a hill, his chain is always held level.

For those in any way interested in the automobile, whether in driving, designing or manufacturing, it is the distance along the grade that is measured and compared with the vertical, as shown in the third of the small diagrams, in which *A* — *C* is deemed to be 100 ft. and *C* — *B* is the vertical rise, and the two are expressed as percentage. If *B* — *C* equals

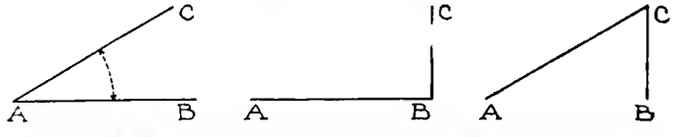


Fig. 1—Diagrams illustrating how the civil engineer contrasts the base of the right angle triangle with the vertical, while the automobilist contrasts the hypothenuse of the triangle with the vertical

three, the grade is a 3 per cent grade. If it equals 5 or 10 it is a 5 or 10 per cent grade, and so on. In other words, the engineer contrasts the base of the right angle triangle with the vertical, while the automobilist contrasts the hypothenuse of the triangle with the vertical.

The larger diagram shows the three methods of describing grade in a single drawing, so that the relation between angles, per cent and rise in the hundred may be apparent, showing the interchangeable values of a number of grades, as expressed in any of the three ways.

Three Methods of Describing a Grade

The line *A* — *F* is approximately the steepest grade that an automobile is expected to ascend. Very few can do better and many will not reach it. An engineer would describe it as 60 in 100. It is also properly to be described as a 50 per cent grade, because the perpendicular drop from the point *K* is exactly half the length of the line *A* — *K*, and it can also properly be described as a grade which makes with the horizontal an angle of 30 deg. of arc.

The 45 deg. line, from *A* to *L* is drawn as a matter of interest, because, from an engineer's standpoint, the horizontal distance and the rise being equal, it is properly described as 1 in 1 or 100 in 100 and it is very improperly described as a 100 per cent grade, which it is not. It is, in fact, approximately a 71 per cent grade. It should be here said that the degrees are only approximately correct, and this is true also of all the figures relating to the grades of 5, 10 and 15 per cent, the errors being too slight to be noted.

45 Deg. Not Really a 100 Per Cent Grade

The absurdity of calling the 45 deg. grade a 100 per cent grade is brought out by considering that it is perfectly possible to have steeper grades, as for example railroad embankments, so that one would proceed to 150 and 200 per cent grades, and at the point where the slope merges into the perpendicular, under this system of nomenclature, the grade becomes infinite.

On the other hand, there are very strong reasons for applying the per cent term to the grades that are designated by measuring along the slope and comparing that with the perpendicular. The horizontal is, of course, a zero grade. As the perpendicular is approached the grade per cent increases to 90 per cent and above, but at the point where the perpendicular is reached, the grade is 100 per cent. In other words, it is all grade and no horizontal advance.

Should Measure Grades in Per Cent

There is also the additional reason for using the per cent term, that where the weight of a vehicle is expressed in tons of 2000 lb., each rise of one per cent of grade requires an addition of 20 lb. of engine torque per ton to overcome it. That is to say, if a car is proceeding on the level and comes to a 10 per cent grade, its reserve torque must be at least 200 lb. per ton to carry it up the grade. If the grade increases to 15 per cent an additional 100 lb. is needed, and so on.

Fortunately for the average owner the practical difference between 15 per cent and 15 in a hundred and any lesser grade is too slight to take into account, and on the main highways a grade exceeding 15 per cent is scarcely ever met with. It is said that the grade up Pike's Peak does not exceed 10 per cent at any point. Occasionally on back roads 20 per cent or 25 per cent grades may be encountered, but in those cases it it frequently the bad character of the road bed that troubles the driver quite as much as the steepness, or degree of incline, of the road.

Take 7 or 8 per Cent Grades on High

The average automobile, if in good condition, should be able to surmount a 7 or 8 per cent grade on high gear. The effect of reduction to low gear and the enormous increase in reserve torque applicable to the surmounting of hills are illustrated when one multiplies 40 or 50 per cent of grade by the 20 lb. for each per cent of rise and finds that for the weight of his car in tons the engine must furnish on account of grade alone 800 to 1000 lb. respectively of energy, a very considerable expenditure.

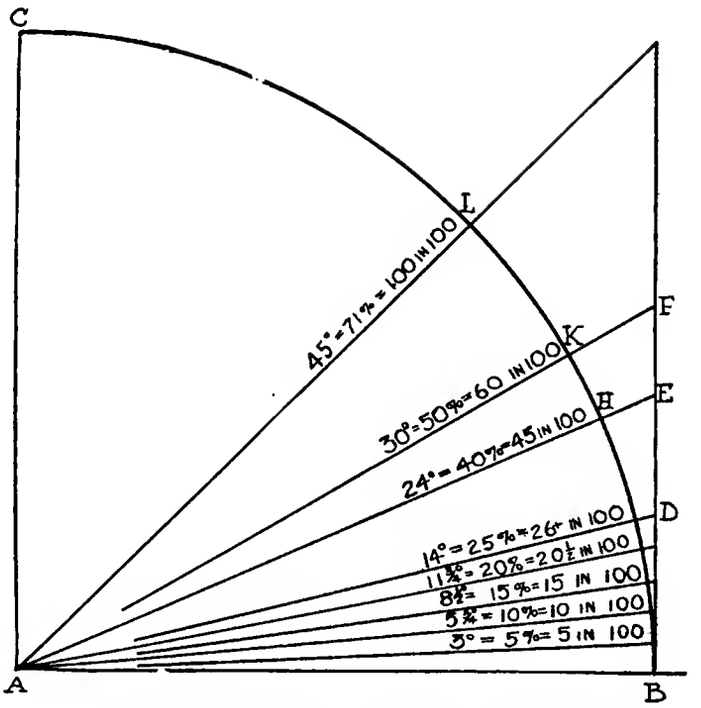


Fig. 2—Three methods of describing grade in a single drawing so that the relation between angles, per cent and rise per hundred feet may be apparent, showing the interchangeable values of a number of grades as expressed in any of the three ways. The line A-F is approximately the steepest grade an automobile is expected to climb

Confusing to the Car Buyer

It may be noted also that so long as the terms descriptive of grade are confused, the purchaser may do injustice to the manufacturer who claims an ability in his car to climb a 50 per cent grade, if his mind is taken up with the idea that it is a grade of 50 in a hundred, whereas the claim is 60 in a hundred and the engine power proportionately larger. On the other hand, if the manufacturer claims an ability of his car to climb a 60 per cent grade and what he means is 60 in a hundred, the purchaser may erroneously believe that he is claiming for his car the extraordinary ability to climb a real per cent grade, requiring the putting forth of 1200 lb. per ton of torque for the sole purpose of overcoming grade alone, a claim which would be apt to discredit the rest of the statements made with respect to the car, although they might be really true.

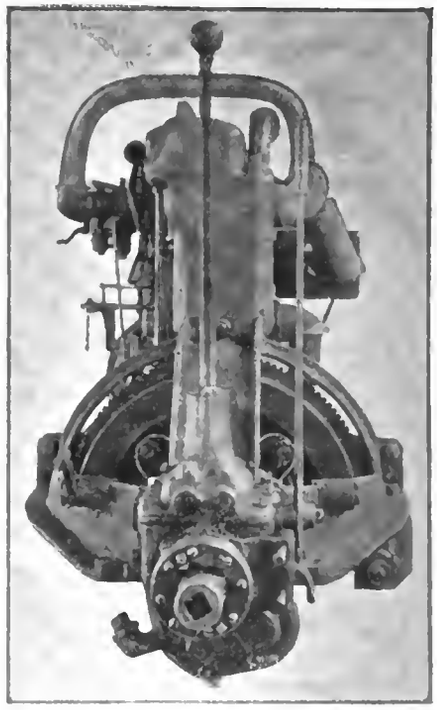
It is to be hoped, therefore, that both makers and users of cars will differentiate between so many feet in a hundred, the engineer's terms for grade, and per cent grade, which has to do with gravitation and which is so intimately connected with engine ability.

Transverse Tables Aid in Solving Problems

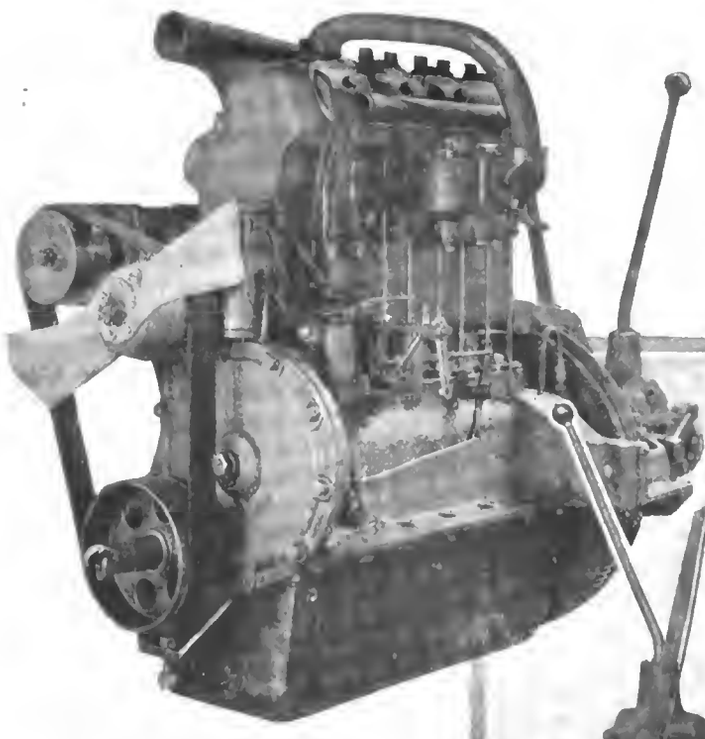
For the convenience of anyone who may wish to make further comparisons of the three ways of expressing grade, it may be suggested that the tables, used by all seamen and surveyors, showing angle, distance, latitude and departure, and known in surveying as Traverse Tables, will quickly furnish them the means of solving all the triangles, these tables having the elements of all possible right angle triangles set down with a sufficient degree of accuracy for the purpose of calculation and comparison.

Monroe Adds Touring Car

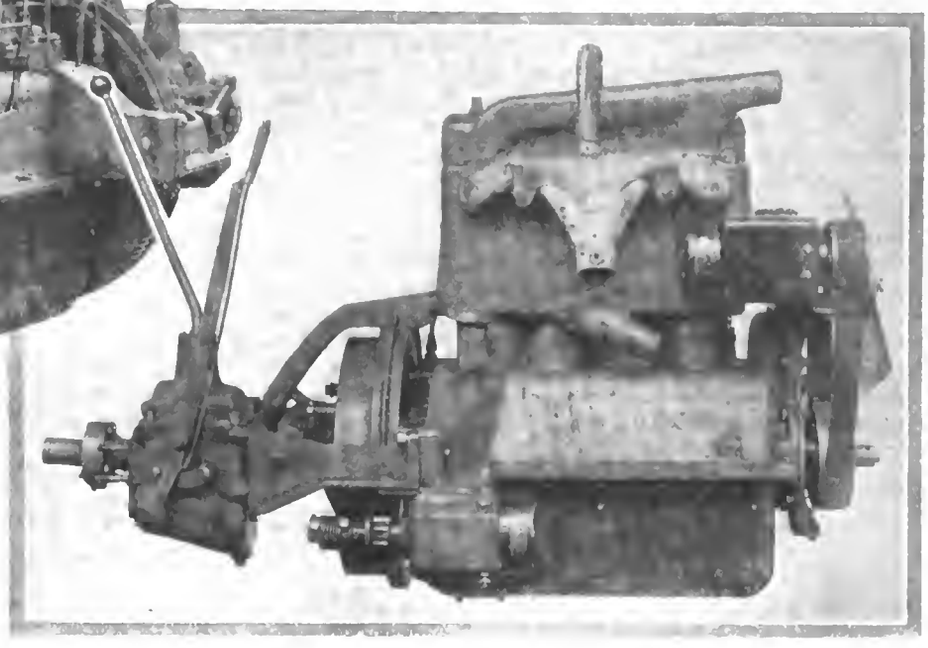
New Car Has 115-In. Wheelbase, Overhead Valve Engine with Detachable Cylinder Head —Dry-Plate Clutch and Cantilever Springs



At the right is a rear-end view of the four-cylinder block unit power plant used in the new Monroe touring car. Note attachment of gearset and hot-air carbureter connection



The view of the engine shown above gives an idea of the belt drive used for the two-bladed aeroplane-type fan and the generator. Ignition unit drive and high mounting of carbureter are also illustrated



At the right is the exhaust side of the engine, illustrating the liberal exhaust manifold, generator and starter motor mounting and Bendix drive of latter

MONROE cars have hitherto been made only as roadsters, but the Monroe Motor Co., Pontiac, Mich., has now added a touring model. The new car, designated as model M-4, is a roomy 115-in. wheelbase vehicle with the modern straight-line center cowl effect, and embraces the latest in construction ideas, particularly in the frame, which is the deep-section design in which the mud aprons and running boards are part of the structure.

Everything about the car is very much in line with the latest tendencies. The overhead valve engine, detachable cylinder head, big valves, dry-plate clutch, slanting windshield and cantilever springs are a few of the high spots chosen at random to illustrate that the latest practice in everything has been studiously followed in this moderate-weight touring car which is to sell for $985 f.o.b. Pontiac, Mich.

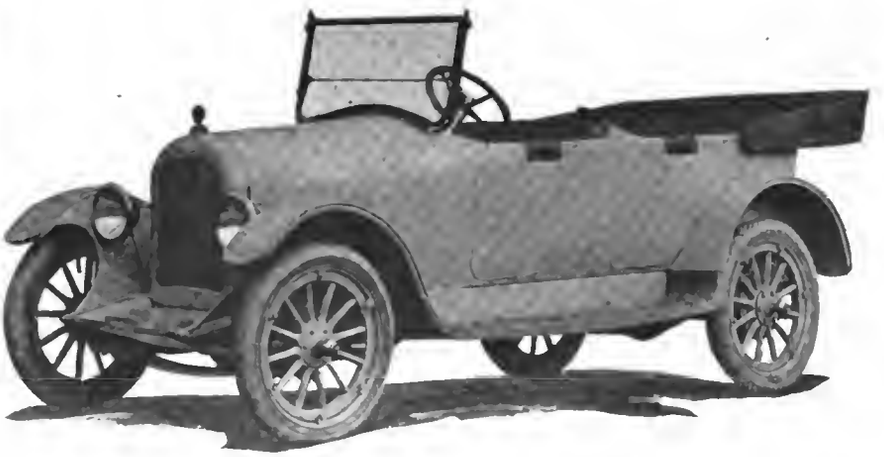
Even a casual inspection of the power plant will disclose its high-speed characteristics. The ports are large and the overhead valves are carried directly in the head. There are no sudden bends in the gas passages as the intake manifold is integral with the engine head.

The cylinder block is cast integrally with the upper part of the crankcase. It is of gray iron. The dimensions of the cylinders are 3¼ by 4½ in., giving a piston displacement of 150 cu. in. The entire combustion chamber is exposed by the removal of the upper part of the engine formed by the head casting, and the valves are also very accessible, as the push rods are carried down on the outside, and there is also no difficulty in reaching them from above by removing the nuts from the top.

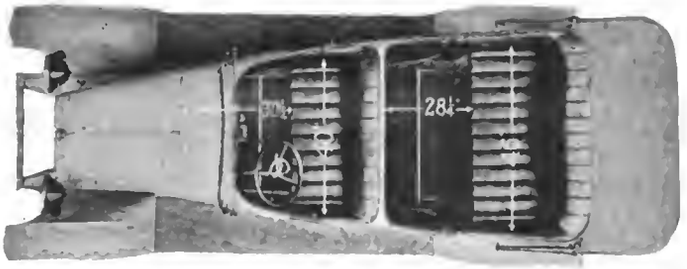
A two-bearing crankshaft is used with two large babbitt-lined bearings. The front bearing is 1¾ in. by 2 7/16 in. in diameter and length and the rear bearing is 2¼ in. diameter by 3 in. length.

Force-feed lubrication is used with a hollow crankshaft through which a gear pump, driven off the camshaft, forces

Rear view of the new Monroe touring car, showing platform spring. Plan appears below



The new Monroe four-cylinder, five-passenger touring car, which sells for $985, f.o.b. Pontiac, Mich. It has a 115-in. wheelbase, and uses 32 by 4-in. tires



the oil to all bearings. There is a pressure gage on the dash which indicates at all times when the system is working. Carburetion is taken care of by a Zenith instrument and ignition by the Connecticut system driven off the camshaft. Both the carburetion and ignition are very simple, as far as the driver is concerned, the carbureter having a fixed adjustment which need not be altered after the car has left the factory. The gasoline tank is carried at the rear of the chassis frame, and has a capacity of 14 gal. The feed to the carbureter is by gravity from the Stewart vacuum feed tank.

Starting and lighting is accomplished by a two-unit Auto-Lite system in which the generator is belt-driven while the starting motor engages with the ring gear on the flywheel by means of a Bendix attachment. The battery is a Willard. This gives a very compact electrical layout and the same idea of clean-cut electrical mounting is noticeable in the ignition where the coil and timer-distributer are side by side. This cuts the length of the high-tension leads, lessening the electrical loss through leakage and resistance.

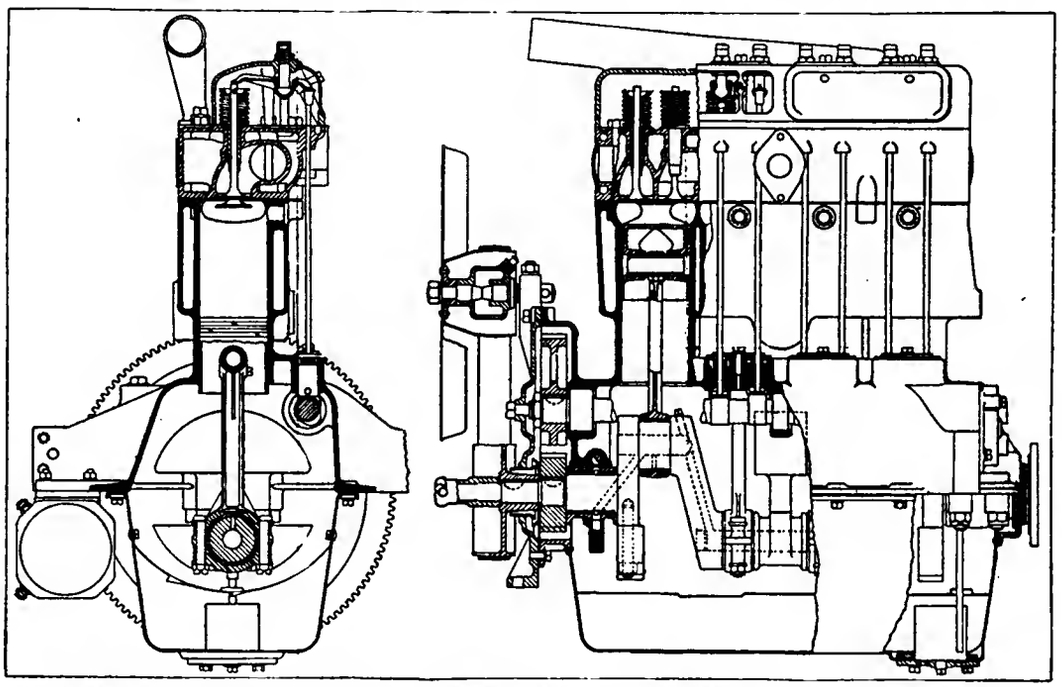
A multiple-disk clutch having six dry plates is used to transmit the power from the engine. The clutch is housed within the flywheel and transmits the drive through a facing of Raybestos against steel.

From the clutch the drive passes through a three-speed gearset which is a part of the unit power plant formed by engine, clutch and gearbox. The materials used in the construction of the gearset are chosen for their rigidity and the gears are made of double heat-treated nickel steel. Ball bearings are used for the main and counter shafts.

M. & S. Differential Used

Two universals are used on the drive shaft and the rear axle is a floating design with a pressed-steel housing and axle shafts of alloy steel. The axle housing is reinforced by the insertion of nickel-steel tubing. The pinion and ring gear are spiral bevels and a factor in the lightness of the axle is in the keying of the rear wheels directly to the outer ends of the live axle shafts. The reduction in the rear axle gives a clew to the high-speed characteristics of the engine, as it is 4¾ to 1. Another feature of interest is in the use of the M. & S. differential as stock. This differential is noted because of the fact that it gives traction on both wheels.

The wheels are artillery type, with twelve spokes. They are made of selected hickory and have spokes of 1⅝ in.



Sectional view of the four-cylinder, high-speed block unit power plant employed in the new Monroe touring car. It has a bore of 3¼ and a stroke of 4½ in., giving a piston displacement of 150 cu. in., and the valves are carried directly in the head. The cylinder block is cast integral with the upper half of the crankcase

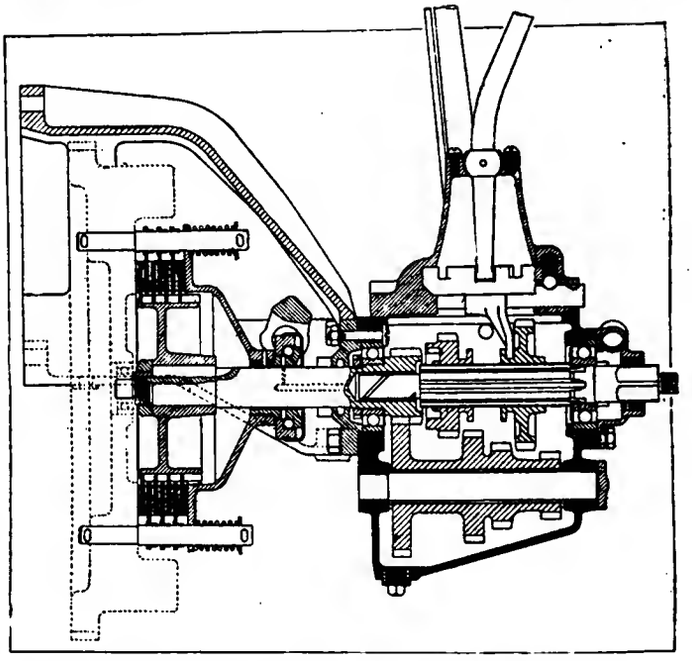
They are fitted with Q.D. demountable rims. Wire wheels can also be secured for the Monroe cars at extra cost if they are desired. The rear wheels carry the brakes, which are double, acting on a single drum 12-in. diameter. The face width of the brake is 1¾ in. and the lining is asbestos fabric. Non-skid tires are furnished on the rear wheels and the tire size is 32 by 4 in. all around.

In the structural part of the frame, the general layout of the Brush deep-side member arrangement is used. The longitudinal members are 6 in. in depth, with the steel running boards, hot-riveted to the side members, forming part of the frame. This design makes it unnecessary to use heavy sills for the body and also does away with the step hangers and the side shields. The entire assembly has the effect of strength with minimum weight.

Compound Cantilever Rear Springs

Compound cantilever rear springs are used, mounted across the rear of the chassis. This type of spring, which is a rather novel type, is noted for its elimination of side sway. In the Monroe application it is fitted throughout with self-lubricating shackles which tend to reduce the necessity for frequent attention and also add to the life of the parts and produces quietness. Semi-elliptic springs of the conventional type are in front.

A full five-passenger capacity is given by the body. The upholstery is in machine-buffed leather and a double cowl effect is secured in the molding of the back of the front seats. The doors are given an added touch by the use of leather flaps. As a comfort feature the upholstery is lined with curled hair and is mounted over cushion springs. Carpet is placed in the rear tonneau and there is space under the front seat for the jack, pump and heavy tools. All the doors have pockets, the front left-hand door being made to carry an assortment of small tools. The finish is in standard black with nickel trim. The fenders are crowned with curved steel running boards having metal-bound lineoleum pads.



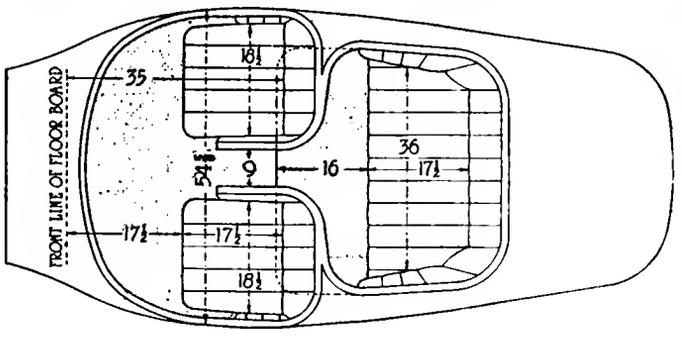
Section through the three-speed-and-reverse gearset used in the new Monroe touring car. Rigidity is a feature of this unit and the gears are of double heat-treated nickel steel. Ball bearings are employed for the main and counter shafts

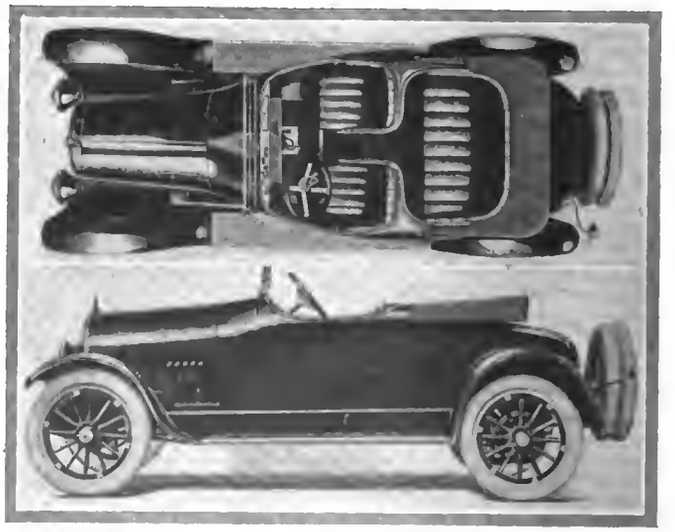
The windshield is sloping with the glass overlapping to eliminate rain leakage.

For a color choice the Monroe company offers royal blue with cream or red wheels. The finish of the metal work is black, as stated. Full equipment is sold with the car, this including besides the accessories mentioned, a heavy rubber one-man top, Collins curtains, electric horn, extra rim and carrier, Connecticut lock switch, Stewart-Warner speedometer, muffler cut-out and complete set of tools.

Westcott Four-Passenger Cloverleaf Roadster

LARGE and comfortable seats are one of the leading features of the new four-passenger cloverleaf roadster recently brought out by the Westcott Motor Car Co., Springfield, Ohio. The seating arrangement in this model has been designed to provide maximum comfort for four passengers. Entrance to the rear compartment is through an aisle 9 in. wide between the front seats. This permits passengers to change from one compartment to an other without interfering with the driver and also insures a pure circulation of air to the rear seat after it is forced to the floor in front of the driver through the double ventilating windshield. This body is mounted on the standard Westcott 125-in. wheelbase chassis. Dimensions are given in the diagram below.





The side view and plan of the new Westcott four-passenger cloverleaf roadster appearing above give an excellent idea of the lines and general appearance of this model, which has a smooth exterior and fenders conforming closely to the contour of the wheels

At the left is a plan diagram giving the dimensions of the seating arrangement

ACCESSORIES

Moore Steering Gear

THIS steering gear head was designed to overcome lost motion or backlash by providing against wear in gears of the worm and sector type. Its construction is evident from the illustration, the two parallel levers *A A* rigidly connecting with the shafts of the sectors *C*. These sectors engage the worm *D* which operates them, the right and left threaded locking screw *B* serving to draw the levers *A A* together or to separate them. By this means the teeth of the sectors may always be kept in contact with the worm, thereby preventing lost motion. When the levers are drawn together the wear comes on one side of the teeth and, when apart, on the opposite side.

Thus the mechanism may be kept in perfect adjustment and all lost motion eliminated until the teeth of the sectors are worn to a knife edge and are no longer strong enough to do the work required of them. One of these gears has been in use for 5 years, frequent adjustments being made always in the same direction and no fault has developed. By the use of the two sectors *C* twice the number of teeth in the gears and double the number of threads of the worm are brought into play giving double the worm service.—V. M. Moore, 5046 Lakeside Avenue, Cleveland.

Dean Knife Timer for Fords

An ignition timer for Ford cars. The contact is made by two tempered steel knives passing over both sides of a tempered distributing terminal, not coming in contact with any other substance or metal. The shell is made of a special metal and is insulated to eliminate short-circuits. The timer is said to facilitate starting in cold weather and to never need cleaning. Price, $1.75.—Tisch Auto Supply Co., 215 Division Avenue, South, Grand Rapids, Mich.

Line Carbureter Heater

A heating coil operated from storage or dry batteries heats the carbureter in this device. The coil is clamped around the bowl of the carbureter and is controlled by a switch on the dash. By closing the circuit heat is generated, causing the gasoline to volatize more readily, aiding easy starting. Price, $3, complete.—Mechanical Utilities Corp., 5 North La Salle Street, Chicago, Ill.

Pennsylvania Bar Circle Tire

Bar Circle non-skid tires have treads of tough black rubber formed into a combination of cross-bars and circles. This construction is claimed to put the rubber where it is most needed and to enable the tires to exceed their guaranteed mileage under normal conditions. Prices of some popular sizes are:

Size	Price	Size	Price
30 x 3	$10.35	34 x 4	$22.50
30 x 3½	13.45	36 x 4½	31.80
32 x 3½	15.45		

Of course, all other standard sizes are obtainable. — Pennsylvania Rubber Co., Jeanette, Pa.

Toscot Belt Coupling

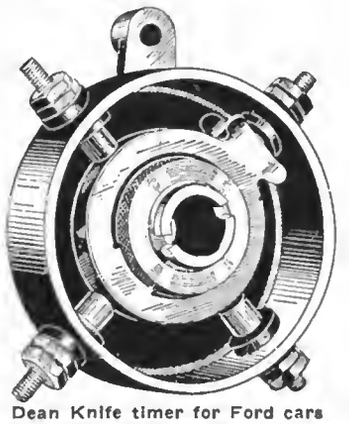
The Toscot is a detachable coupling for flat belts and the Victor for round belts. The former is used in 1 and 1¼ in. sizes for automobile work. Prices of the flat belt coupling run from 90 cents to $2.80 per dozen, according to sizes, ranging from 1 to 6 in. The round belt coupling costs from $2 to $26 per dozen in sizes varying from ½ to 1¼ in.—Stewart & Co., New York City.

Searchlight Torch

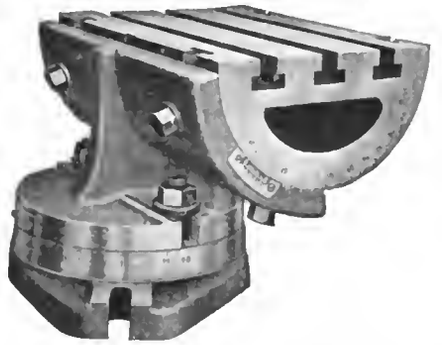
A brazing or soldering torch that may be attached to any automobile or motorcycle acetylene tank. An extremely hot flame is produced immediately and may be regulated to suit the requirements of the work. The device is small, provided with a convenient handle and may be used in a limited space. Price, $1.50.—Searchlight Co., 415 Karpen Building, Chicago, Ill.

Universal Angle Plate

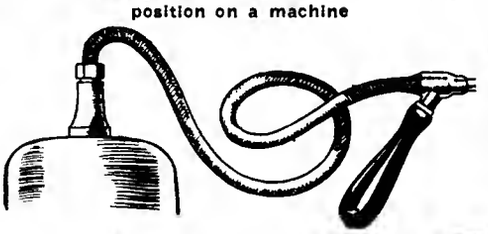
The Universal plate holds the work in almost any position, either in a lathe, planer, milling machine, shaper, drill press, or grinder. A cast iron base is bolted to the machine tool, and carries a double adjustment standard supporting the semi-cylindrical table to which the work is clamped. This standard may be



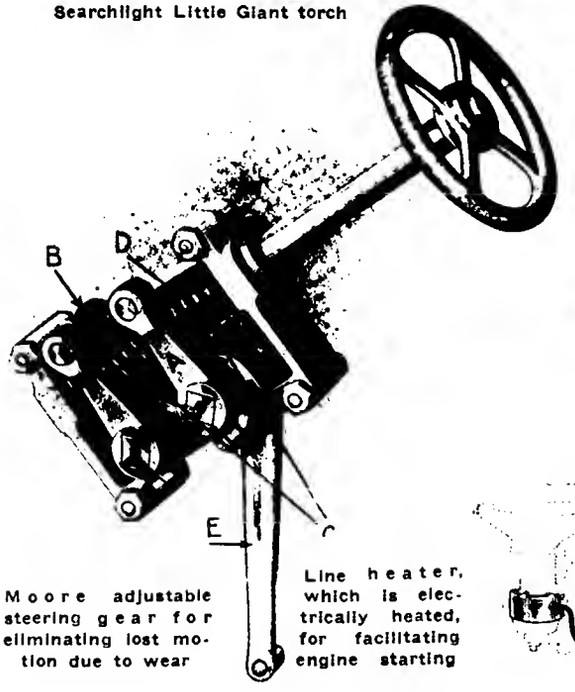
Dean Knife timer for Ford cars



Universal angle plate for holding work in any position on a machine



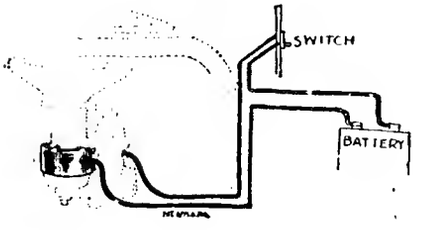
Searchlight Little Giant torch

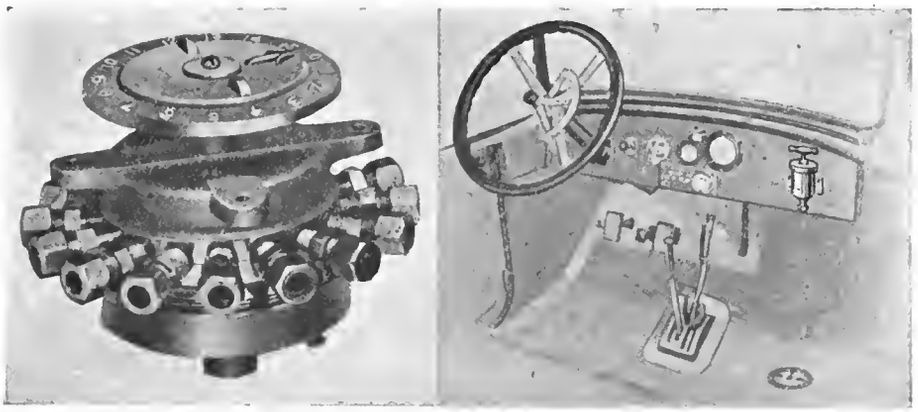


Moore adjustable steering gear for eliminating lost motion due to wear

Line heater, which is electrically heated, for facilitating engine starting

Pennsylvania Bar Circle non-skid tire, showing distinctive non-skid tread





Monitor lubricator. Distributer illustrated at left is mounted under floorboards as shown at right. The device is designed to replace grease cups

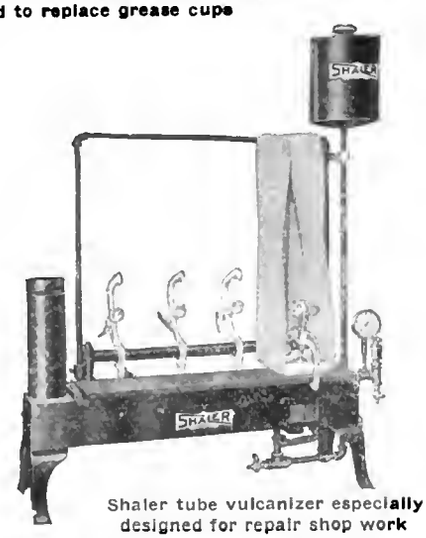
moved through 360 deg. horizontally, and work table may be swung through an angle of 90 deg., the amount each is moved being shown by a scale on the face of the adjusting members. It is said that the work is rigidly held, may be adjusted to any angle while bolted to the table, and is particularly adapted to tool room work. Price, 4 by 6 in., $50; 6 by 8 in., $75; 8 by 10 in., $100.—Boston Scale and Machine Co., 381 Congress Street, Boston.

Monitor Lubricator

Grease cups are eliminated throughout the car, and all grease is supplied by an attachment which is mounted in the driver's compartment. The device consists of a grease gun which is fastened permanently on the cowl and which delivers grease to a distributer sunk in the floorboard. Pipes run from it to the various points on the car which require lubrication. The top of the distributer consists of a dial with numbers placed at points on its circumference, each one corresponding to some pipe running to a point requiring lubrication. If the pointer is turned to number 3, for example, and the handle on the grease gun is screwed down, grease might be delivered to the right front spring bolt. The delivery of the grease to the various points is claimed to be positive, and only occurs as the driver deems it necessary. The pipes running to the springs are carried along the frame side members and those running to the axles branch off from the frame and run along the springs. The pipes are sufficiently flexible so that the relative motion of the different parts of the car will not cause breakage. — Monitor Lubricating Co., 1218 Chestnut Street, Philadelphia, Pa.

Shaler Tube Vulcanizer

This vulcanizer is especially designed for repair shop use, the machine surface of the tube plate which is 4¾ by 24 in. standing 9 in. above the base, adapting it to installation either on the floor or work bench. This vulcanizer, like all Shaler types, embodies the automatic temperature control. The tube clamping device is also new, four clamps being provided, adjustable to any position along the plate, and instantly attachable to a tube. The entire length of the plate may be used for single long repairs or four tubes can be mended as quickly as one. Steam is generated to vulcanizing pressure in 15 min. and is maintained there indefinitely without attention from the operator by means of a thermostatic damper, which regulates the intensity of the flame produced by the gas or the gasoline burner. A steam gage and safety valve are fitted. The vulcanizer sells for $25.—C. A. Shaler Co., Waupun, Wis.



Shaler tube vulcanizer especially designed for repair shop work

Dig-U-Out

This emergency device provides extra traction. A metal paddle is clamped onto each rear tire when the roads are exceptionally bad or the car is stuck, and is said to enable a car to pull out of any mudhole. Price, single-tire size, $10; dual-tire size, $14.—Protex Co., 1790 Broadway, New York City.

Dig-U-Out emergency traction device

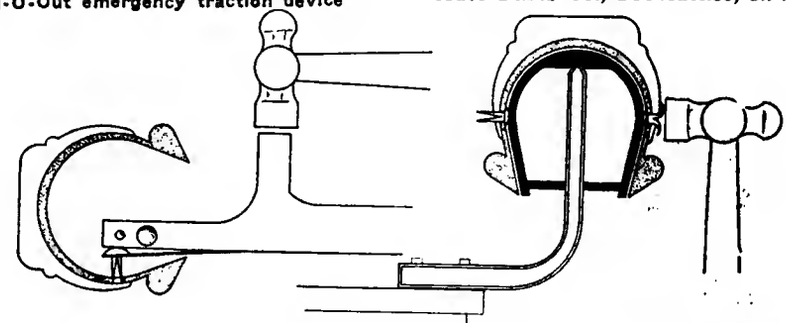
Star Tire Retread Kit

This kit contains the tools necessary to rivet the tread of one old tire over another. It consists of three mandrels, a rivet set, fabric knife, pliers, can of cement, brush and clamp. The bead of one old shoe is removed and its tread is cemented over the tread of another old shoe having a good bead. The mandrels are then employed in driving the rivets from the inside and clinching them securely on the outside of the tread. Price, complete, $8.—Star Auto Supply Co., Spokane, Wash.

Apco Ford Specialties

A set of valve grinding equipment including the Apco valve spring remover which keeps the springs compressed, permitting the use of both hands, a grinding tool that can be easily used on the fourth cylinder and a large box of carborundum grinding abrasive sells for 60 cents.

The company's improved clutch control throws the clutch into neutral when the brake pedal is used. This prevents the engine working against the brake and saves wear on the brake lining. The control is easily attached with a screw driver and wrench in a few minutes, no fitting being required. The manufacturer states that the control is of special value in congested traffic. It sells for 30 cents. —Auto Parts Co., Providence, R. I.



Star kit containing all tools required for riveting the tread of an old tire over another

Industrial Miscellany

Factory

Ajax-Grieb Rubber Co., Trenton, N. J., is building a four-story brick and steel addition to its plant at a cost of about $300,000.

Youngsville Radiator Co., Youngsville, Pa., builder of automobile radiators, will increase its capital stock from $25,000 to $50,000. The company now occupies 8600 sq. ft. of space, but will build probably next spring.

Motor Parts Co., Newcastle, Ind., is building an addition to its plant, 80 by 180 ft.

Reliance Motor & Tool Co., Toronto, Ont., has been formed to make tools and motor appliances. Incorporators are W. B. Sturrup, J. S. Duggan and C. A. St. C. McKay, of Toronto.

Pilot Motor Car Co., Richmond, Ind., has work well under way on its new building, which it expects to occupy in three weeks.

Pull-More Motor Truck Co., New Castle, Pa., has broken ground for the erection of a new plant. The company is capitalized at $800,000 and employs 300.

Boone Tire & Rubber Co. will establish a plant in Sycamore, Ill. It is expected to have tires on the market in February.

G. W. Childers & Co., manufacturers of steel casings for automobile tires, is locating its principal plant in Wichita, Kans.

M. E. Kern has bought land in Allentown, Pa., on which he will erect a plant for the manufacture of motor trucks.

Rogers & Madison Truck Co., Petersburg, Va., is planning the construction of a factory building to cost $15,000.

Westgard Tire & Rubber Co., Warren, Ohio, will shortly begin the erection of the first unit of its new plant, which will be 100 by 240 ft., two stories and basement, and a power plant.

Howell Electric Motors Co., Howell, Mich., has increased its capital to $100,000, and is preparing plans for an addition 40 by 100 ft.

Doehler-Die Casting Co., Brooklyn, has let the contract for a concrete and steel addition to its plant. It will be 50 by 100, seven floors, and will cost about $150,000.

Wright Wrench & Forging Co., Canton, O., has disposed of its entire wrench and small tool business and the name has been changed to American Forge & Machine Co. The plant has been doubled in size and is now devoted exclusively to the manufacture of heavy drawn forgings up to 15 tons in weight and a line of motor car drop forgings. A heat treating plant has been added.

Lycoming Rubber Co., Williamsport, Pa., has started the erection of a large brick addition, 55 by 100 ft.

Marion Metal Products Co., Marion, Ind., has been formed to manufacture automobile accessories. The directors are W. E. Plummer, G. A. H. Shideler, C. A. Williams, G. C. Condo and J. R. Browne.

Dall Motor Parts Co., Vermillion, Ohio, has been formed and will erect a building, 40 by 83 ft., to manufacture pistons and other automobile parts. W. E. Derr is president, and L. A. Dall, general manager.

Cutler-Hammer Mfg. Co., Milwaukee, manufacturing the C-H magnetic gearshift and other electric controlling devices, switches, etc., will start work at once on the erection of a new administration building, laboratory and general industrial building, costing $150,000. Plans have been completed and contracts awarded. The building will be 283 ft. long and 50 ft. wide, six stories and basement, of fireproof construction. It is to be ready about May 1, 1917.

Four Wheel Drive Auto Co., Clintonville, Wis., which has been erecting large additions to its factory all year, is now erecting a solid brick warehouse, 40 by 100 ft. in size, for storing rough castings.

Skilled foundry labor is restricting the desired extension of operations by the Western Malleables Co., Beaver Dam, Wis., which some time ago added a department for the production of castings for the motor car and tractor industry. The company owns three large foundries, two of which are operating at full capacity. One furnace in the third plant was lighted during the last week, but only one or two heats a day can be taken because there are not enough men available to handle the work.

The Automobile Calendar

ASSOCIATIONS

Dec. 2-9—Electricians' Country-wide Celebration.
Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.
Jan. 9-11—New York City, Society of Automobile Engineers' Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.
Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.
Nov. 16—New York City, S. A. E. Meeting.
Nov. 23—Philadelphia, Pa., S. A. E. Meeting.
Dec. 7—Baltimore, Md., Safety First Convention of Safety First Federation of America.

CONTESTS

Nov. 24 and 25—Newark, N. J., 24-Hr. Endurance Run of N. J. Automobile and Motor Club.
Nov. 30—Uniontown, Pa., Speedway Race.
Nov. 30—Los Angeles, Cal., Ascot Speedway 200-mile Championship Race.

1917

April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23—Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 14——Des Moines, Iowa, Speedway Race, Championship.
July 28—Tacoma, Wash., Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15—Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race, Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13—Chicago Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Nov. 20-25—Worcester, Mass., Show, Worcester Casino; Worcester Automobile Dealers' Assn.
Dec. 2-9—Springfield, Mass., Show, Auditorium, H. W. Stacey, Mgr.
Dec. 9-16—Akron, Ohio, Show for Passenger Cars Only. Market Street Gardens, Akron Automobile Dealers' Show Assn.
Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel, I. R. Gates, Mgr.
Dec. 30-Jan. 6—Cleveland Automobile Accessory Show, Dreamland Auditorium.
Dec. 30-Jan. 6.—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.
Jan. 6-13—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 9-10—Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.
Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.
Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 23-27—Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 27-Feb. 3, 1917—Chicago Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 5-9—Boston, 8th National Good Roads Show, Mechanics' Bldg.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 12-17—Louisville, Ky., Show, First Regiment Armory, Louisville Automobile Dealers' Assn.
Feb. 12-17—Cedar Rapids, Ia., Show, Cedar Rapids Automobile Trade Assn.
Feb. 18-25—St. Louis, Mo., Show, Automobile Manufacturers' and Dealers' Assn.
Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.
Feb. 19-24—Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.
Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.
Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.
March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co. Armory of the University of Ill.
March 3-10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 14-17—Davenport, Ia., Show, Coliseum Bldg., Tri-City Automobile Trade.

Forschler Motor Truck Manufacturing Co., Inc., New Orleans, made the first display of 1 and 2-ton trucks, built in the plant of the former Forschler Wagon Manufacturing Co., at the National Farm and Live Stock Show here. The company was organized June 6, capitalized at $500,000, and will turn out vehicles steadily. Adolph Dumer, president of the Metropolitan Bank, is president.

Ever-Tight Piston Ring Co., St. Louis, has increased its capital stock to $50,000. R. Koehler is president and treasurer. The company's plant will be enlarged at once.

Yuma Auto & Tractor Co., Yuma, Col., agent for Ford cars and Plowboy, Moline, Bull and International tractors in Yuma County, has built a $14,000 fireproof garage, 60 by 140 ft., two stories, pressed brick.

Auto Radiator & Fender Works, Tacoma, Wash., has purchased machinery for the manufacture of automobile radiators.

Personal

Frank Dawson, for several years manager of the Mogul Truck Co. of St. Louis, has resigned to go to Chicago, where he will be connected with a company that will begin the manufacture of trucks Jan. 1.

H. H. Brooks has been appointed superintendent of agencies for the Madison Motors Co., Anderson, Ind.

W. T. Stalnaker, formerly of the mechanical department of the Pathfinder Co., Indianapolis, has been appointed service manager of this company.

D. B. Ashton, Marion, Ohio, will handle the Cadillac and Chalmers.

R. C. Ridge, former superintendent of the Marathon Tire & Rubber Co., Akron, and at one time connected with the Firestone company, of that city, has succeeded C. F. Piskton as superintendent of the Porter Rubber Co., Salem.

George Muehl has resigned his position as assistant manager of the Cadillac Motor Car Co., Detroit branch, and will associate himself with a concern dealing in investments and bonds.

J. F. Madden has been appointed sales director of the Pacific Coast for the Pennsylvania Rubber Co., and C. F. Kent, of the Rocky Mountain District of the West.

P. G. Sedley has become manager of the direct branch of the Eisemann Magneto Co., Chicago, Ill. He was formerly manager of the New York branch of the Heinze Electric Co., Lowell, Mass. Mr. Sedley will take up his new duties on Jan. 15.

George Tracy has been transferred to the Newark, N. J., office of Clodio & Engs, New York distributer of the Kissel Kar.

R. P. Ford has joined the truck sales organization of the Peerless Motor Car Co., Cleveland. He has been connected with the automobile industry since 1906, at that time with the Overland company.

H. W. Winn is the new sales manager of the Southern Motors Co., Louisville, Ky.

A. E. Ward, formerly sales representative of the Prest-O-Lite Co., New York, has been made division manager.

A. E. Walden has joined the C. T. Silver organization in New York, Chalmers and Dort, where he will have charge of the service and mechanical departments.

F. H. Whitman has been appointed production engineer for the National Motor Vehicle Co., Indianapolis. He was formerly connected with Dodge Brothers.

L. H. de Graaf, Richmond, Va., former manager of the Richmond branch for the Kissel Sales Co., has been made retail sales manager for the Terminal Motor Co., selling Hupmobile and Dort.

Herbert W. Little has been transferred to the Willys-Overland factory, Toledo. Mr. Little was formerly the zone service manager for the company in the New England States. He will be succeeded by F. H. White.

George Cushing has accepted a position with the advertising department of the Hudson Motor Car Co., Detroit. Mr. Cushing was formerly the advertising manager of the Federal Motor Truck Co.

James Coggeshall has been appointed manager of the wholesale department of the R. E. Taylor Co., New York, distributor for Garford trucks in this city, New Jersey and New England.

Dealers

Prest-O-Lite Co., Inc., Milwaukee, has been reorganized. C. F. Mitchell, manager of the Milwaukee branch, 18-20 Martin Street, has been promoted to division manager, with headquarters at Milwaukee. He is succeeded by E. P. Drummond.

Carl M. Green Co., Detroit, has been selected as advertising agent of the Nash Motors Co., Kenosha, Wis.

H. A. L. Motor Sales Co., Milwaukee, has been organized by Charles Gordon to act as distributer of the Hal Twelve in the Wisconsin and upper Michigan territory. Offices have been opened at 424 Wells Building, Milwaukee.

Quaker City Taxi Cab Co., Philadelphia, has placed an order with J. D. Howley, manager of the local White branch, for 100 taxicabs, the largest order placed in this city.

Hearn Tire & Rubber Co., Columbus, Ohio, has been succeeded by the Kelly-Springfield Tire Co., which has established a direct factory branch at the former location, Gay and Fourth Streets.

Chattanooga Saxon Co., Chattanooga, Tenn., recently organized, announces the purchase of the Saxon agency and territorial rights from the Bill Jones Automobile Co. Until salesrooms are leased the new company will retain headquarters with the Bill Jones Co.

All-Year Motor Co., Denver, is the name of a new Kissel distributing agency for Colorado and southern Wyoming. It is located at 1517 Cheyenne Place.

Chandler Motor Co. of Colorado, Denver, Chandler distributer for Colorado and Wyoming, has secured the Stutz distributing agency for the same territory.

Tate-Gillham Motor Co., St. Louis, Dodge agent, has moved to 3107-11 Locust Street.

J. B. Howard Motor Sales Co., St. Louis, will handle the Dixie Flier and the Old Hickory truck in Missouri and Illinois south of Peoria.

Packard Missouri Co., Kansas City, has opened a branch at Wichita, Kan. C. G. Anderson, who formerly sold the Packard in St. Louis and in Kansas City, is in charge of the new branch.

James Barnes, general sales agent for the R. E. Dietz Co., lamp maker, has moved his office from 71 Parkway to 306 and 307 Carter Building, corner Church and State Streets, Rochester, N. Y.

Fisk Rubber Co. has leased a four-story building at 664-66 North Broad Street, Philadelphia.

Goodyear Tire & Rubber Co. will move into a new building in New Orleans, at 818-20 Howard Avenue.

Smith Form-A-Truck Sales Co., Indianapolis, has opened new quarters at 1327 East Washington Street.

Springfield Body Co. has opened a New York service station at 22 West 61st Street. Charles Baasch, formerly located at the factory in Springfield, Mass., is manager of the new service station.

Kokomo Brass Works, Kokomo, is represented by the Prie Sten Sales Co., Chicago.

R. Greenlaw, New Orleans, motor truck dealer, has added the Avery tractor.

Mohawk Rubber Co., Akron, has leased a two-story building in Kansas City at 1928 Grand Avenue.

Michelin Tire Co., Milltown, N. J., has established an agency in Indianapolis.

Mohawk Rubber Co. has established a tire branch in Kansas City at 1928 Grand Avenue. W. J. Smith is in charge.

R. C. Greenlease, president of the Greenlease Motor Co., distributer of the Cadillac in Kansas City territory, has purchased a site 114 by 300 ft., on which a building will be erected for the company in the spring. The site is at Twenty-ninth and McGee Streets.

H. H. Heaps, formerly with the Hiatt-Buick Co. at Kansas City, Mo., has been made local manager of the Reno Buick Co., Hutchinson, Kan. R. R. Rosier has disposed of all his interests in the Hutchinson Buick Co. to the new firm.

Kelly-Springfield Tire Co. has just opened a factory branch in Baltimore, Md. H. H. Grobe, formerly manager of the truck-tire sales at the New York branch, is manager. Carl Spoerer's Sons Co., which formerly handled the Kelly-Springfield line, has taken on the Republic Rubber Co.'s line.

Ross Eight, handled by J. J. McCarthy at Boston, Mass., for the past year, is now represented by the Bishop Motor Car Co.

Connell-McKone Co., Boston, Mass., has opened new salesrooms at Manchester, N. H., where it recently started an Overland branch.

Dodge Brothers opened an agency at Holyoke, Mass., with the P. A. Williams Co., Springfield.

Reo and **Chevrolet** have been placed at Manchester, N. H., with H. C. Lintott.

J. F. Grant has added the Buick to his line at Brockton, Mass.

White Motors Co., New Haven, Conn., is in its new home. It will give the company some 25,000 sq. ft. of floor space. The service department is already in its part of the building. The building is located at 264-266 Crown Street.

M. Bell's Son, Franklin, La., State distributer of the Marmon cars, has opened salesrooms at 536-538 Barronne Street, New Orleans. A. N. Jacobs of Franklin is manager of the new branch.

Goodyear Tire & Rubber Co., New Orleans branch, has moved into a new three-story building at 818-820 Howard Avenue. W. E. Dermondy is manager.

Electric Starting and Lighting

The AUTOMOBILE

Vol. XXXV
No. 22

NEW YORK, NOVEMBER 30, 1916

Ten cents a copy
Three dollars a year

Editorial Contents, Page 3

Advertisers' Index—Next to last page

Stewart Products

Stewart Speedometer
$25

$1
Stewart V-Ray Spark-Plug

Chase the Winter "Bug-a-boo"

It exists in memory only. It's a thing of the past. The dull-winter-business period of previous years is dead. Let's bury it—then forget it.

Get a new grip on your business. *Believe* as other live dealers *know* that there will be a *big* winter business this year.

More cars will be in use *this winter* than were driven in the summer two years ago. At least 75 per cent of the cars will be in constant service.

This means that there is a *big winter* business for you if you will only go after it.

And don't forget, Stewart Products will sell faster than ever. Each Stewart Product is a real necessity for the car in winter as well as summer.

"It will pay you to see that every car is Stewart equipped."

STEWART-WARNER SPEEDOMETER CORPORATION
CHICAGO, U. S. A.

$6
Stewart Motor Driven Warning Signals

$50
Warner Auto-Meter

Stewart PRODUCTS
PRESTIGE QUALITY SERVICE SATISFACTION

Stewart Vacuum System
$10

$3.50
Stewart Hand Operated Warning Signal

$12
Stewart Tire Pump

$10
Stewart Speedometer for Fords

The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, NOVEMBER 30, 1916—CHICAGO NO. 22

Hydraulic Steel Co. Refinancing

Plans $10,000,000 Co.—Standard Oil Interests Back of Reorganization

CLEVELAND, OHIO, Nov. 27—The Hydraulic Pressed Steel Co., one of the largest producers of pressed steel wheels, frames and forgings, has a plan under consideration with the Standard Oil Co., which provides for the formation of a $10,000,000 company which will include the Hydraulic company and one other. Under this plan the holders of the Hydraulic common will receive approximately $108 cash for each share plus $162 par in the stock of the new company. By the deal this would mean a withdrawal of part of their investment in cash by sellers of the Hydraulic stock while the balance would remain in the company as now.

The management would undergo virtually no change and the board of directors would include Clevelanders and representatives of the country's leading financial interests. The Hydraulic company would continue to manufacture its present lines, according to the plan, and would enlarge its output.

This company was organized in 1906 and its production has amounted to $7,000,000 yearly.

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Farr Leaves SKF Bearing Co.

HARTFORD, CONN., Nov. 28—A. V. Farr has become sales manager of the Hess Steel Corp., Baltimore, Md. He was formerly advertising manager of the SKF Ball Bearing Co., this city.

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Herschell-Spillman Adds New Model

NORTH TONAWANDA, N. Y., Nov. 28—The Herschell-Spillman Co., whose motors now are used in a large number of passenger cars and commercial vehicles, is shortly to bring out a new model. It will be a 3¼ by 5 motor, of L-head design, for commercial vehicle and small car use. The present capacity of the plant is from 15,000 to 20,000 of these motors a year. Details of the new motor are at present being worked out by Designer E. O. Spillman, and it is hoped to have samples ready by Jan. 1.

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Schoeneck to Make One Chassis

CHICAGO, Nov. 27—The Schoeneck Co., of which J. Alvin is president, will produce one chassis equipped with four body models. These are two, four, six and seven-passenger types. The car is equipped with a 4 by 5½ in. six-cylinder Herschell-Spillman motor, other equipment including a Brown-Lipe four-speed gearset, Brown-Lipe disk clutch and Timken axle. The wheelbase is 139 in. and tires are 34 by 4½.

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Schaaf with Fisher Tractor Interests

INDIANAPOLIS, Nov. 27—A. R. Schaaf, for many years secretary of the Fiat Automobile Co., Poughkeepsie, N. Y., and previous to that connected with the Pope Mfg. Co., Toledo, Ohio, has united with Carl G. Fisher in the manufacture of a farm tractor and will associate himself with that organization in the capacity of factory manager.

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Pfeffer to Retire from Chalmers

DETROIT, Nov. 28—C. A. Pfeffer, vice-president and assistant general manager of the Chalmers Motor Co., this city, will retire shortly from that company to enter into business for himself. He will remain, however, as a stockholder and director.

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Hibbard Is Regal Asst. Sales Mgr.

DETROIT, Nov. 27—V. S. Hibbard has joined the Regal Motor Car Co. as assistant sales manager. Mr. Hibbard was formerly sales and advertising manager of the R. C. H. Corp.

Oct. Truck Exports Smaller

Drop Nearly $2,000,000 in Value—Passenger Cars Gain —Total $9,341,119

		1916			
Mos.	Cars	Value	Trucks	Value	Parts
Oct.	4880	$3,756,768	1144	$3,635,291	$1,949,060
Sept.	3585	2,819,405	1835	5,203,215	2,095,188
		1915			
Oct.	3479	2,749,255	1596	4,307,190	1,819,950

WASHINGTON, D. C., Nov. 27—The feature of the export trade in October was increased exports of passenger cars and parts with a diminution of exports in commercial cars. Figures just announced by the Department of Commerce show that during October last there were 1144 commercial cars, valued at $3,635,291, and 4880 passenger cars, valued at $3,756,768, together with parts to the value of $1,949,060, exported to various foreign countries. For the corresponding month of last year the figures were: Commercial cars, 1596, valued at $4,307,190; passenger cars, 3479, valued at $2,749,255; parts, not including engines and tires, $1,819,950.

During the 10 months of 1916 the figures show that 15,917 commercial cars, valued at $44,006,346, and 51,699 passenger cars, valued at $36,049,497, together with parts, not including engines and tires, to the value of $20,091,793, were shipped abroad. During the same period of last year the commercial car exports numbered 18,865 machines, valued at $52,076,406 and passenger cars to the number of 34,515, valued at $29,543,227. The exports of parts, not including engines and tires, were valued at $12,814,809.

The big buyers in October last were as follows: France, 522 cars, valued at $1,782,088; United Kingdom, 684 cars, valued at $1,687,152; Canada, 1021 cars, valued at $718,962; West Indies and Bermuda, 665 cars, valued at $505,198.

Knickerbocker Co. Reorganized

Larger Output — Capital Is $500,000—To Add Tractors to Truck Line

NEW YORK, Nov. 24—The Knickerbocker Motors, Inc. has been incorporated in this city to take over the Knickerbocker Motor Truck Mfg. Co., which for several years has made trucks in New York City. The new corporation is essentially a reorganization of the old concern on a broader scale and contemplates the production of 500 chassis the first fiscal year.

H. G. Streat, president of the Streat Coal Co. and founder of the Knickerbocker Motor Truck Mfg. Co. is president; A. C. Brady, formerly president of the Brady-Murray Motors Corp., Chandler dealer in New York City is vice-president and sales manager; H. G. Streat, Jr., son of the president, is treasurer; and W. C. Guilder, formerly production manager for the Kelly-Springfield Motor Truck Co., designer of the first Garford trucks and early Macks, and also production man with the Timken-Detroit Axle Co., is production manager.

Mr. Streat, Clarence A. Ludlum, Charles H. Class, W. H. Bonynge and Grove D. Curtis are the directors.

The products will be a 2½-ton truck, a 5½-tonner and a 3-ton tractor. Two hundred of the 2½-tonners, 100 of the 5½-tonners and 200 tractors are expected to make up the first year's production.

The concern has an authorized capital of $500,000, all common, $10 par value per share. In a statement by W. A. Lewis and J. B. Linn, underwriting managers it is stated that $250,000 of this stock will be placed on the market, to be held until it is all paid for, subscribers receiving receipts to be held until it is all subscribed. If, after a reasonable time the stock is not all subscribed, the full amount paid in by subscribers will be returned. It is also stated that none of the capital thus raised will be used for promotion; but will all be devoted to the conduct and expansion of the business.

The concern will occupy the old plant of the Knickerbocker company at 151st Street and River Avenue, Bronx, New York.

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Race Gillette Tire Sales Manager

EAU CLAIRE, WIS., Nov. 25—C. G. Race, until now general manager of the Chicago branch of the Gillette Safety Tire Co., this city, has assumed the position of general sales manager and a director of the Eau Claire concern. Further, the entrance of eastern capital into the company has caused it to increase its authorized capital from $250,000 to $1,000,000. As soon as possible, the second unit of the new tire and commercial rubber goods plant just completed will be undertaken, and by March 1 or April 1 the capacity will be more than doubled. Within a year it is hoped to increase the output to 1000 tires a day. R. B. Gillette, founder of the concern, continues as general manager.

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Wilson Adds 1-Ton Model

DETROIT, Nov. 27—Smaller than the 2-ton single chassis upon which the J. C. Wilson Co. of this city has heretofore specialized, but incorporating the same general features of design, a 1-ton model of Wilson truck has just been placed on the market. The new model rounds out the line more than is at first apparent, since with tractors made by shortening the wheelbases of these two models it is possible to embrace practically all load capacities from 1 to 6 tons.

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Smith Truck-Forming Attachment for All Cars

CHICAGO, Nov. 27—Additional capital brought about through the re-organization of the Smith-Form-A-Truck Co., and the taking over of this concern by the newly formed Smith Motor Truck Corp., is to make possible the extension of this particular truck-forming attachment to cars other than Fords. Already attachments are being made for such cars as Dodge, Maxwell, Buick, Overland and Chevrolet. The new unit for application to other cars will be known as the Universal, although this term does not have its usual meaning since units under this name will not apply to all cars for some time.

Attachments for Maxwell and Chevrolet have a frame of 4-in. channel section, the same as the unit for Fords and they sell at the same price as the Ford attachment or $350. This unit will convert this car into a 1-ton truck, but the larger size, the frame of which will be 5-in. channel section, will be designed for loads of 1500 lb.

Capacity for production of the attachment that has been made for Ford cars for the last 2 years is now 300 a day, and as announced last week, additions to the plant will be built which will practically double the floorspace and thus the company expects to be able within 3 months to take care of any demand that may come for these units either for Fords or other cars. At present the company is making an average of one a day of the Universal attachment, but is unable to keep pace with the demand for this particular unit, dealers in some cities asking for them in carload lots.

The method of attachment for the newer units is the same as for the Ford; that is, the rear axle of the car is used as a jackshaft for chain drive.

Detroit to Be Aviation Center?

Signal Corps, Representing Army and Navy, Visits Detroit and Buffalo

NEW YORK CITY, Nov. 27—The interest of the government in having automobile manufacturers take up the problem of aeroplane manufacture was evidenced last week when the Signal Corps, representing the Army and Navy, visited Detroit, Buffalo, and some other points with the thought of establishing aviation training stations in at least Detroit and Buffalo. The government recognizes that the automobile manufacturers are well qualified to carry out all work of aviation design and manufacture. There is no better manufacturing organization to handle such work and it is for this reason that these two cities are being considered, Detroit because of its leadership as an automobile manufacturing center and Buffalo because of the volume of aeroplane manufacture at present carried on there.

May Buy Joy Field

With this object in view the government is considering the possibility of taking over in Detroit what is known as the Joy Aviation Field, which is the testing ground purchased some time ago by the Packard company. The matter is only under contemplation. Howard Coffin of the Council of National Safety, and also of the Navy Consulting Board, has been making the rounds with the Signal Corps in its investigating work.

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Stout Is Packard Aircraft Manager

DETROIT, Nov. 24—W. B. Stout has been appointed manager of the aircraft division of the Packard Motor Car Co. Mr. Stout is at present general sales manager and advertising manager of the Scripps-Booth Corp. He will resign his present position on Dec. 2.

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Brown Becomes Scripps Sales Manager

DETROIT, Nov. 24—W. I. Brown, who has been assistant sales manager of the Scripps-Booth Corp., will become the general sales manager Dec. 1. Mr. Brown joined the Scripps-Booth company after resigning from Dodge Bros.

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Smith Blair Truck Sales Manager

NEWARK, OHIO, Nov. 24—G. E. Smith has become sales manager of the Blair Motor Truck Co., F. L. Swanberg has resigned as manager. The management of the factory will be in charge of J. P. McCune and F. O. Spaulding.

Two 1917 Studebaker Chassis

Four-Cylinder in Three Body Styles—Six-Cylinder Available in Six

DETROIT, Nov. 28—*Special Telegram*—The program of the Studebaker Corp. for 1917 will include a four-cylinder and six-cylinder chassis. These are known as series 18. Both of these chassis and the bodies are considerably refined and improved in the direction of greater comfort and convenience for the passengers. Fundamentally neither chassis has been altered. Among the important changes are a reversible seat, so that the passenger can face either front or back. Both front seats are adjustable for different leg lengths and on the backs of the front seats there are flexible leather robe straps. The tonneau is roomier because of a new design of auxiliary seats which fold under the rear seat, instead of against the back of the front seat. These new seats are armchairs.

Pistons Are Lighter

In the engine the pistons have been lightened, to some extent reducing vibration, and the oil pump has been re-designed to move a more positive oil feed.

Although the rear axle is quite similar to last year's Timken bearing design, it has been materially strengthened and in the electrical system the characteristics have been altered to give about 12 per cent greater starting torque. There is a new convertible top known as Every-Weather which fits to the touring body, providing a sedan when in place. Better equipment is provided, particularly in the way of Blackmore door curtain openers which permit the side curtains to open with the door; also Yale lock for the ignition switch.

In the four-cylinder model there will be a three-passenger roadster at $930, a seven-passenger touring car at $940 and a three-passenger landau roadster at $1,150.

On the six chassis there will be a three-passenger roadster at $1,170, a seven-passenger touring car at $1,180; a three-passenger landau roadster at $1,350, a seven-passenger touring sedan at $1,700, a four-passenger coupé at $1,750 and a seven-passenger limousine at $2,600.

Charter Oak Six on Market Next Spring

HARTFORD, CONN., Nov. 27—Early spring is the time at which the recently incorporated Eastern Motors, Inc., this city, expects to have the first Charter Oak car on the market.

The Charter Oak is to be an assembled proposition combining a Herschell-Spillman six-cylinder engine, a four-speed Brown-Lipe transmission and Timken axles. It is the desire of the Eastern Motors, Inc., to build the car in Hartford. A canvass of possible sites for a factory have availed little as yet.

Rumor has it that the concern may possibly locate in Waterbury. The sales department announces that dealers have been secured for the first year's output at least. The temporary executive offices and the engineering department are located at 1026 Main Street in the Pilgard building. The major portion of the stock is owned in Waterbury.

Grant Will Move Shortly

DETROIT, Nov. 24—The Grant Motor Corp. of Findlay, Ohio, will move to its new plant in Cleveland within the next two weeks. The company still has 300 cars to finish at Findlay and will start production before Dec. 1 in Cleveland with a schedule for 1,000 cars in December.

General Motors Opens Marquette Plant

DETROIT, Nov. 24—The old Marquette motor plant at Saginaw, Mich., has been opened by the General Motors Corp. to be used as a storage and transfer house this winter. The plant has been opened to facilitate shipment of Buick cars.

E. S. Swift an Overland Director

TOLEDO, OHIO, Nov. 24—E. S. Swift, vice-president of Swift & Co., Chicago, has been elected a director of the Willys-Overland Co.

Autocar Co. Elects Officers

ARDMORE, PA., Nov. 28—E. A. Fitts, formerly secretary and treasurer of the Autocar Co., this city, has been elected vice-president, and F. C. Lewin, formerly assistant secretary and treasurer, has been elected secretary and treasurer. J. C. Taney will take up Mr. Lewin's former duties. The other officers were re-elected, being D. S. Ludlum, president, and L. S. Clarke and W. W. Norton, vice-presidents.

Hoover ¾-Ton Delivery Car

YORK, PA., Nov. 27—A ¾-ton delivery car has been brought out by the Hoover Wagon Co., this city.

The engine is 3¾ by 4½ block cast design, cooled by thermo-syphon circulator through a cellular radiator. Ignition is supplied by a high-tension magneto with hand adjustable spark advance. The clutch is a three-plate design and the gearset has three speeds. Final drive is by shaft and two universals to a worm-driven semi-floating axle. Torque and propulsion being taken by the spring. Both springs are located on the rear wheel drum.

Four Companies To Raise Prices

Velie and McFarlan Cars and Riker and Chase Trucks Increased on Higher Cost

MOLINE, ILL., Nov. 27—The Velie Motors Corp., this city, will advance its prices $50 on the open bodies delivered on and after Jan. 1, 1917. Cars ordered and delivered prior to that date will be at the present prices, which are as follows: Model 28, $1,085 (with detachable sedan top, $1,285); four-passenger roadster, $1,085; two-passenger roadster, $1,065; model 27, $1,550. The closed models are excepted from the advance.

McFarlan Raises Prices $300

CONNERSVILLE, IND., Nov. 24—The McFarlan Motor Co., this city, will raise its prices $300 after Dec. 1. Touring cars and companion models will list at $3,500 and closed work will list from $4,600 to $5,300.

Riker Prices to Be Higher

BRIDGEPORT, CONN., Nov. 24—The Locomobile Co. of America on Dec. 1 will raise the prices of the Riker trucks. The 3-ton truck will sell for $3,600, an increase of $100, and the 4-ton truck will sell for $3,750, also an increase of $100.

Winton Continues Two Sixes

CLEVELAND, OHIO, Nov. 24—The Winton Co., this city, will continue its present models in 1917 without change, Model 33 selling at $2,485 and the 48 at $3,500. The company, however, may make an increase in its prices.

Chase Raises Some Prices

SYRACUSE, N. Y., Nov. 27—On two of the Chase models an increase of $75 in list price has been made. These are the 1-tonner, raised from $1,650 to $1,725, and the 1½-tonner, from $1,950 to $2,025. Other prices remain the same as before.

Start Work on Kelly-Springfield Plant

NEW YORK CITY, Nov. 24—Engineers will start work in the near future on plans for the new plant of the Kelly-Springfield Tire Co. at Cumberland, Md. The plant will cover about 75 acres. Ground will be broken early next spring. The completion of the new plant will mean a minimum increase of 400 per cent of the present capacity of that company.

$50,000,000 Business for Pontiac

Financial Outlook There Bright for 1917—Nine New Car and Parts Cos.

DETROIT, MICH., Nov. 25—A banquet held at Pontiac last Thursday night, promised the city the brightest and most prosperous financial future in its history. There were nine new companies engaged in the manufacture of automobiles and automobile parts represented who promised approximately $50,000,000 worth of business to the city for the coming year.

The Olympian Mfg. Co. employing 300 men with a weekly pay roll of $6,000 estimated $2,000,000 worth of business for 1917. The Oakland-Northway Co., employing between 1000 and 1500 men with a monthly payroll of $65,000 to $100,000, estimates business for the coming year at from $40,000,000 to $50,000,000. The Monroe Motor Co., employing 500 men with a payroll of $9,000 weekly estimates its next year's business at $4,000,000. The American Forging & Socket Co., employing sixty to eighty men, weekly payroll $1,200 to $1,600, estimates $430,000 in 1917. The Michigan Drop Forge Co., employing ninety-seven men, has a weekly payroll of $2,225 and estimates its business for next year at $388,000. The Columbia Truck & Trailer Co., employing fifty men with a weekly payroll of $1,500, makes an estimate of $4,000,000 in 1917. The Markley Handle Co., employing twenty-one men with a weekly payroll of $400, estimates its business for next year at $50,000. The Vanauken Blower Co. will employ from twenty to twenty-five men with a $500 weekly payroll and makes an estimate of $97,500.

Among those who responded to toasts were: R. F. Monroe, president of the Monroe Motor Co.; F. G. Clark of the Columbia Truck & Trailer Co.; R. A. Palmer, president of the Olympian Motors Co., and T. H. McDearmon of the Oakland-Northway Co.

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Page Buggy Adds to Force

DETROIT, Nov. 24—The Page Bros. Buggy Co., Marshall, Mich., manufacturers of automobile tops, has recently doubled the working force of the organization and is in search of more men. The company is supplying the Briscoe Motor Co. and others with automobile tops.

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Cole Heads Perfection Tire Co.

CHICAGO, ILL., Nov. 24—C. R. Cole has become president of the new Perfection Tire & Rubber Co. as a result of the recent merger of that company with the Champion Auto Equipment Co., Wabash, Ind., and the Perfection Tire & Motor Co., Niagara Falls, Ont. Arrangements have been made for the transfer of the assets and obligations of each company to the new company, which has taken out a charter under the laws of Delaware. The other officers of the new company are: Vice-president, R. J. Evans; secretary, C. W. Harris and treasurer, E. A. Stickelman. In addition to the officers, the directorate consists of the following: F. E. Humphrey, T. J. Moll, T. W. Cole, and H. M. Scambler.

Outside of the patents, the new company will have tangible assets of nearly $1,000,000 with less than $25,000 of liabilities.

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Haynes Plans Increased Production

DETROIT, Nov. 24—The Haynes Automobile Co. has made plans for the purchase of machinery for a capacity of 100 cars daily. A new building will be erected with a capacity for three times as many cars as are made at present, and will have 600,000 sq. ft. of floor space. The company has 350,000 sq. ft. at present.

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New Record for Delco Shipments

DAYTON, OHIO, Nov. 24—All former production records were broken last week in the plant of the Dayton Engineering Laboratories Co., this city. Though no figures were given as to the number of Delco systems shipped during the week, the former record was that ending Oct. 28, when 6836 systems were shipped.

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Canadian Chevrolet Co. Expands

DETROIT, Nov. 24—Extensions are being made to the present plant of the Chevrolet Motor Co. of Canada, at Oshawa, Ont. The company has been manufacturing cars for a year and disposed of 8000 last year. Three new buildings are in process of erection and will give an added floor space of 277,075 sq. ft.

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Hilts Enters Advertising Agency

DETROIT, Nov. 28—M. R. Hilts has resigned as advertising manager of the Puritan Machine Co., this city, to enter an advertising agency in Chicago.

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Vincent Wheel in New Location

DETROIT, MICH., Nov. 24—The Vincent Clear-Room Steering Wheel Co., this city, has moved to 756 Woodward Avenue, the former offices of the Hyatt Roller Bearing Co. This company recently effected a reorganization by which E. H. Vincent became president and general manager; J. A. Martin, vice-president; H. H. Vincent, secretary and treasurer, and G. F. Burger, sales manager.

Detroit Electrics in Quantity

New Model $500 Lower Because of Standardized Design and Greater Production

DETROIT, Nov. 27—An entirely new Detroit electric has been brought out by the Anderson Electric Car Co., this city. The new model, known as 68, represents the initiation of a production policy for Detroit electrics. As a result of a greater increased production schedule the model 68 will sell for $500 less than its predecessor. This cut from $2,275 to $1,775 in the face of greater increased cost of materials represents the saving due to the installation of a large amount of labor-saving machinery and the adoption of a standardized chassis in which the number of options has been minimized so far as color and equipment is concerned. For instance, in upholstery there are three designs to choose from, while in painting there is one standard, whereas last year there was an unlimited field for either upholstery or painting. No sacrifice in material or workmanship has been made in any part in quoting the new figure.

The body is a brougham having a passenger capacity of four and is built on a chassis of 100 in. wheelbase with 56 in. tread. It has the standard Anderson motor with forty-two cells, thirteen-plate battery, giving a speed of 6 to 25 m.p.h. and a mileage of 75 to 100 on a battery charge.

100 Per Cent Business Gain

Officials of the Anderson company estimate at the present rate of increase the company's current year's business in electric passenger cars will exceed last year's by at least 100 per cent. The raw material for building the coming year's product has either been delivered to the plant or is under contract for specified delivery dates. The production of Detroit electric cars increased in 1916 over 1915 by 141 per cent, while the labor increase was not 100 per cent. This ratio is due to the introduction of a large amount of new machinery.

The first 4 months of this fiscal year show an increase of 79 per cent over last year.

The company has just erected in Detroit a new four-story service building of brick which has a capacity of 400 cars with repair and charging facilities and a large show and sales room.

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Dort Director of Guaranty Securities

DETROIT, Nov. 27—J. D. Dort, president of the Dort Motor Car Co., has been made a director of the Guaranty Securities Corp. of New York.

Parcel Post to S. A. Wrong

U. S. Accessory Makers Making Serious Error by Shipping Goods That Way

BUENOS AIRES, ARGENTINA, Oct. 31—U. S. A. accessory manufacturers are making a serious error by sending accessories by parcel post to automobile dealers in Argentina. While the parcel post service is entirely satisfactory for such trade in the U. S. A. it does not work out satisfactorily here; in fact it is the most unsatisfactory way of sending small accessory parts to this country.

Recently a large dealer in Rosario had a typical experience with parcel post. An anti-glare equipment for headlights was sent from a U. S. A. maker and here is the chain of troubles the Rosario dealer had to solve:

"A few days after the anti-glare devices arrived I received an official card without stamp. I presented this at the post office which is only open from 10 to 12, that is that particular section of it. I was asked to call the next day and fortunately found the right man in. I presented the official card and was politely asked to go four doors away to get twelve centavo stamps on it (a centavo is approximately ½ cent, U. S. A. currency). On my return with this they looked a long time to find cards that had come with the parcels. I was sent with these cards to another place where I had to purchase sixty-nine centavo stamps, costing 35 cents. On my return with these and after waiting half an hour I tried to get the package but instead was sent to the custom house.

Ransoming the Package

"At the custom house the real stamping act work begun and for each parcel I had to put a pesos (44 cents) stamp. I required two of these, or 88 cents. With these duties the cost of the anti-glare device was just five times what it sells for in the U. S. A. In addition I had spent nearly a week getting the parcel post package through the post office and custom house.

"After all this trouble I asked what I had been paying for and the chief of the department advised me that the parcel post of the United States is a one-sided affair, and while they send any parcel away from the U. S. A. at regular rates yet in Argentina they charge duties and customs as they wish. The United States should get real parcel post service as far as Argentina is concerned. For reasons I cannot explain parcel post packages from Europe enter Argentina free. When asking why this is, the only answer you get is that if anything is wrong the U. S. A. is at fault. It is pretty hard to buy U. S. A. accessories here and pay exorbitant duties while European goods come in free. It is a subject which U. S. A. accessory manufacturers should consider.

"Now that U. S. A. cars are selling in good quantities through Argentina it is imperative to have accessories for them. Naturally parcel post is one of the simple ways of handling this work and it should be worth while to get parcel post service for Argentina on the same basis as that from England."

Troubles With Shipments

This is only one of the many difficulties the South American automobile dealer has to put up with in connection with shipments from the U. S. A. Recently a large accessory dealer from Cordoba, a city in the interior of Argentina, was required to make a night's trip by railroad from Cordoba to Buenos Aires because of custom difficulties in connection with U. S. A. shipments. The dealer makes a specialty of U. S. A. accessories, but has constant troubles with shipments. On the occasion in question the New York shipper had not made his shipping documents correspond with packages sent. The shipping document showed five packages or crates but there were only four in the custom house. An examination disclosed the fact that the shipping department had combined two of the crates without making the necessary corrections on the document. This resulted in a cost of nearly $70 U. S. A. gold to the Cordoba dealer.

Recently a Buenos Aires dealer in hardware and automobile accessories cited another glaring example of the treatment Argentine merchants are being given at the hands of U. S. A. makers. The dealer here ordered $400 (U. S. A. gold) worth of certain hardware. It was necessary to pay cash with order in order to be assured of reasonably prompt delivery. This order was placed in August, 1915, practically a year ago. In September, 1916, the shipment had not arrived. It arrived a few weeks ago. The U. S. A. manufacturer had the use of the money for a whole year. During that time numerous excuses for delayed delivery had been made. When the order was placed in 1915 there was a great shortage of this kind of hardware in Buenos Aires and the dealer would have had a good ready market. Now conditions have changed. Other supplies have arrived and the market is lower. It is almost impossible in the face of such treatment to see any possibility of U. S. A. firms holding Argentine trade after the present war unless it is that European countries are not financially able to come back and give the market service which they gave before the opening of the war in July, 1914.

Shippers Must Remove Freight

Given 10 Days or Goods Will Be Removed and Stored at Their Risk

NEW YORK, Nov. 28—The freight car shortages has become so serious as a result of the big tieup of cars being used on tracks other than their own, that immediate steps have been taken by the railroads to relieve this condition. All of the railroads of the country have been notified to return to their home lines as soon as possible all cars not their own, especially those used for perishable freight. All shippers and receivers have been notified that freight left on cars for 10 days will be summarily removed by the railroads and the shipment stored at the shipper's or consignee's risk.

Freightage has become so heavy on the smaller railroad lines, that they have been forced to borrow cars from the larger lines, thus curtailing their use on larger lines where they are badly needed at the present time. For instance, one line running out of Detroit bought 9000 cars last year. Less than one-third of these are now in use on its tracks.

With the exception of Fords, which are shipped in parts to assembly plants, all automobiles are being shipped in special cars, either with end doors or very wide side doors. When these cars are diverted to other traffic, the rest of the box cars become useless. Some of the automobile factories have been taking long chances by shipping their products in flat cars over which they constructed temporary tops and in coal cars covered with tarpaulins.

Car Makers Unable to Ship

DETROIT, Nov. 25—More than $4,000,000 worth of automobiles are awaiting freight cars to carry them to their destinations. The shortage has become so severe that manufacturers are seeking storage space so that they can manufacture far enough ahead to care for future business.

Goodrich Accessory Assn. Changes Name

PHILADELPHIA, Nov. 27—The Goodrich Accessory Association of Philadelphia, manufacturer of the Goodrich lock and switch for Fords, license brackets, truss rods, ignition assemblies, and brake shoes for Fords, has changed its name to the Goodrich-Lenhart Mfg. Co., with offices in the Widener Building as heretofore.

The officers of the company remain the same, Ivan Goodrich is acting president and manager of sales, and Mr. Lenhart will continue in active charge of the factory in Hamburg, Pa.

S. A. E. Testing System Proved

Specifications for Acceleration and Economy Tried Out Successfully

NEW YORK, Nov. 21—Yesterday and to-day the research division of the S. A. E. standards committee tried out their recommended standard form for economy and acceleration testing, using the Sheepshead Bay speedway for the trial. It was desired to ascertain if the committee's recommendations were entirely practical, which proved to be the case. Cars for the test were lent by the Marmon company and the Packard company and members of the New York staffs of these firms assisted the members of the committee.

For the acceleration tests records were made on rolls of paper, marks being made as the car reached successive distances equally spaced. In one system there were switches set on the track 100 ft. apart, these being set by a device attached to the front axle, and in this case the recording drum with the paper was stationary. In the other the track switches were replaced by a commutator attached to the front wheel of the car, which made contact once during each turn of the wheel, the recording drum being carried on the car.

In comparing the two methods it would appear that the stationary apparatus is more convenient for a series of tests on different cars, while that mounted in the car itself is a little more flexible for use on the one car. The record of the former is more compact and easier to use for plotting, because there are a smaller number of indications of distance, and these are in even figures. With the latter, acceleration runs are not limited in length, and can be made at any convenient place. There was some discussion as to the accuracy of measuring distance by the front wheel but it was found that two measurements, one at high speed and the other at low speed, checked accurately within the limits of personal error. The slight apparent difference was that the wheel made two more revolutions at high speed than at low speed over the same distance. There is still some question as to the accuracy of a chronometer carried on a car moving at high speed. A series of apparently perfect records was obtained by both methods, in a number of instances records being made by both devices on the same car during the same run.

Each of the cars was given a series of runs for fuel economy, one covering 4 miles at speeds of 6.9, 11.9, 21.5, 27.5, 40, 53.5, 63 m.p.h., and the other being given a similar series of runs at speeds of 9, 19.5, 29.5, 44, 57 and 63 m.p.h. As this was in no sense a regular test of the cars, they were run part of the time with tops down instead of up as called for in the tentative recommendation of the division. Also as the time devoted to the fuel-economy runs was limited, the lengths of different runs were cut down from the specific distance of 10 miles at each of the various speeds except the lowest, which is to be of sufficient length to consume at least 2 lb. of fuel, making complete circuits of the course.

The method used for measuring the fuel is to have two small tanks mounted on the windshield. One of the tanks is arranged for easy detachment so that it can be weighed before and after each run. Both are connected to the carbureter after the regular gasoline pipe is disconnected. The shut-off cocks from the two tanks are interconnected so that the same motion shuts one cock and opens the other.

The tank containing the unweighed fuel is used for manipulating the car and driving before each run at the same speed at which the run is to be made, in order to get the car to the temperature prevailing during the run. As the starting line is crossed the change is made from the unweighed tank to the weighed one, and vice versa at the finish line.

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New Madison Four-Passenger Roadster

ANDERSON, IND., Nov. 27—The Madison Motors Corp. is placing on the market a new four-passenger roadster on its 120-in. chassis. It is equipped with a 3⅛ by 5 in. Rutenbur engine, and lists at $1,150. The finish is mouse-gray, with red wheels and black fenders.

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Remodel Aeroplane Factory

DETROIT, Nov. 25—The Williams Aeroplane factory at Fenton, Mich., has been remodeled and made ready for new machinery.

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Ontario Registrations

WALKERVILLE, ONT., Nov. 24—The province of Ontario leads the other Canadian provinces with 36,300 registrations. Saskatchewan is next with 11,966; British Columbia, third with 9100. There are about 120,000 cars in the whole of Canada, of which 100,363 are Fords.

Toronto leads with 8815 cars as compared with 7367 in 1915. Montreal is second with 3917; Vancouver, third with 3688; and Winnipeg fourth with 3688.

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254,000 Ohio 1917 Registrations

COLUMBUS, OHIO, Nov. 25—So far 254,000 registrations for 1917 for automobiles have been issued in Ohio. That number includes gasoline and electric car owners as well as dealers and manufacturers.

S. A. E. Sections Are Active

Truck Division of Standards Committee Meets—Detroit Banquet Dec. 15

NEW YORK, Nov. 28—A meeting of the truck standards division of the Society of Automobile Engineers was held in Detroit yesterday, for the consideration of military truck specifications. General progress in the consideration of the subject was made. H. D. Church of the Packard company presided, and General Manager Coker Clarkson attended.

At the next meeting of the Indiana Section, S. A. E., Dec. 15, the subject for consideration will be carbureters and manifolds.

The Cleveland Section S. A. E. at its meeting Dec. 15 will have a paper by J. B. Replogle on how car manufacturers can co-operate with manufacturers of electrical apparatus, such as starting, lighting and ignition. Mr. Replogle is research engineer of the Remy Electric Co.

The Mid-West Section will hold its December meeting on Friday the eighth at Chicago, when Prof. Roach of Armour Institute will outline a new method of test for gasoline engines.

At the meeting of the Metropolitan Section S. A. E. New York, Dec. 21, Elmer Sperry, inventor of the gyroscope and authority on aviation engineering, will speak on the military aspect of aviation possibilities in America.

The Detroit Section, S. A. E., has decided that its annual banquet to the automobile industry will be held at 7 o'clock on Friday evening, Dec. 15, at the Ponchartrain Hotel. This will be the second dinner of the kind by this section, the one a year ago marking the start of the movement.

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Belgian Automobile Engineers in Detroit

DETROIT, Nov. 28—P. E. Kellecom and J. R. Perrier, engineers of the Fabrique National des Armes de Guerre of Belgium, are in this city investigating the automobile production. They state that the European countries plan to enter immediate quantity production at the end of the war.

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Cadillac Builds New Sales Structure

DETROIT, Nov. 27—The Cadillac Motor Car Co. will erect a seven-story structure on the site of several temporary buildings, and will use it exclusively for retail sales and service. The building will contain 154,000 sq. ft. of floor space and will have a special feature of a reception room for the service department that will measure 65 by 116 ft., with a domed ceiling 29 ft. high.

Want Higher Fees for Trucks

Commissions Appointed by N. Y. and N. J. Seek Basis Covering Wear on Roads

NEW YORK, Nov. 27—Commissions have been appointed in this State and in New Jersey to determine an equitable basis for increasing the motor truck registration fees. This action is due to the depreciation of the roads in these States, a large measure of which, it is claimed, is caused by the increasing use of motor trucks. The work of the New York commission applies only to the State roads, and, since only about one-fifth of the trucks in the State are driven over these roads, the problem of arriving at a just determination as to how trucks shall pay in proportion to their use of these highways is very difficult. The task of the New Jersey commission is no easier, due to the practical impossibility of increasing the fees of the vehicles responsible for the wear on the roads without discriminatory taxation.

Of National Importance

Any action taken in New York and New Jersey in increasing registration fees for motor trucks will have a wide influence on the procedure in other States throughout the country, so the matter is of national importance.

The New York State Commission, composed of the State engineer, the commissioner of public works and the highway engineer held its first public hearing at Albany Nov. 21. This commission has not yet promulgated any new proposed schedule, so that the first hearing before it resulted in the giving of suggestion. Among the most important of these was the fact that roads should be classed as governmental or State institutions, benefiting alike those who use them as well as those maintaining plants in the area served or those who own real estate in the same territory.

It was pointed out that any law passed basing fees upon the extent of use and wear and tear of roads should include all forms of vehicles, including horse wagons, as well as automobiles and motor trucks. If motor trucks are taxed and not the other types, such a provision would be unconstitutional because of its discriminatory nature.

The impossibility of living up to the word of the New York State law which specifically provides that the new schedule of fees be based upon the extent of use and amount of wear and tear, was brought out by the fact that any such determination along scientific lines would require a tremendous amount of experimentation of various kinds of vehicles operating over various classes of roads at various times of the year.

It was pointed out that upon principle all vehicles should be charged a certain fee to cover registration for identification only and that any additional tax to help pay for the cost of construction and maintenance of the roads should be placed upon all vehicles.

The New Jersey State Commission, which is formed of the engineers of the various counties, acting under the supervision of the State Commissioner of Motor Vehicles is seeking to preserve the present roads until such time as new roads can be built to carry the vastly increased amount of traffic now passing through the State. This Commission, like the one in New York, has its powers limited to the taxation of the motor truck alone and it cannot decide upon any similar tax for horse vehicles.

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Geronimo Plant for Enid, Okla.

ENID, OKLA., Nov. 25—The Geronimo Motor Car Co. has been organized to manufacture automobiles in this city in a three-story plant. It will produce a six-cylinder car with a Continental motor. The directorate consists of mostly local bankers, and the capital is $500,000. Shands & Funnel are the fiscal agents for the company.

W. C. Allen is president, G. E. Darland is secretary and treasurer and Walter Krouse is vice-president. F. B. Buzzard is a director.

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Overland Opens N. Y. Salesroom

NEW YORK, Nov. 28—The Willys-Overland Co. to-day opened its new retail sales and display rooms on Broadway and Fiftieth Street. This building is three stories and has a frontage on Broadway of 100 ft.

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Local Shows

NEW ORLEANS, Nov. 27—The success of the automobile displays at the National Farm and Live Stock Show here has caused much talk among dealers for a concerted effort toward making this exhibition the occasion of an automobile show. The eight dealers who have displays there are telling of sales made and of many prospects obtained. The reason for the limited number of displays was that the managers of the show proposed a tent exhibit, but later consented to place the automobiles in the Manufacturers' Hall. The dealers hope by beginning in time to arrange for suitable quarters next year.

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Worcester Show a Success

WORCESTER, MASS., Nov. 25—The second annual show of the Worcester Automobile Dealers Assn. ended here to-night and it proved to be a bigger success than the men anticipated.

U. S. Wheel Corp. Is Organized

New Concern Will Manufacture Baker Pressed Steel Wheel—Production Starts Jan. 1

CHICAGO, Nov. 28—The U. S. Wheel Corp. is a new organization formed for the purpose of manufacturing the Baker pressed steel wheel for automobiles, motor trucks, tractors, etc. This concern is an outcome of the Baker Wheel & Rim Co., of this city, a $5,000 corporation organized for the development of the Baker wheel. The U. S. Wheel Corp., which has absorbed the Baker Wheel & Rim Co., will have a large capitalization. Factory location has not yet been decided upon and at the start production will be by having the most of the work done by pressed steel specialists. Production will be started soon after Jan. 1.

Spokes Under Tension

The Baker pressed steel wheel is a flat-spoke type with spokes arranged bicycle-wheel fashion and held under tension. The wheel is stamped from an original circular piece of steel. It is first converted into a plate-shaped stamping resembling a large brake drum which would be the diameter of the wheel. By a further stamping process the spokes are formed. Alternate spokes attach to opposite ends of the hubs, giving two circles of spokes. The wheel is of approximately the same weight as an artillery wood wheel for motor cars. At present two of the large automobile makers are testing the wheel and others are arranging to test it.

The U. S. Wheel Corp. will have for its president, Chas. G. Hawley, a Chicago man representing financial interests. Jos. A. Anglada, consulting engineer of New York City, will be vice-president. For 3 years Mr. Anglada was chairman of the Metropolitan Section S. A. E. Erle K. Baker, inventor of the wheel, will be secretary. Mr. Baker is best known as the inventor of the Baker split rim, which is now used exclusively by the General Motors. Mr. Anglada will move to Chicago to devote his entire work to the organization.

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Reo Makes Additions to Factory

LANSING, MICH., Nov. 27—The Reo Motor Car Co. is adding two large buildings to its plant. The larger will be 76 by 528, and will be used as a machine shop, and the smaller will be 95 by 224 and will be occupied for heat-treating purposes. The company is also completing a garage and a clubhouse for its employees.

Studebaker Holds Conference

225 Officials Attend South Bend and Detroit Meeting —Interesting Addresses

SOUTH BEND, IND., Nov. 27—More than 225 officials, branch managers, blockmen and dealers connected with the Studebaker sales department, were entertained Wednesday at the annual conference. The program which started in South Bend was concluded Thursday and Friday at the Detroit factory, followed by private conferences with branch managers and blockmen on Saturday. The yearly conference is a sort of debutante party for the new model car, which is brought out about this time.

Four Addresses

Four addresses were delivered at the meeting Wednesday morning in the administration building. The welcome was delivered by F. S. Fish, chairman of the board, who was followed by President A. R. Erskine, giving a resume of the year's work. J. M. Studebaker followed Mr. Erskine, with a talk on "Sixty-four Years of Business Administration." L. J. Ollier spoke at length on the sales policy for 1917. He stated that the corporation did a larger business last year than ever before and that they expected to exceed all previous sales records in 1917.

Speeches at Detroit

Addresses at Detroit were made by R. T. Hodgkins, general sales manager, C. C. Hanch, treasurer, H. T. Myers, commercial car manager and G. L. Willman, assistant sales manager and advertising manager.

L. Markle, the Chicago Studebaker representative, to-day, told of the Studebaker systematic service plan of caring for the car after it is sold, C. N. Weaver, of San Francisco discussed "Exclusive Representation," and E. R. Benson, Portland, Me. presented the dealer's view of Studebaker methods.

The convention closed to-day, with a banquet at the Detroit Athletic Club. L. J. Ollier, vice-president, presided as toast-master.

Special Train for Overland Convention

ST. LOUIS, Nov. 27.—T. L. Hausmann of the Overland Automobile Co. of St. Louis has completed arrangements for a special train to leave here the night of Dec. 10 to take 150 persons to Toledo for the annual Overland convention. The train will be of fifteen sleepers and the delegation will include the local sales force and nearby dealers.

Electric Auto-Lite Service Meeting

TOLEDO, OHIO, Nov. 27—The Electric Auto-Lite Co., this city, will hold a meeting for its service representatives at the factory Dec. 4 and 5, at which it is expected that more than seventy-five will be in attendance.

Bennett Perfecting Distribution Plan

DETROIT, Nov. 24—O. G. Bennett, who resigned from the presidency of the General Export Co., is developing a new automobile distribution plan.

Moon Ships to Porto Rico

ST. LOUIS, MO., Nov. 27—The Moon Motor Car Co. has made a shipment of twenty-five cars to Santiago A. Panzardi of San Juan, Porto Rico, which has taken fifty-five cars from this company since May. The company has agencies in Cuba and formerly sold French and other European cars.

Decker Top Increases Capital

DETROIT, Nov. 24—The Decker Auto Top Co. has increased its capital from $15,000 to $50,000.

Gary Truck Capital Doubled

SOUTH BEND, IND., Nov. 27—The Gary Motor Truck Co., Gary, Ind., has increased its capital stock from $25,000 to $50,000.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Week's Ch'ge
Aluminum, lb.	.65	.65	.65	.65	.65	...
Antimony, lb.	.14	.14	.14	.14	.14	...
Beams & Channels, 100 lb	2.97	3.17	3.17	3.17	3.17	+ .20
Bessemer Steel, ton	52.50	52.50	52.50	52.50	52.50	...
Copper, Elec., lb	.33	.35	.35	.35	.35	+ .02
Copper, Lake, lb	.33	.35	.35	.35	.35	+ .02
Cottonseed Oil, bbl	12.85	12.75	12.65	12.75	12.70	— .15
Fish Oil, Menhaden, Brown, gal	.68	.68	.68	.68	.68	...
Gasoline, Auto, bbl	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal	1.30	1.30	1.30	1.30	1.30	...
Lead, 100 lb	7.15	7.20	7.30	7.30	7.30	+ .15
Linseed Oil, gal	.96	.96	.96	.96	.96	...
Open-Hearth Steel, ton	52.50	52.50	52.50	52.50	52.50	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb	.80	.80	.80	.80	.80	...
Rubber, Ceylon, First Latex, lb	.69	.71½	.70	.70	.70	+ .01
Sulphuric Acid, 60 Baume, gal	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb	45.30	45.75	45.50	45.50	45.50	+ .20
Tire Scrap, lb	.06¼	.06¼	.06¼	.06¼	.06¼	...

Materials Market Steady

Copper, Steel and Lead Slightly Higher—Rubber and Oils Little Changed

NEW YORK, Nov. 27—Prices on automobile materials last week were exceedingly steady, despite the scarcity of these products and the large demand for them. Copper, which has been uppermost in the skyward activities of the metals, has risen 2 cents more a pound to 35 cents. Beams and channels, after quite a steady period, have taken a turn upward, rising to $3.17 per 100 lb., a net gain of 20 cents for the week. Lead prices, always fluctuating, reached $7.30 per 100 lb. on Thursday, holding at that price through to Saturday.

Rubber and the oils have been unusually steady, with few price changes. Shipments of rubber have been coming in regularly from Ceylon. Para rubber seems to have steadied down to normal prices after a period of unsteadiness on account of conditions on the Amazon River.

Standard Parts Stock Issue

CLEVELAND, OHIO, Nov. 25—The Maynard H. Murch Co., investment broker,, is offering a new issue of 7 per cent cumulative tax free preferred stock of the Standard Parts Co., the consolidation of the Perfection Spring Co. and the Standard Welding Co. Par is $100 a share and the dividend periods are March, June, September and December. Of the authorized capital of $10,000,000 preferred, $5,000,000 is to be issued and of the authorized issue of $25,000,000 common only $8,000,000 is to be issued at this time.

White Wants Tax Reduction

CLEVELAND, Nov. 24—County Auditor Zangerle added $5,000,000 to the White company's statement, claiming this to be good will. The company asks for a reduction of valuation amounting to $13,071,000, which the auditor has refused to make.

Metz Makes Welfare Improvements

WALTHAM, MASS., Nov. 24—The Metz Co., this city, has formulated plans for the social benefit of its employees. A clubhouse, athletic field and the freedom to a tract of 147 acres of land are included under the new welfare policy. There is also in contemplation a gymnasium, a separate baseball field, and ½-mile track, which will probably be built in the spring. An adjoining building to the executive and sales force

offices, is now being converted into an engineers' club.

Production at the plant has been increased 40 per cent, and now the capacity is more than 100 cars a day.

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Bonus for Westinghouse Employees

PITTSBURGH, PA., Nov. 24—Employees of the Westinghouse Electric & Mfg. Co., this city, have been granted an extension of their present bonus system which is to include salaried and office employees on hourly rates, by which they will receive a bonus of 8 per cent of their salary each month, providing their total excusable time absent and late during the month does not exceed 6 hr. incurred on not over three occasions.

An additional 4 per cent will be given each month to employees who have not lost any time from work during the month through absence or tardiness.

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Automobile Lock Co. Incorporates

GRAND RAPIDS, MICH., Nov. 24—The S. & S. Auto Lock Co. has been incorporated for $20,000. Incorporators are E. W. Slausson, W. B. Brown and A. M. Freeland.

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Disbrow Motors Co. Organized

CLEVELAND, Nov. 24—The Disbrow Motors Co. has been organized with a capitalization of $25,000. Incorporators are Louis Disbrow, W. D. Callinan, M. Becker, M. L. Fisher and A. B. Crowell.

Automobile Issues Fluctuate

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Lower Than Last Week—General Motors and Chevrolet Lead Decline

NEW YORK CITY, Nov. 27—Automobile and accessory issues on Saturday closed lower though stronger than on the previous Saturday. There has been a lot of covering in the motor shares during the last few days. Their position had grown strong during the early part of the week as a result of too much enthusiasm on the short side. Motor issues, it seems, are usually in fair demand when other industrials are depressed, and vice versa.

Chalmers and General Motors were the features last week. Chalmers rose 4 points on its common and General Motors dropped 90 points after a similar gain in the previous week. Chalmers held strong despite the publicity given the stock on account of the short selling of its underwriting syndicate. Threats have been made that the handling of the stock would be brought to the attention of the governors of the stock exchange, but this did not affect the issue one way or the other.

The automobile and accessory issues have been on a down market for some time, but it is expected that as soon as the short sellers have their run, prices in general will rise to and above their old marks. Last week Chevrolet dropped 4 points to 172; Peerless dropped 2 points. A few gains were made, however, led by Chalmers, Chandler, Miller, Packard, Regal and Overland. Chalmers rose 4 points on its common; Chandler rose 4 points; Miller Rubber rose 5 points; Packard preferred rose 7 points; Regal, 5 points and Overland 5-8 points on its common and 3⅛ on its preferred.

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Barley Increases Wages

STREATOR, ILL., Nov. 27—The Barley Mfg. Co., Streator, Ill., maker of the Roamer and the Halladay, announced an increase in wages, or rather the operation of the plant on an 8-hr. basis with 10-hr. pay. In addition, there will be a bonus for the senior employees, etc.

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Dividends Declared

Stutz Motor Car Co. of America, $1.25-100 per share, payable Jan. 2, 1917, to stock of Dec. 15. Mitchell Motors Co., $1.50 per share to stock of record of Nov. 10, payable Nov. 24.

Morgan & Wright, coupon due Dec. 1 upon 5 per cent gold debentures is payable upon presentation at the Industrial Trust Co., Providence, R. I., or the Chase National Bank, New York.

Texas Co., $2.50 per share on outstanding capital stock, payable Dec. 31 to stock of record Nov. 29.

C. M. Hall Lamp Co., quarterly of 2 per cent.

Packard Motor Car Co., quarterly of 1¾ per cent, payable Dec. 15.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co.	70	72	—3½
J. I. Case T. M. Co. pfd.	87	88	—1
Chalmers Motor Co. com.	134	150	+4
Chalmers Motor Co. pfd.	111	114	+1
*Chandler Motor Car Co.	110	112	+4
Chevrolet Motor Co.	172	180	—4
Fisher Body Corp.	38	42	..
Fisk Rubber Co. com.	80	90	..
Fisk Rubber Co. 1st pfd.	100	110	—9
Fisk Rubber Co. 2d pfd.	90	100	—5
Firestone Tire & Rubber Co. (new com.)	168	171	..
Firestone Tire & Rubber Co. pfd.	106	108	..
*General Motors Co. com.	510	875	—90
*General Motors Co. pfd.	120	123	..
*B. F. Goodrich Co. com.	70½	71	+ ¼
*B. F. Goodrich Co. pfd.	113½	114	..
Goodyear Tire & Rubber Co. com.	294	297	—1
Goodyear Tire & Rubber Co. pfd.	108½	109½	— ½
Grant Motor Car Corp.	8	9½	+1
Hupp Motor Car Corp. com.	4	5	— ½
Hupp Motor Car Corp. pfd.	80	95	—5
International Motor Co. com.	5	8	..
International Motor Co. pfd.	23	..	+1
*Kelly-Springfield Tire Co. com.	76¼	77¾	— ¾
*Kelly-Springfield Tire Co. 1st pfd.	96	99½	..
Keystone Tire & Rubber Co. com.	15¾	16	..
*Lee Rubber & Tire Corp.	38¼	39	—1¾
*Maxwell Motor Co. com.	74	74⅛	—2
*Maxwell Motor Co. 1st pfd.	81½	82	+ ½
*Maxwell Motor Co. 2d pfd.	49½	50¼	— ½
Miller Rubber Co. com.	255	260	+5
Miller Rubber Co. pfd.	107	108	+1
Mitebell Motors Co.	59	60½	..
Packard Motor Car Co. com.	173	176	..
Packard Motor Car Co. pfd.	101	103	+7
National Auto Corp.	..	..	..
Paige-Detroit Motor Car Co.	38	38¾	— ½
Peerless Truck & Motor Corp.	21	23	—2
Portage Rubber Co.	165	170	..
Regal Motor Car Co. pfd.	25	35	+5
Reo Motor Car Co.	45½	46¼	— ½
A. O. Smith Corp. com.	78	79	..
A. O. Smith Corp. pfd.	96¾	97	+ ¾
Saxon Motor Car Corp.	78	80	— ¾
Spicer Mfg. Co.	47¼	47¾	— ⅝
Springfield Body Corp. com.	90	95	..
Springfield Body Corp. pfd.	120	130	..
Smith Motor Truck Co.	6⅛	6⅛	— ⅛
Standard Motor Construction Co.	7	7½	..
Stewart Warner Speed. Corp. com.	106	108	—1
Stewart Warner Speed. Corp. pfd.	..	..	..
*Studebaker Corp. com.	124	124¾	— ½
*Studebaker Corp. pfd.	109¼	110	..
Stutz Motor	65	65⅛	..
Swinehart Tire & Rubber Co.	85	89	—1
United Motors Corp.	61½	62	— ¼
*U. S. Rubber Co. com.	65¾	66¼	+3¼
*U. S. Rubber Co. pfd.	112¼	113	— ⅛
White Motor Co.	54	54¼	— ⅛
*Willys-Overland Co. com.	38½	38⅝	+ ⅛
*Willys-Overland Co. pfd.	98⅛	98½	+3⅛

*At close Nov. 25, 1916. Listed New York Stock Exchange. Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	45	48	+ ½
Chalmers Motor Co. com.	140	150	+10
Chalmers Motor Co. pfd.	112	..	+2
Continental Motor Co. com.	41½	42¼	+1½
Continental Motor Co. pfd.	9¾	10¼	+ ¼
Ford Motor Co. of Canada	293	305	+3
General Motors Co. com.	..	825	..
General Motors Co. pfd.	118	122	—5
Maxwell Motor Co. com.	74	77	— ½
Maxwell Motor Co. 1st pfd.	80	83	— ½
Maxwell Motor Co. 2nd pfd.	48	51	—1
Packard Motor Car Co. com.	172	176	..
Packard Motor Car Co. pfd.	104	..	+4
Paige-Detroit Motor Car Co.	38¼	..	— ¼
W. J. Prudden Co.	49	50	..
Reo Motor Car Co.	45	45¾	— ½
Studebaker Corp. com.	124½	127	— ½
Studebaker Corp. pfd.	107	..	—1
C. M. Hall Lamp Co.	29½	..	..

INACTIVE STOCKS

Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd.	25	..	..

$14,000,000 Dealer Merger

Aaron De Roy Co. Combines with Studebaker Sales Co. of Ohio—Contract Enlarged

DETROIT, Nov. 27—The Aaron De Roy Motor Car Co., distributer of Studebaker cars for Pittsburgh and western Pennsylvania, has merged with the Studebaker Sales Co. of Ohio. The Studebaker Sales Co. was incorporated in September and combined the Blevins Auto Sales Co. of Toledo and the A. R. Davis Motor Co. of Cleveland, so that the new merger includes three of the largest Studebaker distributers. The original contract between the Studebaker Corp. and the Studebaker Sales Co. called for $12,000,000 worth of cars. With the new merger the contract has been changed to $14,000,000, and is the largest single contract made in the history of the industry.

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Baker Takes Atlantic and Horner

BOSTON, Nov. 25—Day Baker, one of the pioneers of the electric field in New England, who resigned recently as an executive of the General Vehicle Co. at New York, has taken on the Atlantic electric and the Horner gasoline trucks for New England.

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Leavitt Will Handle Columbia

DETROIT, Nov. 25—J. W. Leavitt will handle the Columbia car for the Pacific coast and is making his preliminary plans for a large campaign.

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Westinghouse Makes A.B.C. Starter Contract

DETROIT, Nov. 25—The Westinghouse Electric Co. has closed a contract for $250,000 worth of electrical supplies with the A.B.C. Starter Co.

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Auto Specialties Gets Overland Contract

DETROIT, Nov. 24—The Willys-Overland Co. has contracted with the Auto Specialties Co., St. Joseph, Mich., for 300,000 Bair automobile top holders.

—

Kline in New York

NEW YORK, Nov. 27—The Kline Car is now handled in this city by the W. S. Roberts Motor Corp., 1838 Broadway, at Sixtieth Street.

—

Hassler Motor Co. Formed

INDIANAPOLIS, Nov. 27—The Hassler Motor Co., this city, has been incorporated with a capitalization of $200,000, the incorporation papers stating that the company will manufacture automobiles. R. H. Hassler, head of Robert H. Hassler, Inc., manufacturer of automobile parts, who heads the new company, declined to make any announcement of the company's plans, stating that the plans would be announced in the near future. The incorporators, in addition to Mr. Hassler, are E. D. Fouts and D. G. Ong.

—

Gillam Increases Capital to $800,000

DETROIT, Nov. 28—The Gillam Mfg. Co. has voted to increase its capital stock from $350,000 to $800,000. An issue of $225,000 7 per cent cumulative preferred stock was authorized and has already been subscribed for by present stockholders and others. The company will erect a building for malleable iron manufacture and one for semi-steel work to meet the increasing demand for its products.

—

Wright Adapter Now Western

SEATTLE, WASH., Nov. 27—An agreement has been reached by the Wright Truck Attachment Co. and the Truck Attachment Co., both manufacturing Ford truck adapters under the name Wright, under which the former concern becomes the Western Truck Attachment Co. and its product the Western attachment.

—

Acme Truck Maker to Add

CADILLAC, MICH., Nov. 27—The Cadillac Auto Truck Co., this city, maker of the Acme 1 and 2 ton trucks, will soon add to its factory a new concrete, steel and brick building 96 by 176 ft. The new 3½-ton model is well under way.

—

Universal to Organize Subsidiaries

DETROIT, Nov. 27—The Universal Valveless Four Cycle Motor Co. will move from Grand Rapids to Muskegon, establishing a plant there, with C. E. Johnson president, and will organize subsidiary companies to manufacture its motor. The parent company will have a capitalization of $250,000.

—

New Era Increases Factory

DETROIT, Nov. 24—The New Era Spring & Specialty Co. has increased its productive facilities at Grand Rapids by the purchase of the Ruskin Biscuit plant, which is to be remodeled immediately. The company will maintain its main salesrooms at Detroit.

—

Trucks Carry U. S. Munitions

EL PASO, TEX., Nov. 27—Motor trucks transported the trainload of shrapnel and cannon shells recently received here to Colonia Dublan, the advanced base. There were twenty-seven box cars of ammunition, containing 67,500 shells, packed four to a case.

Kemco Starter Under Hood

Type of Mounting on Ford Crankshaft in Front of Radiator Abandoned

NEW YORK, Nov. 28—The Kemco Electric Mfg. Co., Cleveland, has changed its starting motor for Ford cars so that it will be located under the hood instead of on the crankshaft in front of the radiator, as heretofore. The construction of the motor has undergone no decisive change, although it is somewhat smaller and lighter. It will be installed at the right of the engine and bolted firmly to a casting which takes the place of the front plate on the Ford engine, this casting also being employed as a bracket for the generator. The drive will be by sprockets and roller chain direct to the crankshaft. The fan-type generator will remain unchanged with the exception of its connection with the starting motor, the drive being direct to the crankshaft instead of through the jackshaft assembly.

—

Chevrolet 6000 Cars Behind Orders

DETROIT, Nov. 27—The Chevrolet Motor Co. will close November 6000 cars behind on deliveries on the month's business alone. The scheduled output for December is 10,000 cars. The company reports an export business that will probably amount to 10,000 cars for 1916.

—

Taylor Timken Advertising Manager

DETROIT, Nov. 28—W. H. Taylor has been appointed advertising manager of the Timken Roller Bearing Co., this city. Mr. Taylor was formerly with the Campbell Ewald Co. advertising agency in this city.

—

Chain of Disco Branches

DETROIT, Nov. 28—The Disco Starter Co. shortly will establish a chain of branches in the larger cities by way of facilitating the administration of service to owners. The first branches will be located in New York and Chicago.

—

New Champion Delivery Chassis

CHICAGO, Nov. 27—To manufacture ½- and ¾-ton delivery chassis the Champion Motors Co. has been formed by Cleveland interests in Fulton, Ill. The vehicles will have electric starting and lighting, bumpers, side curtains and other detail refinements. They will sell for from $750 to $775.

The plans of the company were first made public last Saturday, when ten of the new chassis were paraded down the

main streets of Fulton to arouse public enthusiasm.

W. L. Widlar, N. R. Wildman and William Greif head the concern, which has a capital of $5,000,000. Mr. Widlar is interested in several accessory, lumber, real estate and steamship companies, and is president of the Champion company. Mr. Wildman, vice-president, is a financier of large interests, and Mr. Greif, secretary and treasurer, is heavily interested in a number of Cleveland manufacturing concerns. H. D. W. Mackaye is vice-president in charge of production and designer of the chassis. He has been employed by the Mora, Jenkins, Croxton-Keeton, Metzger, King and Keeton companies.

—

N. A. C. C.'s New Dealers' Arrangement for National Shows

NEW YORK, Nov. 27—The dealer arrangements for the national shows in New York and Chicago have been considerably simplified. Manufacturers will supply lists of dealers, and these lists will be checked and so blended that the name of a dealer cannot appear more than once. This means that if a dealer handles several lines of cars his name will appear but once instead of several times, as in the past. To each of these dealers will be sent three single admissions for his personal use. Dealers in important cities will receive three additional tickets, also intended for their personal use. In addition to these tickets, which will be sent direct to the dealers, each exhibiting member of the N. A. C. C. will receive a limited number of blank tickets to be distributed by the dealer to his representatives.

—

Three More Accessory Exhibitors

NEW YORK, Nov. 28—The Motor and Accessory Manufacturers have allotted space to three more accessory manufacturers for the New York and Chicago national automobile shows. This makes the total 343. They are: The Syracuse Malleable Iron Works, Syracuse, N. Y., maker of axles and castings; the Universal Motor Products Co., Indianapolis, winter tops for Fords, at both shows, and the Ericsson Mfg. Co., Buffalo, maker of the Berling magneto, at New York only.

—

New Era Buys Accelerator

DETROIT, Nov. 27—The New Era Spring & Specialty Co. has purchased the Ford foot accelerator formerly manufactured by H. E. Petrie of Battle Creek. About $8,000 was involved in the transaction.

—

Specialty Mfg. Co. Organized

DETROIT, Nov. 24—The Specialty Mfg. Co. has been organized at Minerva, Ohio, to make automobile accessories.

Drivers To Build Racing Cars

De Palma, Rickenbacher and Chevrolet Will Manufacture Machines in Detroit

DETROIT, Nov. 27—De Palma, Rickenbacher and Chevrolet are going to manufacture racing cars for their own use in the 1917 speedway campaign. Rickenbacher, who is entered in Los Angeles for the 150-mile Ascot race, will come to Detroit to build a team of racing cars to be owned by W. Weightman, III, of Kenova, W. Va. Chevrolet will work over the three Frontenac cars built jointly by himself and Joseph Boyer, Jr., this year. De Palma will devote himself to the De Palma Mfg. Co., which is to build special speedsters for those who want cars of that type.

—

Two Killed at Uniontown Speedway Practice

UNIONTOWN, PA., Nov. 27—C. M. Heist of Sharpsburg, Pa., and F. E. Bush of Pittsburgh, his mechanician, were killed to-day while traveling 60 m.p.h. on the local automobile speedway in preparation for qualification tests for the race on Thanksgiving Day. The front axle of the car broke.

—

Swiss Magneto Moves to Monroe

MONROE, MICH., Nov. 25—The Swiss Magneto Co., manufacturer of Swiss high-tension magnetos, has moved from Chicago to this city, having bought out the Elkhart Mfg. Co., and now occupies its factory. The new facilities will enable the production of Swiss magnetos to be considerably increased. No change in personnel will be made. The manufacture of Elkhart magnetos, which were the product of the Elkhart company, will be discontinued, it is understood.

—

Issue Gasoline Cards in France

PARIS, FRANCE, Nov. 23—Gasoline tickets and a ban on the use of private automobiles, it is stated, is part of a scheme in this country, for regulating the consumption of food and other supplies. If necessary, the government will forbid the running of any automobiles except public or semi-public machines.

—

104 Cars Burned in St. Louis

ST. LOUIS, Nov. 28—One hundred and four Overland cars were destroyed here yesterday in a fire in a wing of the warehouse of the Cedar Street Warehouse and Storage House. The machines were the property of the Willys-Overland Co. and were insured through the Toledo office. All were intended for Southwestern distribution. The local distributer says that the loss will not cause immediate inconvenience. Eight hundred additional cars of various makes in the main storage house were saved by closing of fire doors.

—

White Detroit Battery Sales Mgr.

DETROIT, Nov. 28—C. E. White has become sales manager of the Detroit Battery Co., this city. He was formerly connected with the General Electric Co.

—

King Trailer Co. Formed

ANN ARBOR, MICH., Nov. 28—The King Trailer Co., this city, has been organized to make trailers and has purchased outright the Ann Arbor Buggy Co. L. C. Long is vice-president and city sales manager of the Chicago branch of the Federal Motor Truck Co. He was formerly New England sales manager for this company.

—

Victor Motor in Jenkintown

WILMINGTON, DEL., Nov. 27—The Victor Motor Co., which recently purchased land at Claymont, Del., for a plant, has decided to locate at Jenkintown, Pa.

—

Manly Truck in New Plant

CHICAGO, Nov. 27—A new factory in Waukegan, Ill., a short distance north of here along the lake shore, has been secured by the Manly Motor Truck Co., which recently put the Manly truck on the market. Tht new plant will be occupied about Dec. 1.

—

Marvel Accessories Capital Increased

CLEVELAND, Nov. 27—The Marvel Accessories Mfg. Co. has increased its capitalization to $100,000, and a new factory building, which will greatly increase output, is now under construction. When completed more than 45,000 sq. ft. of floorspace will be available.

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Logan Leaves Logan-Fischer Co.

CLEVELAND, Nov. 24—C. M. Logan, president of the Logan-Fischer Motor Co., Chalmers distributors, is severing his connection with that firm.

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Hupmobile Tour Reaches Santa Fé

DETROIT, Nov. 27—The Hupmobile capital-to-capital party reached Santa Fé, the thirty-fourth capital in its journey, on Nov. 23. The car is now on its way to Phoenix, Ariz.

—

Stern-wear Tubes on Market Dec. 1

ST. LOUIS, Nov. 27—The Efficiency Oil Corp., of this city, announces that Stern-wear inner tubes, guaranteed to wear 20,000 miles, will be placed on the market from the new factory here Dec. 1.

The Automobile

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Bed Rock

THE way in which automobile engineers this year have shown an inclination to get to the real bottom of subjects is very encouraging. There are many things in connection with automobile engineering that have been haphazard and rule of thumb, and they are mostly things that have been good enough in the past but are not good enough now, other parts of the chassis being improved so greatly. Such an example is the paper on retardation printed on another page, for it deals with primary forces and touches not at all on mechanical detail. Another constant subject of discussion during the year has been crankshaft balance, mainly a theoretical subject, the theory being forced upon us by the obvious imperfection of older designs.

There are many other things; lubrication is one, carburetion another and spring action a third, which may be mentioned as matters which require much more scientific treatment, and it would be easy to extend the list. The great thing, however, is not so much what has been done and is doing now, but the spirit of the thing. These discussions are lifting automobile engineering up to a higher plane; they mean that the automobile engineer of the future will need as good a scientific training as any other.

In its infancy the automobile industry was looked down upon by other branches of engineering because it had no theoretical basis; and in very truth it was once all a cut and try proposition. This is no longer so, and the cut and try methods of design and manufacture are dying, surely if not yet, very rapidly.

The automobile has really created a new section of engineering much broader than the road vehicle field. It has created the engineering of light structures, the engineering of weight saving. From the motor car chassis the aeroplane has grown, the high-speed boat has come into being and even railway engineering has felt the influence. This influence is but at its beginning. In the future we shall see much more machinery economical in use because light in weight, and all of it should go to the credit of automobile engineering. Let the good work go on.

Generator Reliability

THE only attention now needed by the electrical equipment of an automobile is the regular examination of the battery and occasional oiling of the generator and motor bearings. Adjustments of any kind are hardly ever provided by generator manufacturers, and they all state with emphasis that the less the owner knows of the existence of the commutator and brushes the better.

A generator and a starting motor should have an expert examination every 20,000 miles or so, or if they give trouble, but nearly every trouble that can occur happens outside the generator, which is about the most reliable part of the whole equipment.

Manufacturers list their troubles with generators as due to three things, over lubrication, under lubrication and "tinkering." Other troubles are all traceable to some accidental fault in manufacture and are correspondingly extremely rare. The reason for this is that the modern electric generator is extremely simple. It is far simpler than a magneto, for example. It did not take the public long to realize that any ignition trouble within a magneto was so rare that it need hardly be considered, and they would tackle spark plugs and wiring many times before commencing to investigate the internals of the magneto. Slowly, the same thing is becoming true of the electrical equipment; the generator is being suspected last of all.

Needs Little Attention

Like a magneto a generator is designed to run without attention, and there is no attention that can be given it which will help it to run properly beyond frequent, gentle lubrication. Its brushes require attention far less often than even the breaker points of a magneto, and when they do need touching it is usually a case of renewal rather than of adjustment. Never touch a generator until every detail of the battery and the wiring has been tested, not once, but several times, and thoroughly at that. This will be found the best policy at all times.

Commutator sanding and the fitting of new brushes are jobs that have to be done at rare intervals and they are not difficult, but they should never be attempted by anyone who has not been shown how by some man with experience in this work, otherwise the last state of the commutator may easily be much worse than the first.

Electric Systems Simpler

Better Manufacturing Feature of Starting and Lighting Equipment Progress in Year—Fewer Types Electrically and Mechanically — Two-Unit Gaining Steadily — More Generators with Ignition Combined—General Reduction in Weight

By A. Ludlow Clayden

THERE has been no really large change in the design of lighting, starting and ignition apparatus during the year of 1916. Every trend seen last year is seen again at present. The starting motor itself is almost eliminated from this discussion because it is so extremely simple that changes in its electrical makeup are unthinkable. The generator is becoming a better manufacturing proposition as the different big producers tool up for more and more each, of a decreasing number of models, for the innumerable patterns and designs each "special" in some way that the leaders of the industry were being forced to make two years ago, have been cut down and down again till unreasonable modifications are a minimum. The time is not far off when the generator business will be as standardized as carbureter manufacture. This is the case already in some plants, where the owners have had the courage to say to the automobile industry, "Gentlemen, here are our models of generator, we would like to have you choose one, but if none will suit you then please take your business to some other plant." Other plants not quite so courageous have gone a part of the way and persuaded some of their customers to give up needless petty individualities.

Concentration on Types

There is another thing, too, that has had an effect in improving the factory conditions, and this is that the electrical firms have been able to pick the types on which to concentrate. Some of the largest makers very wisely have been making machines of several different electrical systems. These they have sold in thousands and they have their records in service. In this way the most reliable out of two or three systems is quickly discovered, and a firm can concentrate on one system without any fear that they may not have made the best choice. The mere matter of size of generator had to be settled by time and experience, and we can see now that many machines being made two years ago were larger and heavier than they needed to have been. We have arrived at the light-weight generator by a series of successive easy stage reductions in dimensions. The substitution of press work and stamped parts for castings and forgings has enabled pounds of weight to be saved, but it has taken time to obtain and install the necessary presses, so here again a tendency observed last year is seen intensified at the present time.

Two-Unit Systems Almost Universal

It has become an accepted fact now that there are limits of rotative speed beyond which it is uneconomical to drive an armature, so this practically confines the single unit dynamotor with a constant gear connection with the crankshaft, to fairly slow speed engines. In cases where the engine runs upward of 2000 r.p.m. it is rare to find anything except two unit systems, excepting those few single units which have one connection to the crankshaft while being driven and another of lower ratio when they are operating as the starting motor.

For starting motor drives the Bendix pinion is still the almost universal equipment and it is unlikely that this eminently efficient and simple device will be displaced for a long time to come. Magnetic shifts are used on a few cars and mechanical shifts have not disappeared altogether, but there are very few of these remaining.

A matter which is still very much in the air is that of the attachment of the generator and the starting motor to the crankcase. At first almost all generators were designed to fit on a platform after the fashion of the magneto. Next, came round body generators which were clipped in cradles cast on the side of the crankcase and, finally, we now have the flange type of generator or motor, which has a large flange with three or four bolt holes on one end of the frame, attaching to a machined surface on the back of the crankcase front end, in the case of the generator, and to a facing on the crankcase rear arm in the case of the motor.

This flange mounting is every bit as secure as the platform or cradle mountings, especially with the present-day low weight of electrical units, and it is cheaper for the automobile manufacturer, because on a crankcase there are already several surfaces which have to be machined into planes at right angles to the axis of the crankshaft and it is little trouble to machine the necessary extra two faces for the generator and motor. The armatures of these two machines must be parallel to the crankshaft, and with a platform mounting some precautions in fitting have to be taken to insure the parallelism, thereby making the crankcase machining a little more expensive.

Flange Mounting Not Always Possible

A trouble, which is retarding the adoption of flange mountings more generally, is that it is not always possible to adapt this style to existing engines without alterations in the design of the crankcase. A committee of the Society of Automobile Engineers is investigating the situation, and has been doing so far nearly a year, and it has discovered a strong tendency amongst engine builders to make their new models suitable for flange mountings. This being so the S. A. E. expects that it will be able to standardize three flanges of different sizes, and that these standard ends for generators and motors will come steadily into use; though it may take some years for this to happen in cases where engine design has first to be changed.

One big advantage of the flange mounting is that it permits adjustment of the centers in the front end. If the flange has one round hole and two slotted holes it can be swung a little on one of the bolts, so allowing adjustment of the degree of mesh of the front end gears, or even effecting adjustment of the chain where a chain drive is employed for the generator. The starting motor does not need this adjustment, and may therefore have a standard flange somewhat different from that for the generator. The trend toward the use of the flange has begun and one of the largest suppliers is putting on all possible pressure to have it adopted by every one of its customers, but it will need another year yet before the work now being done by the electrical firms will show its effect to the full as they are pushing for flange mountings on the 1918 cars rather than for 1917 business, which is practically all closed.

Unit Ignition Increasing

The trend toward unit assemblies of generators with ignition distributers is very marked this year. Not only does this eliminate one of the drives from the engine, but with a normal sort of generator location it usually brings the distributer into a position somewhere nearly midway of the cylinders, so that the high-tension leads to the spark plugs can be short and direct. There is another small advantage, in that the timing can usually be made very exact, because the pitch of the fine teeth of the bevel or spiral gear drive for the vertical shaft will differ from that of the front end gear, thus offering a chance for a sort of differential setting.

The manufacturers of generators do not appear to have any preference with respect to the location of the ignition distributer. The demand for combining it with the generator appears to have come from the automobile manufacturer and it depends upon him whether this will be the most common type in the future. One tendency with respect to ignition units is worth noting. Two years ago a number of generators were being put out with the ignition breaker and distributer mounted on the end and appearing from the outside almost exactly the same as a magneto distributer. These types are still being made, but they are not being used to anything like the same extent as are the generators combined with a cylindrical distributer on a vertical shaft.

There are two reasons which may explain this situation. The first is that the provision of a vertical shaft on the end of a generator will allow a number of different kinds of distributers to be fitted, so a manufacturer need not purchase the generator and the ignition device from the same firm, even if he uses them in unit combination. The other is that the cylindrical distributer on the vertical shaft is usually less liable to be rendered inaccessible by manifolds or other parts on an engine.

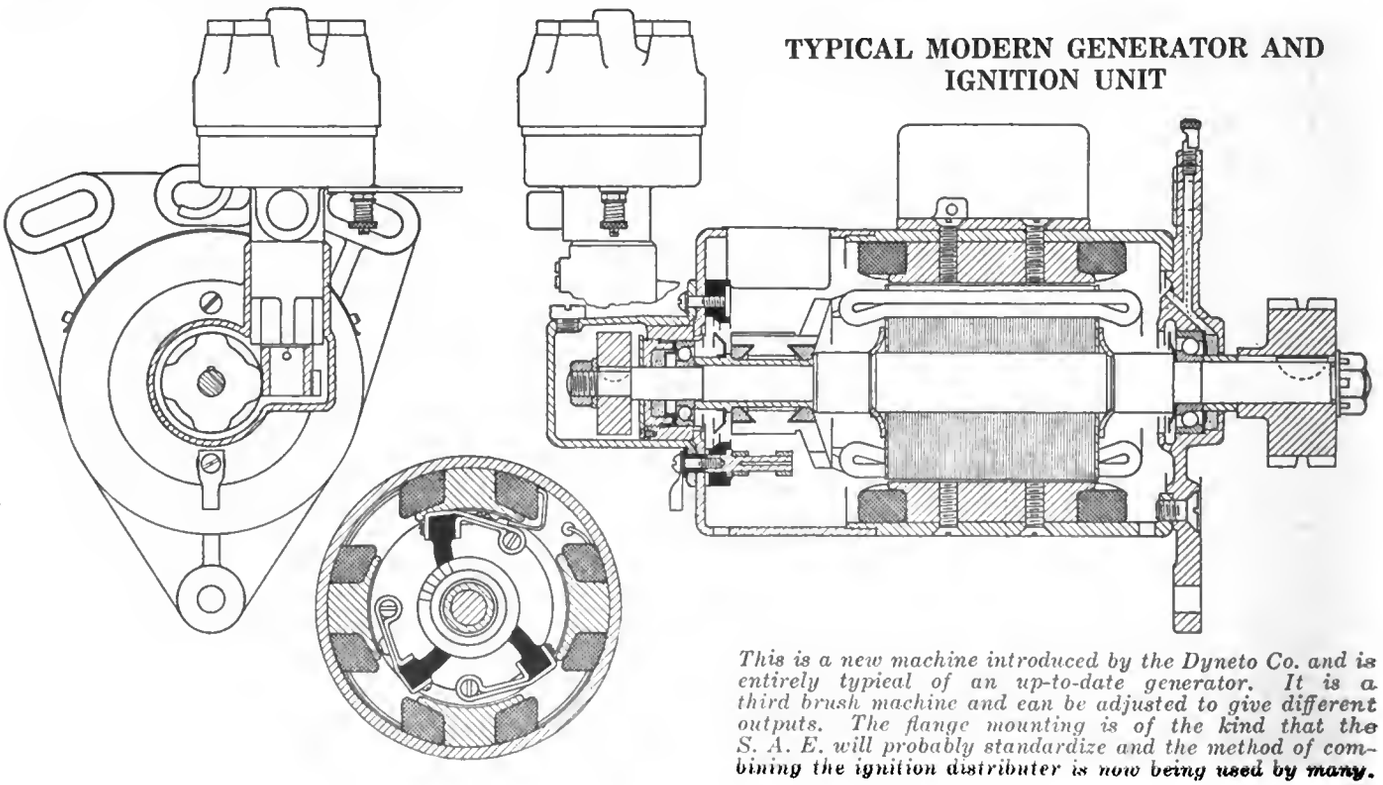
There is another point which is sometimes of importance in determining the choice of a unit generator and igniter. With the magneto type of distributer and contact breaker it is not usually so easy to carry the armature shaft out at both ends of the generator. When the vertical distributer is used it is quite easy to extend the armature shaft so that a water pump or some other accessory can be driven tandem with the generator. With a flange mounting for the generator and an armature shaft carried right through, a drive for a tire pump can be arranged very conveniently and the pump will not interfere with the accessibility of the distributer.

Fewer Regulating Systems

For holding the voltage steady throughout a very wide range of armature speed a large number of different schemes have been tried. Three years ago there was very little indication as to what would be the ultimate choice of manufacturers. Even a year ago it would have been hard to forecast the situation to-day, but it is now possible to state quite definitely that the third brush system of regulation is far the most popular and that the vibrator controller for either voltage direct or for current is second favorite.

It also appears now that we shall almost certainly see several systems of regulation continuing in use for many years. For very many purposes it is hardly possible to improve upon the third brush system. For cars having a big lamp load, a rather lighter machine can be built with a vibrator control, while the bucking coil and some other system of control are often preferred in special cases.

The action of the different controlling systems has been explained several times in THE AUTOMOBILE, but the two



TYPICAL MODERN GENERATOR AND IGNITION UNIT

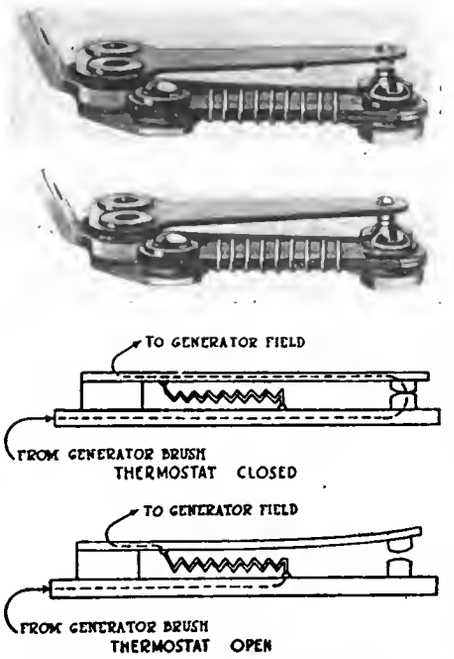
This is a new machine introduced by the Dyneto Co. and is entirely typical of an up-to-date generator. It is a third brush machine and can be adjusted to give different outputs. The flange mounting is of the kind that the S. A. E. will probably standardize and the method of combining the ignition distributer is now being used by many.

principal controls may be outlined briefly once again. There are two main brushes on the generator from which the current is taken and this current has two paths. One is the outside path to the battery, etc., the other is the internal path round the field magnets. Now, if we assume that there is 6 volts difference of potential between the main brushes we could regard one brush as being plus three and the other brush as minus three. If we apply a third brush midway between these two its potential would be zero. If, therefore, we take a wire from the third brush, wrap it around the poles of the field magnet and take it back to either of the two main brushes there will be a difference of 3 volts between the two ends of this secondary field magnet winding. This means that a current will flow through this second winding as well as through the main winding.

As the speed of the armature varies the magnetic lines of force are distorted. At very low speed they go straight from pole to pole and as the speed rises they are dragged around by the armature so that they take up an angular position. The effect of this is to vary the potential at the point on the commutator where the third brush makes contact, so that the current flowing from the third brush to whichever of the main brushes it may be connected varies with the speed of the machine. It is possible so to place the third brush that the current from it will assist the excitation of the field magnets at low speeds and oppose it at high speeds.

The action may be compared to that of a fan placed in a flue from a stove. When the stove is burning freely we can set a fan to blow up the flue, thereby increasing the draft and encouraging the fire. When the fire is burning freely so that the natural draft up the flue is very strong, we could decrease the rapidity of the draft by reversing the direction of the fan and blowing *down* the flue instead of *up* it.

It is obvious that, with this third brush system, the exact nature of the current produced from any one machine will depend upon the position of the third brush relative to the other two. If we want the generator to start charging at a very low speed we can set the third brush so that the current from it will assist the magnetization of the fields very strongly. If we want to reach the peak of the output of the generator at a higher speed we can move the brush so as to reduce or even entirely remove the assisting feature, letting it act only in opposition at high speeds. Thus the third brush machine has a possibility for adjustment. Nearly all third brush machines are so made that the manufacturer can adjust it, but very few indeed have an adjustment which is intended to be touched outside the factory. The reason for this is that the adjustment must be operated intelligently. It is a useless thing to anyone who does not understand its function. It used to be thought that the difference in the average lamp load between summer and winter would make an adjustment imperative, but this idea has lost ground steadily and has few supporters to-day. The reason is two-fold; first, batteries will withstand a greater degree of overcharging than they used to do, and secondly, generators are commonly so constructed that they produce the maximum charging current at fairly low speed and considerably less current at high speed. This means that the reduction in speed which accompanies night driving actually increases current output. Furthermore, with some of the vibrator controls, the output of the generator depends only upon the condition of the battery and, if the battery is full, the generator will deliver very little current, scarcely more than enough just to keep the battery in proper condition.

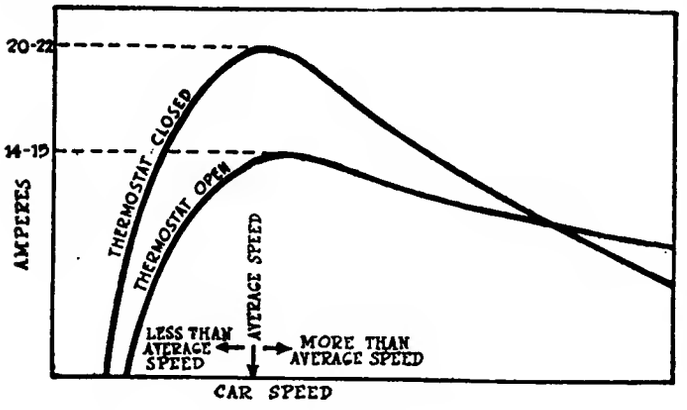


Photograph and diagram of connections for Remy automatic output regulating thermostat

The Remy company, however, considers that some sort of differentiation is required for the sake of the battery, and it has recently developed a very interesting device for varying the charging rate between summer and winter. If the generator is made so that it will carry the winter lamp load it is bound to do a certain amount of battery overcharging in the summer and, although this may not do the battery any real injury it is bound to evaporate the electrolyte a little quicker than it would otherwise do.

The Remy idea is very simple and it consists of an automatic device controlled by temperature which switches a resistance into the field windings as soon as the temperature of the generator rises above a predetermined point, usually about 150 deg. The device consists of a pair of contacts normally kept together, one of them being mounted on a compound strip of two dissimilar metals. When temperature increases above 150 deg. this strip bends, so breaking the contacts and thereby throwing in the additional resistance coil.

The thermostat is mounted inside the generator, where it will normally be at about the same temperature as that prevailing throughout the coils and body of the generator. It is proposed by the Remy company to proportion the additional resistance so that the effect of throwing it in is to reduce the current about 30 per cent. An automatic device



Effect of Remy thermostatic output control

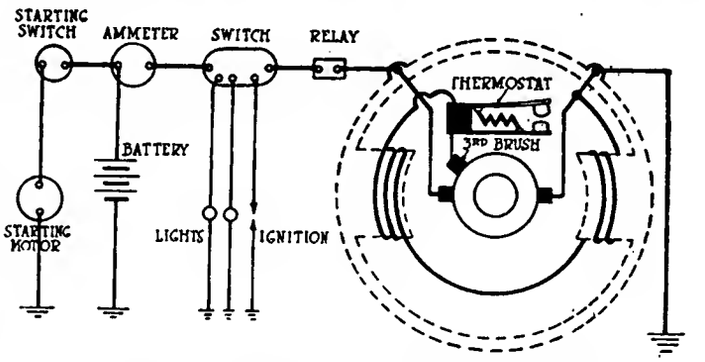
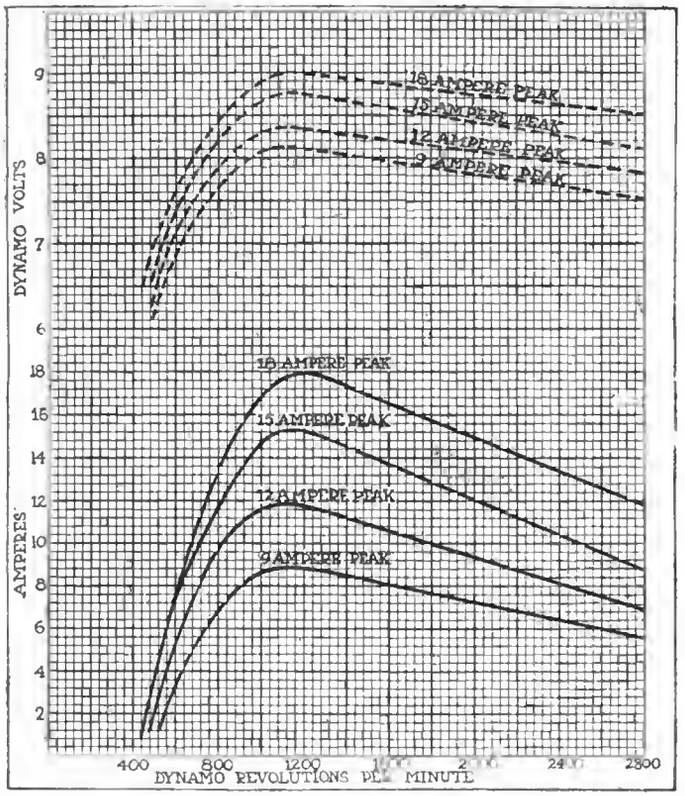
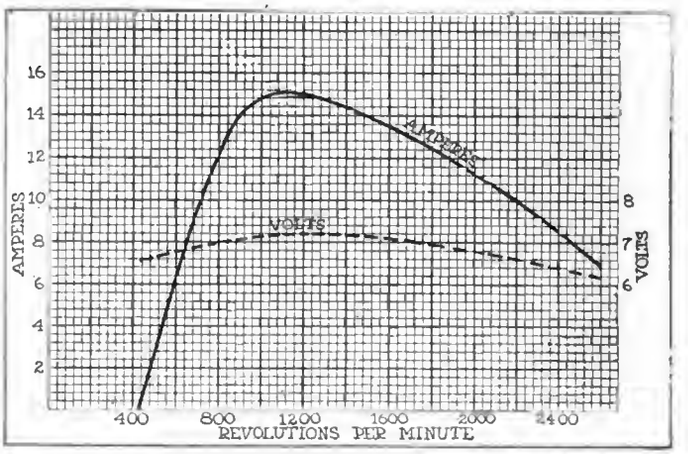


Diagram of connections with Remy thermostat

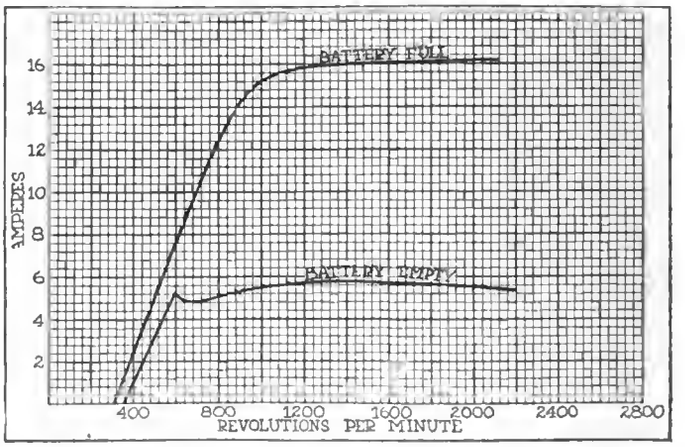
Characteristic Curves From Different Controls On Various Generators



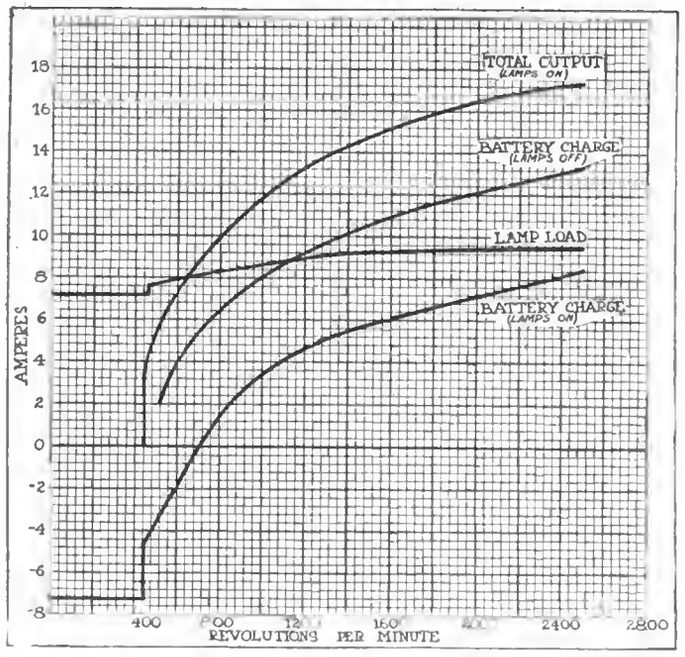
Voltage and ampere curves obtained from the same generator with third brush regulation obtained by altering the adjustment of the third brush. These give an excellent idea of the adaptability of this kind of regulation to various conditions, a very desirable feature



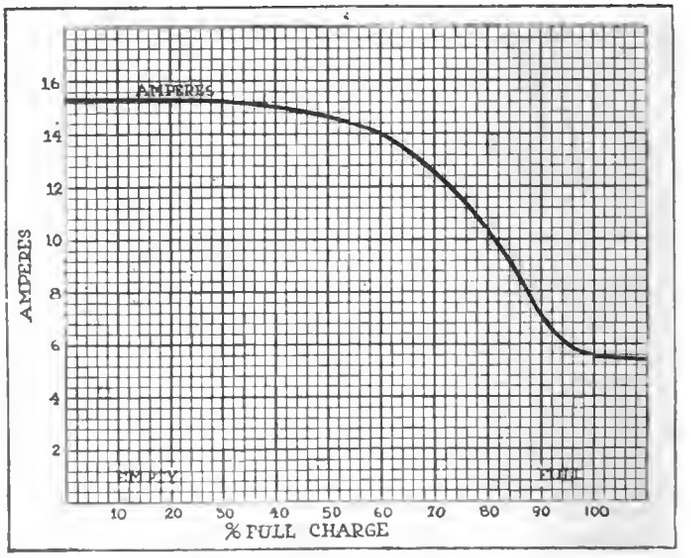
Characteristic curves from third brush generator plotted to a different scale



Shows how the state of charge of the battery affects the output from a generator with voltage regulation by vibrator



Bucking coil regulation curves showing characteristics, which, as may easily be seen by comparing them with the curves in the cuts appearing above, differ greatly from those of the third brush machine



Another way of showing the effect of the state of the battery on a voltage regulated generator. The curve is the output measured at successive intervals of time as the generator brings the battery from full discharge to full charge

of this nature should have the advantage over anything requiring manual operation.

Several generator makers give directions in their instruction books for hand adjustment of the third brush and recommend its use, so it is quite probable that automatic or hand settings will return to favor in course of time.

Vibrator Like a Throttle

Vibrator control operates quite differently from the third brush system. In its simplest form there is an ordinary shunt coil passing from one main brush to the other and no subsidiary winding on the pole pieces. The shunt winding is connected permanently to one brush and its connection to the second brush is controlled by the vibrator. This vibrator is a spring reed furnished with contacts and with a small electro-magnet. The coil of this magnet is placed somewhere in the circuit so that if the current in it increases above a certain point the reed is attracted and the contacts either made or broken. With the reed in one position there is direct connection of the second brush to the end of the shunt winding, which means that as much current as possible will be flowing around the magnet poles. If this current becomes too strong, the reed of the vibrator moves and the change in the contacts thus caused switches a resistance coil into the shunt circuit. The effect of this is instantly to reduce the amount of magnetization, which in turn reduces the current. As soon as the current drops the reed of the vibrator is released and flies up, thus cutting out the resistance and returning the state of affairs to what they were immediately beforehand. This action is performed with great rapidity and, returning to our stove analogy, it is as though there was a valve in the flue which automatically closed as soon as the draft passed a certain degree of vigor. The instant it shuts the draft ceases and the valve automatically reopens only to shut again as the draft increases once more.

The vibrator control was developed previous to the days of the automobile, being used for other electrical work, and it was its great reliability in this service which suggested the idea that it would be satisfactory for automobiles. It has proved wonderfully reliable and has the advantage that it can be assembled as a unit separate from the generator itself. The vibrating reed, the resistance coil and the little electro-magnet are commonly all mounted in a sealed case which is attached either to the body of the generator or to some other convenient point on the car, although mounting on the generator is the most usual method. In the rare event of anything going wrong, the whole control unit can be replaced as easily as changing a spark plug. Comparing the two systems, the third brush is the simpler and the cheaper to make. It has no parts which can possibly fail or give trouble excepting the brush itself. The two drawbacks are that the characteristic output curve is not quite so close to the ideal as can be obtained with vibrator regulation, and the fact that there are three brushes instead of two is bound to make a slight difference in the rapidity of commutator wear. These two drawbacks, however, are extremely small and can be largely offset by a slight increase in size.

Little to Choose Between Systems

The vibrator controls enable the generator to be somewhat smaller and lighter and usually they will bring a discharged battery back to the fully charged state most rapidly. The drawback, if indeed it can be called one, is the presence of a moving part and contacts which are made and broken constantly, but since the life of the vibrator is apparently very much greater than that of the brushes and other parts of the generator this is a very small point. Thus, in weighing up between the two systems, when you consider the type of output curve and the weight and the cost it will often be found that there is very little to choose.

A point which has been very much discussed is the car speed at which the generator should commence to charge. This, however, is of small importance by itself. It cannot be considered alone any more than we can consider the diameter of a valve without any knowledge as to its lift and timing. The essential thing is to have such a generator and to drive it at such a speed that we can be sure of an output equivalent to the full lamp and ignition load at an average night-driving road speed. The practice of various manufacturers differs a good deal, but almost all of them find it necessary to provide this amount of current at a speed of 15 m.p.h. Some of them consider 12 m.p.h. is better. In any case it is between 12 and 15 m.p.h. that something approaching the full output of the generator should be reached. How much below 12 m.p.h. the cut-in should take place depends upon the characteristics of the generator. That is to say, it depends upon how rapidly it comes up to full output.

May Raise Generator Speed

The great majority of generators are now geared to run one and one-half times crankshaft speed. Whether this is going to be conventional practice for many years is debatable. More than one manufacturer of electrical apparatus considers that an increase in armature speed would be desirable because it would permit the generator to be smaller and lighter. The limitations of speed are almost entirely mechanical. With an engine capable of revolving 3000 r.p.m. we must be certain that the armature commutator, etc., will withstand prolonged running at 4500 r.p.m. if we are going to us a 1½ to 1 ratio. Using a 2 to 1 ratio would mean that the armature would need to be safe at 6000 r.p.m. Manufacturers have had to discover methods of construction which enabled the armature to be manufactured conveniently and which also provided strength to resist the considerable centrifugal forces at these very high speeds. When the construction of an armature, consisting of bundles of wires wound round a peculiarly shaped piece of iron, is considered, the difficulty of resisting the disintegrating forces becomes apparent.

Self-Lubricating Bearing Popular

There is very little trouble with bearings, the loads are so light that these seem to be able to stand any number of revolutions. Ball bearings are used very extensively in mounting armatures, but there is a noticeable tendency towards the use of plain bearings and a most successful type has been a compound metal and graphite bushing. It is necessary with plain bearings to be sure of an adequate supply of oil, and this is usually arranged for by a form of lubricator in which sufficient oil for a month or two of running is carried in a little cup or reservoir and transferred to the bearing itself by a wick. The wick will always supply the same amount of oil per revolution, thus insuring an adequate supply and preventing an over supply. The electric manufacturers' service stations report that two of the commonest troubles are bearing trouble, caused by absence of oil, and commutator trouble, caused by too much oil. The average owner of an automobile either over-oils or under-oils it. Hence generator makers are trying, with good success, to devise forms of lubricators, like the wick lubricators, which make over-oiling impossible and carry so much oil that an adequate supply is guaranteed even if fresh oil is added only very occasionally. Several manufacturers have continued to use ball bearings because of their ability to run when quite dry, but the compound bushing containing a little graphite can also be run dry for a reasonable time without much damage resulting so that the present tendency is certainly toward plain bearings. This seems rather curious in these days when ball and roller bearings are being used more and more extensively, but there are two reasons which make the plain bearings preferable. One is that it is incapable of making any sound, and the other is that the clear-

ance between the armature and the pole pieces can be made rather smaller with plain bearings, which increases the electrical efficiency of the generator. However, we are getting small bearings of a greater and greater accuracy every year, so it will be very difficult to forecast what may be the eventual outcome.

Single Unit's Limited Field

The situation with respect to single-unit and two-unit systems is much the same as it was last year. That is to say, the trend toward the two-unit system is continued. The single unit which has but one driving connection to the crankshaft is giving excellent service and is still being used extensively on cars where the maximum of engine speed is not very great and where the cranking torque required is comparatively low. To give enough cranking torque a single unit in permanent connection with the crankshaft through a chain or gear has to be made larger than it would need to be did it operate as a generator only. It also has to run at a higher speed than would be the case were it only a generator. This is because the size and speed determine the cranking torque which the instrument can exert on the crankshaft.

Obviously, if we have a 3 to 1 gear ratio between the armature and the crankshaft we must have a much larger electrical machine than if we have a 20 to 1 ratio which is easily obtainable through the flywheel engagement.

This difficulty has been overcome in one or two cases by arranging a special form of drive so that the armature is driven at one speed when the machine is operating as a generator and at a much higher speed when acting as a motor. The best known example of this is, of course, the Delco system in which the armature is driven by the crankshaft from one end through an overrunning clutch and can be made to drive the flywheel from the other end, during which cranking period the clutch is in operation and the main drive is doing nothing, but electrically, this is practically the same thing as a two-unit system with the two units combined in one external casing. Possibly it is the great opportunities offered for patenting single-unit machines of this type and the impossibility of patenting two-unit outfits as such, which has encouraged the development of the two-unit system rather than of the "two speed" single unit. Undoubtedly, also, the two-unit system has been favored by automobile engineers because the generator is small and the motor so very small that it can be packed away in very little space.

As with almost every other new part of an automobile the design of the electrical equipment a few years ago was influenced largely by the demand for outfits which could be attached to engines originally designed to receive them. While this did not affect the electrical part very much, it did affect the mechanical detail profoundly, and it is really only now, at the commencement of the 1917 season, that it is possible to say the effects of this original influence have altogether vanished. Even now, however, very many generators and motors are being made to special designs because of the limitations imposed by the producers of old crankcase patterns. For instance, the inboard type of starting motor in which the Bendix pinion moves forward to engage the flywheel is simpler than the outboard pattern in which the pinion moves in the reverse direction, because in the former case it is only necessary to have the two bearings in the motor frame, whereas in the outboard type an additional casting with a third bearing the far side of the pinion is essential. It so happens, however, that the inboard type is difficult to apply to a good many stock engines with bell housing to the flywheel. Similarly with regard to the mounting of the generator, the geared centers in the front end fall very differently in different engines and this makes it hard to avoid the occasional use of special generator frames.

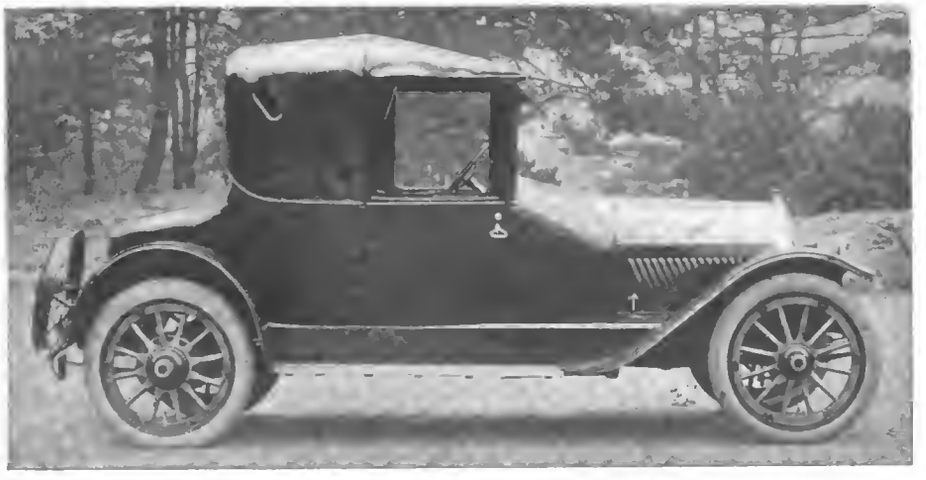
Time, however, will take care of things like this and we are within sight of the day when almost any stock electric generator and motor will fit almost any stock engine, a condition which is eminently desirable.

The application of either generator or motor to the side of the transmission case at one time appeared promising, as it frees the engine of a bulky part, but there is no indication whatever that this idea is likely to be considered except in a very few isolated cases. Probably on the engine is the best place for the generator, as it is most accessible there and well protected.

Steady, Sane Progress

Summing up, therefore, it appears that the electrical equipment record for 1916 is one of sane, steady progress without any prominent high spots. Changes have been mainly of the "settling down" kind; the elimination of peculiar or odd designs and a general bettering of manufacture. More real development work has been done with battery ignition where there have been a good many changes and a good many new things, and these will be dealt with in the next issue of THE AUTOMOBILE.

New Cabriolet on Oldsmobile Eight Chassis



New Oldsmobile four-passenger cabriolet mounted on the eight-cylinder chassis. It sells for $1,775

LONG low lines, flowing curves and German silver radiator with silver finish on lamps, hub caps and door handles are individual touches of the new cabriolet body mounted on the Oldsmobile eight chassis built by the Olds Motor Works, Lansing, Mich. The collapsible top has no exterior braces and can be handled from the inside by one man. Doors are substantial with large rattle-proof adjustable windows. The driver's seat is 15 in. in advance of the main seat which accommodates two passengers. A folding seat pivots under the cowl. The car sells for $1,775 f.o.b. Lansing. The compartment behind the driver's seat is of ample dimensions and can be used for parcels, gloves and other things of that sort.

Denmark — A Good Car Market

American Cars Are Rapidly Establishing Excellent Reputations for Economy and Durability—Field Should Be Further Developed —Industrial Conditions Similar to Those in the United States

DENMARK to-day presents one of the most rapidly growing markets for American-built automobiles and motor trucks, according to Knud A. Mammen, New York manager of Mammen & Drescher, dealers in American cars in Copenhagen. Mr. Mammen states that there are over 30,000 cars in use in Denmark at the present time, as compared with less than 2000 in 1912. The great bulk of these are passenger cars, there being comparatively few commercial vehicles, although there are some 200 taxicabs, which are not fitted with rubber tires, due to the high prices now prevailing for these in the Scandinavian countries.

Industrial conditions in Denmark at the present time are very similar to those in the United States, certain commodities having risen rapidly in price in consequence of the demands of the warring countries. Naturally a large number of people have profited by these developments, with the result that a new wealthy class has been created, the members of which have been dubbed by the general public "goulash barons." These people have been and still are large buyers of automobiles. In addition, farmers have profited by the high prices now paid for their products to such an extent that the majority of them have bought cars. Moreover, the Danish people have only recently awakened to the possibilities of the American car, and the normal demand has been growing at a rapid rate. An example of the interest displayed by the people of Copenhagen in United States of America cars was mentioned by Mr. Mammen, who said that two months ago he drove a new four-passenger American-built machine through the streets of the city one morning and that afternoon over twenty prospective car buyers came into the company's salesrooms with the cash in their pockets to pay for a machine on immediate delivery, but, of course, it was impossible to furnish what they wished at that time. Most of these people subsequently became owners of cars of that make in either the model they had admired or in some other style which appealed to them on making a further investigation. About three months ago similar conditions prevailed, every automobile dealer in Copenhagen having sold out his entire stock, and people were coming into the salesrooms every day with rolls of money to pay for cars which were not available on any terms.

Difficulty of securing shipping accommodations due to war conditions has been one of the greatest handicaps with which the exporters of American automobiles have had to contend. Mammen & Drescher, who handle Chandler, Pathfinder, Haynes, Elcar, and Singer cars, Chase and Duplex trucks, and Knox tractors, in addition to Fisk and other American tires, found that it cost them between $500 and $600 each for the larger cars when these were shipped crated, not including crating and carting and freight from the factory. By arranging with the factory to ship them the chassis knocked down and without bodies the firm effected a saving of 80 per cent. on the freight of each car. Upon the arrival of the chassis in Copenhagen they are taken to the company's shops and fitted with bodies of the European type and more in keeping with the desires of many of the purchasers than the standard American-built bodies appear to be. An interesting development of the present era of nouveux riches in that country is that the so-called "goulash barons" desire the bodies of their cars to be something out of the ordinary, and, as their tastes have not been very highly developed in this regard, the results are frequently grotesque. Sometimes they content themselves with a few flourishes of external ornamentation and perhaps a strikingly vivid coloring, and in other cases they order unusual and impractical body shapes. In the matter of interior arrangement of seats, color, and type of curtains, window operation, etc., they often demand the impossible, but are finally content to accept some approximation of their ideal, if the body builders cannot persuade them to accept a more

KNUD A. MAMMEN

EDITOR'S NOTE:—Our manufacturers of cars, trucks and accessories have frequently been informed that now is the time to develop and establish a world market for their products which will endure after the close of hostilities in Europe and many of them have taken advantage of the opportunities now offered for export trade. This article, based on data furnished by Knud A. Mammen, New York manager of the Copenhagen firm of Mammen & Drescher, and A. H. Anderson, chief engineer of the same concern, gives an inkling of the propitious conditions to be found in Denmark.

A. H. ANDERSON

MAP OF DENMARK, SHOWING SOME OF THE MAIN AUTOMOBILE ROADS

Touring is very good in Denmark, although the distances are of course small as compared with those in the United States. Roads are excellent, macadam and bituminous-surfaced highways preponderating. Those indicated by the black lines on the map are only a few of the more important thoroughfares connecting some of the leading cities of the country, but there are a great many more roads which have all the advantages offered by these and at the same time possess even greater scenic attractions. This is especially the case in the northern part of Jutland where some of the finest touring imaginable is to be found. Connections between the various islands of Denmark and also with the peninsula of Jutland are by ferries and the water trips lend a great deal of variety as well as giving some glimpses of very fine coast scenery. These conditions, coupled with the increasing prosperity of the country and the leaning evinced by the people of Denmark toward American cars, make that country a rich field for the American manufacturer

conventional but less conspicuous design for their machines.

An idea of the difficulties to be overcome in shipping cars from the United States to Denmark under present conditions may be gained by reviewing the necessary routine and red tape through which exporters are obliged to go before the cars are allowed to leave New York harbor. The Merchants' Guild in Copenhagen gives a declaration for orders which have to be viséed by the British Consul and by the Automobile and Cycle Merchants' Association, which is somewhat similar to the National Automobile Chamber of Commerce in this country. The matter then goes to the Scandinavian-American steamship line, which is the only one carrying American automobiles direct to Denmark. The steamship company cables to the agents in New York who handle its shipping from this country. These agents then notify the exporter what accommodations can be obtained for shipping the cars, giving ship, date, etc. It is then necessary for the exporter to write to the British Embassy at Washington, giving complete details of the order and describing all matter to be shipped thereunder, and also giving the names and addresses of consigner, consignee, etc. Upon receipt of an assurance for the goods and a permit from the British Embassy the cars can then be placed on the dock, after which shipment is a mere matter of routine with the steamship company.

Shipping Improved

For about two years after the beginning of the European war automobiles could be shipped to Denmark only on freight boats, and frequently it was impossible to secure space on any of these for long periods at a time, due to the enormous quantities of war munitions which were being sent abroad for the use of the belligerent nations. Now the situation is greatly improved, not only because the exports of munitions have greatly decreased in volume, but also because passenger boats are now available as carriers of automobiles and motor trucks.

Tires Hard to Get

The restrictions enforced by Great Britain upon the shipment of rubber, including tires, to European countries naturally constitute another handicap on the exporter of cars from the United States to Denmark, because it is not only impossible to ship machines fitted with tires, but it is also exceedingly difficult to secure tires with which to equip them when they have arrived in Denmark. All tires must pass through London, and the strictest sort of supervision is exercised in England and also in Denmark to prevent the tires, or, in fact, rubber, in any form, from reaching Germany. For some time after the outbreak of hostilities unscrupulous persons took any means of securing tires, which they could sell in Germany at very high prices. When they were unable to obtain a sufficient quantity by buying in the open market or through private channels they stole them from cars and shipped them to Germany. To check these practices a system was developed by which no one could buy a new tire without

turning in the old one on the deal.

The importance of the first impression made by an American-built car on the market in Denmark is evident from the experience of Mammen & Drescher, as cited by Mr. Mammen, with the first machine the firm imported from this country. This car, a Chandler six, took part in a big reliability run held soon after its arrival in 1914, and made an enviable showing under particularly adverse conditions of weather, road, etc. As a result a demand immediately sprang up for these cars, and that particular machine has been sold three times, the owner each time turning it in for a new car. Similar experiences with the other American cars the company handles have confirmed them in their belief that it pays to demonstrate the good qualities of the machine for the benefit of the Danish public, which has never had very much experience with American automobiles until the last two or three years.

Showrooms of Mammen & Drescher in Copenhagen, Denmark. These are situated in the business district near the station through which the prosperous citizens make their daily trips between home and office. Note the American-built cars at the curb ready to give demonstrations, for which they are usually in great demand

There are too many automobile dealers in Copenhagen, Mr. Mammen says, who know practically nothing about the cars they sell. These dealers cannot give satisfactory service to the people who purchase their cars, and the natural result is that the machines they represent acquire a reputation as unsatisfactory in various ways. The same situation does not exist with regard to tires and accessories, as the dealers are more familiar with these and seem to handle the service matters in regard to them more satisfactorily than for the cars.

No Automobile Row

There is no automobile row in Copenhagen, which is the largest city, the capital, and the most extensive automobile market of any part of Denmark. The various salesrooms, garages, service stations, shops, etc., of the dealers in automobiles and accessories are spread over the business, and part of the residential, section of the city, and apparently only a few dealers have been thoughtful enough to secure locations advantageous from the viewpoint of passing traffic, etc. The salesroom of Mammen & Drescher, which is illustrated on this page, is fortunately situated, Mr. Mammen points out, being so placed in the business section of the city that practically all the prosperous citizens who are legitimate prospects as car buyers must pass it on their way to and from the station on their daily journeys between their offices and their homes in the suburbs or outlying residential districts.

American cars are now most popular of all in Denmark and bid fair to continue so after the close of the war, owing to their low price, durability, simplicity, and ease of upkeep. The possibilities of this country as a field for the United States of America car manufacturer are very great at the present time, and, if properly developed, the trade of our automobile industry with Denmark should grow to very large proportions in the future. When it is realized that the twenty islands and the peninsula of Jutland, which constitute Denmark proper, have a population of approximately 3,000,000, that the city of Copenhagen alone has over half a million people, and that there are about a dozen other cities with populations ranging from 10,000 to 70,000, it is readily seen that here is a field which our makers should not neglect. Then, too, the influence of good reputations established by American-built cars, trucks, and accessories in Denmark will have a very considerable effect in facilitating the development of our business relations with the insular possessions of that country.

American cars have had little competition to meet in Denmark during the last two or three years. Shortly after the outbreak of the war a number of persons, perceiving the increased demand for automobiles in the country, went to Germany and bought up all the French, English, Italian, and other cars they could secure and sold them at a big profit in Denmark. There is a car called the Scania-Vabis which has been sold in large numbers in Copenhagen and other Danish cities since the outbreak of the war. This car is made in Denmark from parts imported from Sweden. It is a rather heavy car and the output is necessarily small, so it does not offer very serious competition to dealers in American cars.

Money Easy to Get

Industrial conditions in Denmark at present are very similar to those in this country. The banks are in excellent condition and money is easy to get, so that dealers have no difficulty in securing financial backing. Thus cars can be sold on the time-payment plan if desired, though there is at present very little call for this arrangement in that country. As Denmark is primarily an agricultural center, the high prices for farm products which the war has caused are responsible for the widespread prosperity to be found among the Danish farmers, who, Mr. Mammen says, are buying cars fast, Fords predominating. No fat or butter is allowed to go out of the country except to England but the large fishing industry of Denmark has profited enormously from the war as it furnishes fish not only to England, but also to France and Germany. There are practically no cattle to be seen browsing in the fields, as an enormous number have been killed and the meat sent to Germany and those remaining are carefully guarded as beef sells for about $1 per pound. Other farm products have increased in price to a marked degree during the past 2 years; milk is 4 per cent higher than at the outbreak of the war and wool 100 per cent higher; butter costs 60 cents per pound, and all meats are far more expensive. Naturally the high price of wool and other cloth-making materials has had a great effect on the price of clothes, which are considerably more costly in every par-

ticular than was the case in that country 2 years ago.

One phase of the situation which must not be overlooked by the American manufacturer is that the farmers, attracted by the high prices paid, have sold practically all their horses for war purposes and these men are almost all logical prospects for the sale of American-built farm tractors and motor trucks.

All Plants Rushed

In the manufacturing field all the aeroplane, war munitions, and textile factories in Denmark are doing an enormous business and the stocks of these companies have soared to remarkable heights. Ammunition supplies and machine tools for factory equipment are produced for Russia in tremendous quantities besides a large output to other countries. The stock of one concern manufacturing these goods sold at $45 a share in 1914 and it is now quoted at over $530. The securities of shipping concerns have also had a rapid rise, the $100 par stock of one company being quoted at over $1,700.

Business morals have declined in Denmark in company with those in other European countries not involved in the great war. People realize that existing conditions are only temporary and many of them have made up their minds to make their fortunes quickly and without particular regard as to the means employed.

A Fine Touring Field

Denmark presents an unusually attractive field for touring and the roads are very smooth and well kept, being largely of macadam or bituminous surface. There is at present a law in effect which prohibits the use of all side roads by cars of over 2000 lb. This has no effect on the smaller cars and only restricts the larger ones to the main highways, which is a hardship only in so far as missing delectable bits of scenery in out-of-the-way places are concerned. It is very probable that this law will be repealed before long.

Roads Are Excellent

Of course all the islands as well as Jutland are covered with a network of good roads but some of the more important ones are indicated in the map on page 926. The country inland is rather flat but along the coasts there are magnificent stretches of rocks and cliffs, the latter being of white chalk in some instances as at Klint in the island of Möen. There are numerous beautiful boat trips between the islands, and in passing through the inland sections of beech woodlands and little lakes overhung by trees present a continuous variety to the neatly fenced fields and cozy cottages. In Northern Jutland there are some particularly lovely bits of scenery in the neighborhood of the chain of lakes running from Aalborg, a city of some 40,000 inhabitants, to the western coast.

Prospects in the Cities

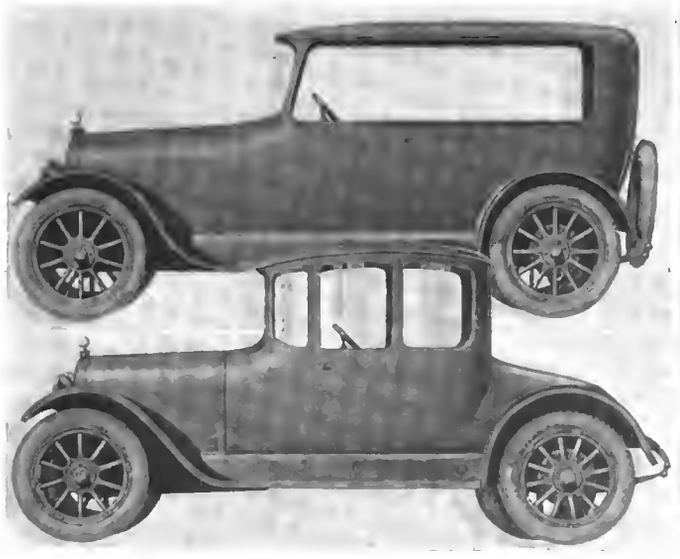
Some of the leading cities of Denmark which offer possibilities to the American car manufacturer are the following, as indicated by their approximate population:

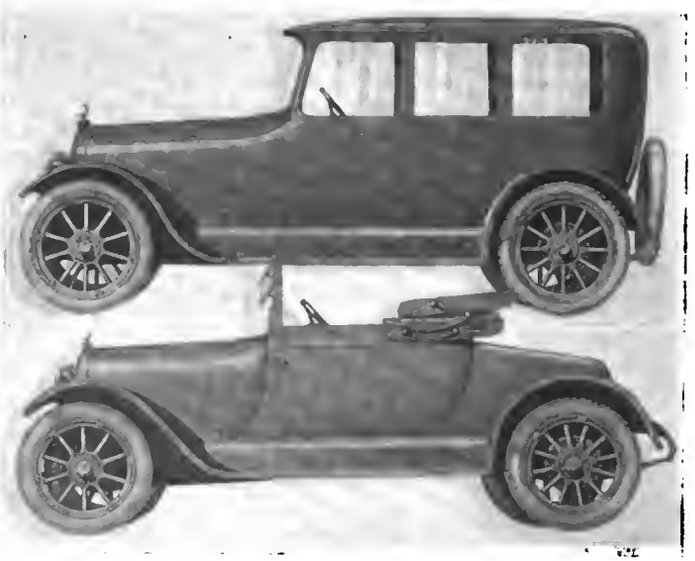
Copenhagen	500,000	Randers	24,000
Aarhaus	70,000	Vejle	15,000
Odense	45,000	Elsinore	14,000
Aalborg	40,000	Fredericia	13,000
Horsens	25,000	Svendborg	12,000

To Assemble a Car

Mammen & Drescher are preparing to assemble a car in Denmark under their own name from standard units bought in the United States. This car was designed by A. H. Anderson, chief engineer of the firm, who is now in Denmark arranging for the handling of the first 500 chassis, parts for which will be shipped to the company's shops in Copenhagen as soon as the necessary preliminaries have been attended to.

Smooth Lines in Moon Closed Models





SUPPLEMENTING the report of the new closed models brought out by the Moon Motor Car Co., St. Louis, Mo., which appeared in a recent issue of THE AUTOMOBILE the above illustrations give an idea of the smooth lines and neat finish of these cars. That at the upper left is the seven-passenger sedan mounted on the 6-66 chassis and selling for $2,250; Below it is the four-passenger coupé on the same chassis and listing at $2,150; at the upper right is a view of the sedan as a closed car, the windows and pillars being folded out of sight in the other view. Below at the right is the cabriolet design which, like the coupé, seats four, and which sells for $1,850 on the 6-43 chassis and for $2,150 on the 6-66. The interior appointments of these bodies are in keeping with their exteriors.

Many Factors in Brake Design

Tire Adhesion, Road and Wind Resistance and the Personal Equation—Brakes on Two Wheels Are Enough

By John Younger

EDITOR'S NOTE:—Paper read by John Younger, chief engineer of the truck department of Pierce-Arrow Motor Car Corp., before the Pennsylvania section of the Society of Automobile Engineers Nov. 22.

DURING the past 2 or 3 years emphasis has been laid on the accelerative ability of cars. Designers have vied with each other in getting the last fractional inch per second, per second into their performance curves. Advertising managers have not been slow in accelerating the peaks a little further and finding that the public liked it.

Get away, Pick up, Dash, Verve—I have myself called it Elan—are all familiar terms for the engineer's word acceleration. There is as yet no term of endearment for retardation. Its significance has not gripped the people's imagination, and yet of the two it is of more vital importance. The automobile death rate increases in inverse proportion to the efficiency of the retardation curve.

In fast rail traffic, with many stops, the possible retardation curve is first studied. Running a continuous stream of cars through New York subways, with an infinitesimal headway at rush hours, has caused their engineers to know almost to a fraction of a foot just where the brakes must be applied to stop at the required point at a station.

Similarly in street car work: The profit that can be derived from a set of rails in a busy district is as much a question of retardation as of acceleration. The automobile moving rapidly in and out of city traffic places, perforce, great dependence on its brakes, and actually good braking contributes greatly to the feeling of liveliness. A car with good acceleration, but sluggish retardation, does not feel as lively as one with both good.

Co-efficient of adhesion of average rubber tire, with good macadam, asphalt, concrete or brick road, 0.5.

Maximum retardation car should be capable of 10 ft. per sec. per sec.

Usual retardation for slow down or stop, 6 ft. per sec. per sec.

With pedal push a man can exert in properly designed seat, 300 lb.

With lever pull a man can exert on brake lever upward of 100 lb.

Efficiency of average brake linkage allowing for usual weak system of lubrication, about 75 per cent.

Radiation that should be provided for long hills, about 200 B.t.u. per minute per ton weight of car.

Retardation can be studied under two heads:

A—Retardation relative to the road.

B—Retardation relative to the forces acting on the car.

The primary object of the former is to slow down and actually stop the car.

The object of the second is to maintain the vehicle at a steady, safe speed, notwithstanding the forces, such as effect of gravity on a hill, that are tending toward acceleration. Both actions have special characteristics which will be taken up separately.

Tire Adhesion Figures

Obviously, the first consideration is the boundary between the car and the road—the co-efficient of adhesion or friction of the tire. This varies greatly; the shape of the tire, the nature of its tread, whether it be solid or pneumatic; the compound of rubber used, play their share in varying this; and the very fact that the road surface ranges from cement or vitrified brick to greasy mud makes us realize how impossible it is to give figures which mean anything. Curiously, pneumatic tires have a co-efficient differing from that of solid tires, the writer having found it sometimes higher, sometimes less.

George Watson, before the English I. A. E., January, 1916, gives 0.4 as the maximum adhesion of solid rubber tires on good macadam. Other authorities state that 0.6 is the figure for pneumatic tires. The writer has found an adhesion of 0.6 for solid rubber tires on cement and vitrified brick roads, and only 0.5 under similar conditions for pneumatics. The measurement of tire adhesion is, however, inextricably mixed up with that of road resistance, the number of factors entering in being exceedingly large. A convenient and accurate standard to assume is 0.5, and this is concurred in by several authorities.

I have been careful to use the term adhesion in the foregoing as specially applicable to the case where the tire does not slip relatively to the road. When the tire slips the proper term is friction. There being no relative motion between the surface of the tire and the road (the road moving back at the same speed as the tangential velocity of the car), it is obvious that the case is analogous to the body at rest on an inclined plane. The co-efficient of stiction or adhesion is greater than that of friction. Incidentally, this partly explains why a car stops more rapidly when the wheels are kept moving than when they are locked.

Road Resistance

Nature has been very good on the whole. Smooth asphalt, concrete, brick, good macadam, which offer little resistance to the passage of the car, have fortunately a good co-efficient of adhesion when dry, thus offering fair compensation. As is well known, road resistance ranges from 5 lb. to over 300 pounds per ton. It is a factor which must be considered in the study of retardation.

Wind Resistance

This may very conveniently be taken as $0.002\ Av^2$ in pounds, where A is projected frontal area in square feet, usually about twenty-five square feet. Again, this is a variable depending on wind velocity and direction. Strictly speaking, it should always be considered, but its effect is small and may

be left out in comparison with the other important items.

Possible Retardation

Given brakes on all wheels, and neglecting road resistances, we would have a retarding force of 0.5 W.

Whence from the inertia formula $F = \frac{W a}{g}$

we have the retardation $= 0.5\ g$

or 16.1 feet per sec. per sec.

The average car has, however, the brakes on the rear wheels only. Its weight is distributed equally on front and rear wheels as a rule.

The retarding force is then $\frac{0.5\ W}{2}$ and thence

the retardation is $0.25\ g$

or about 8 feet per sec. per sec.

With this latter we have that

	Stopping time.	Stopping distance.
A car going 60 miles per hour....	11 Secs.	484 Ft.
A car going 30 miles per hour....	5½ Secs.	121 Ft.
A car going 15 miles per hour....	2¾ Secs.	30¼ Ft.
A car going 5 miles per hour....	.625 Secs.	4½ Ft.

The presence of road resistance, wind resistances, and chassis losses will bring this figure of 8 feet per sec. per sec. up very closely to 10 feet per sec. per sec. deceleration, so that a car traveling at 30 miles per hour will stop in 4.4 seconds and cover about 97 feet.

Comfort in Brakes

Everyone has experienced the peculiar feeling of being shot forward in the seat when brakes are suddenly and strongly applied in railway train or street car. The eyes have not prepared the body to brace up against the action, whereas in an automobile the eyes are usually on the alert and the body is well prepared for violent retardation.

Yet, in railroad service the best stop is that recorded in March, 1914, when a Pennsylvania train experimenting with a new type Westinghouse brake stopped in 1000 feet from a speed of 60 miles per hour. This took 22¾ seconds and was a retardation of only 3.87 feet per sec. per sec.

Experience has shown that an acceleration or deceleration of 6 feet per sec. per sec. is about all that can be borne in comfort by passengers. There are naturally many who cannot even bear this, and many who can bear much more. It is interesting to note en passant the terrific velocities that man can stand, but the very small changes in it.

Extreme change, such as stoppage against a stone wall, will catapult passengers out of their seats with great violence. Six feet per sec. per sec. is on the verge of discomfort; it is, I think, reasonable to believe that 10 feet per sec. per sec. is the maximum that should be cared for. This, by the way, is equivalent to an applied horizontal pressure on the passenger of about one-third his weight. So with the chassis. The inertia effects on the body fastenings, engine and transmission fastenings are usually based on the acceleration at low speed, and this is very rarely more than 10 feet per sec. per sec., the equivalent of a 30 per cent. grade.

Four-Wheel Brakes

It is thus seen that for the average vehicle there is little to gain in putting brakes on more than the two rear wheels. It is true that they could be so adjusted that the braking friction were only half what it might be, but this is exceedingly difficult to determine and keep in adjustment, and there is real danger in excessive retardation being produced under the normal circumstances of driving over dry roads. Railroad conditions are not analogous, as a co-efficient of adhesion of 0.2 is about all that can be reckoned on against our 0.5 to 0.6 on rubber-shod automobiles.

Two-wheel brakes, provided they function properly and are used intelligently, will give all the retardation that it is safe to use. This is not, of course, the only reason why all-wheel brakes have not been adopted generally, but it is one of them.

Truck Brake Considerations

The foregoing remarks have dealt mostly with a car whose weight is distributed equally fore and aft. The passenger load is usually a small percentage of the gross weight, and there is an obvious limit to the human capacity of the space. The truck is often twice as heavy when loaded, and overloading to the extent of double the rated amount may occasionally be met with, though this evil is, I think, getting less.

There are still a few trucks whose load is more or less balanced between front and rear wheels, but they are in the minority. The load is most usually carried 75 per cent. and upward on the rear axle, and it is this the designer must pay attention to. The weight of a truck is in no proportion to its load. A two-ton truck with body may weigh 6000 pounds, or 1.5 times its load, whereas a five-ton truck with body may weigh 10,000 pounds, or equal to its load.

Each truck, therefore, must be considered individually, and the final braking effort on the circumference of the rear wheels be made equal to at least 0.5 times the loaded weight at the rear wheels. Assuming the speed of the truck at fifteen miles per hour, this will stop the truck in about thirty feet, without causing the load to pile up behind the driver's seat. This should be short enough for any board of councilmen, and should preclude the necessity for providing safety guards or fenders.

The Personal Equation

The human element in producing retardation is very great. Brakes must be skillfully applied, so that under varying road conditions the pressure is just enough to not lock the wheels, otherwise a dangerous skid might result. Women are driving cars in increasing numbers. They are unable to exert the same pressure on pedal or lever that a man can. Designers must awaken to this problem. If a light pressure is given, brakes must be adjusted more often, unless some mechanical or electrical means be supplied for assisting the human strength. As stated, this must be very delicately arranged to give perfect gradation of pressure, but the problem should not be impossible of solution.

Continuous Braking

The question of absorption of energy has been ignored in the foregoing, inasmuch as the time interval is short, and the material surrounding the brakes well capable of taking up the heat developed. On a long hill, where brakes are applied continuously, the problems that arise are different. Here there is no question of inertia effects, or of skidding, or of stopping space available; the great question is one of absorption of energy and hence radiation of heat.

At the top of a hill a car possesses both kinetic and potential energy. If at the bottom the car's speed is unchanged, then the brakes, plus the road resistance, have absorbed the potential energy. The weight of the car plays an enormous part in this, the absorption of energy being in direct proportion to it. Whilst the truck lacks the speed of the touring car, it makes up for it by weight in hill descents, and the retardation problem is the more difficult.

A Specific Hill

There are many hills 10 per cent. grade and one-half mile long. A five-ton truck, gross weight 20,000 pounds, has a gravitational component down hill approximately 2000 pounds. Assuming a road resistance of fifty pounds per 2000 pounds, or 500 pounds gross, we have a net force tending to accelerate the truck down hill of 1500 pounds.

If a safe speed of ten miles per hour is maintained the

time of descent is three min. The energy absorbed by the brakes is 1500 x 2640 ft. lb.

Or at rate of 1,320,000 ft. lb. per min.

Or 40 H. P.

Or 1700 B.t.u.'s per minute.

Take now the fact that approximately fifty pounds of metal with a specific heat of 0.12 absorb this, we have enough heat generated in three minutes (neglecting radiation) to raise the temperature of the mass from 60 deg. Fahr. to 900 deg. Fahr.

In a practical corroboration it was found there was one square foot of radiating surface from which the balancing temperature was calculated to be about 760 deg. Fahr.; the surface at the foot of the hill was certainly nearly that, being a black heat.

There are hills much worse than this in length and grade, the only salvation being the use of the engine, alternating with hand and foot brake. For the great majority of touring automobile work the normal brake is satisfactory, but for hilly and mountainous districts there is still much to be done. European designers have been well aware of this, some of the Italian designers whose testing grounds were the Swiss Alps have even gone the length of water cooling their brakes, both by drip and by waterjacket.

Auxiliary Brakes.

Only one truck, and that one of Swiss design, has attempted to solve this problem, and that by means of a device which shifts the camshaft longitudinally, converting the engine into what is really a two-cycle air compressor, the carburetor being shut off and fresh air admitted through a manifold port.

From time to time brakes working on a hydraulic principle have been devised, but always there has been the problem of cooling the liquid and insuring the tightness of pipes and joints.

It is the writer's impression that as the country roads get opened up more, and trucks are used in outlying districts, a demand will arise for a third brake for hilly districts. This will enable the vehicle to coast down a long incline at a predetermined safe speed, with no wear and tear on the engine or undue heating of the brakes.

Discussion of the Paper

At the meeting the chair was taken by B. B. Bachmann, and although the attendance was not very large it was obvious that every member present was very keenly interested in the paper. The discussion was opened by A. Ludlow Clayden, engineering editor of THE AUTOMOBILE, who took up the subject of brake materials, asking whether Mr. Younger had any data with respect to their relative qualities. He pointed out that the usual kind of brake lining is a fairly good heat insulator which means that most of the heat generated in the brake has to be dissipated by the drum since the brake band or shoe is to some extent insulated by the lining. He said that metal brake surfaces were still the most extensively used in Europe and that all kinds of materials had been tried. Cast iron is the most usual but phosphor bronze has been used, and one brake for which great claims were made had the shoes faced with alternate sections of different materials. Trials were made with half the brake surface cast iron in sections about 2 in. by 2 in. and the other half phosphor bronze, white metal, aluminum, and, finally, compressed asbestos fabric.

The last time the speaker had any information from Europe regarding this brake the cast iron and fabric segments were proving very satisfactory, it being stated that the bonding material in the fabric seemed to spread a little over the iron, preventing rust. Also, it was said that the brake operated without the scrape usually associated with a plain iron brake.

Another point which is not often appreciated is the great theoretical advantage of diagonal braking. This consists of having brakes on all four wheels, so connected that one control operates the right front wheel and the left rear wheel simultaneously, the other control operating the other pair. The object of this layout is that as soon as either the front or rear wheel ceases to revolve it loses its power to direct the line of motion of the car. If both back wheels or both front wheels are locked the car is unsteerable, but with diagonal linkage it is possible to lock one pair and still have one wheel on each axle rolling freely and therefore available for steering.

The disadvantages are purely mechanical, the link system becomes very complicated and the brake is costly.

L. Goldmerstein, editorial staff, *A. S. M. E. Journal*, supported Mr. Younger's contention that it would be essential to have two sorts of brakes, one intended for rapid stopping and the other for the descent of long grades. He described a possible form of brake with which he has been experimenting wherein power is absorbed by a reciprocating piston which draws oil into a cylinder and then expels it through a small valve, the lift of which is controllable. This raises the temperature of the oil and the heat can be dissipated by any convenient means. One way he suggested was to extract the heat by making the oil do work such as the driving of a fan.

Regarding the conductivity of linings, this undoubtedly was very poor but the most remarkable fact was that the conductivity decreased as the intensity increased. The soft linings were much better conductors than the hard ones. This doubtless was due to the action of the air which would be contained in considerable quantities between the meshes of the softer fabrics.

Truck Brake Requirements

E. R. Whitney, chief engineer, Commercial Truck Co. of America, said that in designing brakes for trucks it was essential to make them so that a considerable effort was required to apply them. At one time he said his company had fitted a brake of exceptional power and discovered very quickly that truck drivers were using it so viciously that severe damage was being done to the mechanism generally

In his reply Mr. Younger said that he agreed entirely with the last speaker and that he had discovered a brewery truck driver, whose services he had enlisted for the purpose of experiment, was able to exert a pedal pressure of 400 lb. Regarding brake materials, it was undoubtedly a fact that the usual linings were good insulators and this he thought accounted for the rapid wear on brake drums with cars used in mountainous districts. He pointed out that with an internal and an external brake on the same drum all the radiation from the drum is limited to its inner edge and said that he had known a case where the drum had got so hot that it had parted all around the edge, the ring separating from the disk. Cases where the spokes of a wood wheel had been blistered were also not uncommon. Up to the present he had not been able to find any material better than cast iron for facing the shoe of the propeller shaft brake on a truck.

Drum Surface a Factor

One important thing which seldom received any consideration, was the nature of the surface of the brake drum. Evenness of wear he said was affected profoundly by the nature of the surface when the drum was new. If the brake drum is merely turned it is left covered with minute but very sharp points and these exert an unnecessary cutting action on the shoes or band. If the surface of the drum is ground to a fine polish the surfaces will last longer.

Concerning Mr. Goldmerstein's remarks about the conductivity of fabric, this explained something which he had noticed and which had puzzled him. This was that the softer linings appeared to suffer less from prolonged heating, as in the descent of a mountain, than did the heavily compressed fabric, although the latter was much more durable in ordinary stopping service where long grades were not encountered. After prolonged heating, the compressed fabric appeared liable to disintegrate in some way.

Alcohol—The Fuel of the Future

Enormous Demand for Gasoline Makes Alcohol and Benzine Potential Developments for Automobile Engine Fuel—Utilization of Wood Waste Offers Vast Supply

By Bernard N. Glick, M. Sc.

EDITOR'S NOTE:—As previously pointed out by Mr. Glick in his article on the manufacture of gasoline from casing-head gas, the increasing demand for gasoline for automobile fuel renders the development of other fuels imperative. In this article the author reveals many interesting possibilities in the production of alcohol and benzine suitable for fuel purposes, dwelling especially on the enormous supply of wood waste as a source of alcohol.

WITH approximately 3,000,000 motor vehicles doing duty in the United States, from 1,000,000,000 to 1,200,000,000 gal. of gasoline have to be provided annually to keep them running. There are unmistakable signs that the production of this enormous volume of gasoline will become increasingly difficult and as a consequence there is in the minds of many automobile engine students the vague thought that gasoline, while the fuel of to-day, may have to give way to some other product to-morrow. In this connection it is comforting to know that there is a substance already well known, which can take the place of gasoline and run these automobiles just as efficiently, and perhaps more so.

The substance that thus stands out predominantly as the fuel of the future is alcohol. This product has long since passed the stage where its suitability was questionable, the only thing retarding its adoption being its high price, due to the raw materials now used and the limited use to which it is put at present. With a growing demand, such as will arise when the price of gasoline becomes abnormally high, we anticipate a search for cheaper methods of production and for raw materials which will give it in sufficient amounts to meet the enormous demand that will exist for a suitable fuel for internal combustion engines.

The question of the suitability of alcohol as a source of power in internal combustion engines has been sufficiently established by long series of tests conducted by various groups of experimenters. The United States Bureau of Mines has done magnificent work in this direction and many of the following figures comparing gasoline and denatured alcohol are taken from the results of their painstaking efforts to help solve the fuel problem of the future. Although the calorific power of alcohol is little more than one-half that of gasoline —about 11,160 and 20,900 B.t.u. per lb. respectively—its greater efficiency—alcohol 28 per cent; gasoline 16 per cent—compensates for this. This higher efficiency of alcohol is due to various causes, chief among which are the following:

Less Air Required

1—The volume of air required for complete combustion of alcohol is only about one-third that required by gasoline, and thus much less energy goes away in the exhaust. Moreover, this smaller dilution with air enables a more perfect mixture to be formed with consequent more perfect combustion.

2—The alcohol-air mixture can be safely subjected to pressures of 200 lb. per square inch without spontaneous ignition, whereas the safety limit for gasoline is 80.

3—All mixtures of alcohol and air containing from 4 to 13.6 per cent of alcohol are explosive, whereas the explosive range for gasoline is from 2 to 5 per cent, necessitating much more careful carbureter adjustment.

4—The combustion products of alcohol are smokeless, almost odorless, and do not clog up the cylinders and valves.

Gasoline for Starting

The only serious difficulty encountered would be the starting of the engine in cold weather and this could be provided for by carrying a small auxiliary gasoline tank to be used in starting.

Raw Materials Abundant

The possible raw materials for alcohol production are unlimited, for anything containing starch, cellulose or sugar can be utilized. In the case of starch we are limited at present to established crops, and the cost of the raw material from such substances as potatoes, maize and rice includes raising the crop, harvesting it, transportation to the distillery and the final conversion there to alcohol. As a consequence the cost of the raw material is too great, varying as it does from 12 to 25 cents per gallon of finished alcohol.

With cellulose and sugar we are able to make use of by-products of other industries where all the above charges are rightly charged to the main industry, and so with the cellulose waste of the lumber industry, finished alcohol can be produced under present conditions at from 13 to 19 cents per gallon, and from the sacchariferous waste of the sugar industry at approximately 15 cents a gallon.

Around the forests, the fields and sawmills of this country there are millions of tons of waste material now allowed to rot or burn, to get rid of what is in many cases considered a nuisance. Various forms of vegetation, which with the aid of the chemist could be rendered valuable sources of fuel supply, are allowed to die, having served no useful purpose during their existence.

Wastes from paper mills, comprising millions of gallons of liquor containing sufficient fermentable matter to be worthy of exploitation, are allowed to pour into the rivers, impairing their beauty and constituting a menace to the fish in them.

Crops of all sorts, corn, maize, oats, barley, potatoes, rice and many others could be increased and exploited to produce alcohol as a fuel, while the sugar industry could furnish thousands of tons of refuse material eminently suitable for its further production.

Lumber Waste a Vast Supply

Of all the above possible sources, the most interesting, owing to the low cost of raw material, is the waste from the lumber industry, particularly that in the form of sawdust or small chips. This material in the vicinity of sawmills or woodworking plants is often an item of loss owing to its

production in excess of their own power requirements, its value never rising above 50 cents per ton, even when used as a source of power. The disposal of this superfluous waste from figures gathered by the Forest Products Laboratory at Madison, Wis., costs from 30 to 66 cents per cord of 1800 lb., the total annual loss from this cause amounting to about $6,000,000 annually, in addition to the value of the wood so burned. This represents an annual wastage of approximately 15,000,000 cords of wood and constitutes only about 50 to 60 per cent of the total waste material produced in this form. Thus we see that there is produced annually in the United States waste material amounting in volume to about 30,000,000 cords, or around 27,000,000 tons, which is now burned as the easiest method of getting rid of it.

Wood Alcohol Useless as Fuel

From experiments which have been carefully conducted by various experimenters, a ton of dry sawdust has been found to yield with proper treatment around 20 to 25 gal. of 95 per cent alcohol (ethyl or grain alcohol, not wood alcohol, for this latter is useless for fuel purposes owing to the formation of products of combustion which would wreck the cylinders) and we could have therefore an estimated production from this source alone of around 500,000,000 gal. annually. If we add to this the amount of wood wasted in the form of stumps and branches sufficiently thick to be barked, which on a conservative basis is equal in amount to the sawdust and chips produced, we would get from this "waste" wood a volume of alcohol almost sufficient to supply with fuel even the stupendous number of automobiles at present in use.

Process Now Used

The process now used for the production of ethyl alcohol from wood consists first of all in hydrolyzing the hogged and shredded waste with dilute sulphuric acid at a steam pressure of about 60 lbs. for a short time. This is done in rotary digestors, made of steel boiler plate with an acid proof lining to insure a thorough mixing of the wood and acid. In this operation a portion of the wood is converted into a mixture of sugars, some of which are fermentable. The digested mass is then transferred to a diffusion battery where the sugar and other soluble material is extracted. The acid extract is neutralized with lime or limestone. and a heavy sludge of calcium sulphate is formed, leaving a neutral sacchariferous liquor on standing. The clear solution is drained off and fermented with yeast, and the alcohol produced separated by fractional distillation and rectified in the ordinary way.

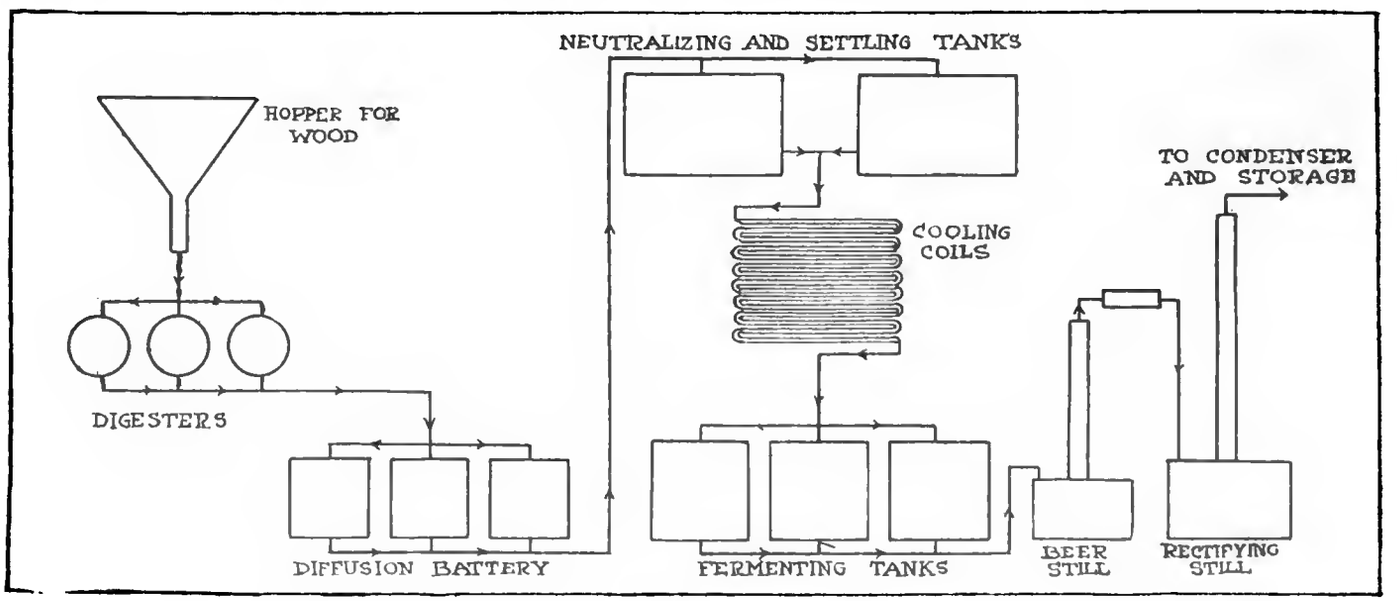
History of Early Work

The first known attempts to produce sugar from vegetable matter were those of Braconnot in 1819, and since that time many have worked, experimental plants have been built and operated, all to meet with failure owing to lack of scientific and engineering knowledge. In 1898 Simonsen published the results of his investigations using very dilute sulphuric acid as the hydrolyzing agent and claimed to have got an amount of alcohol equivalent to 6 per cent of the weight of dry wood used. A small plant was built in Christiania to try out his process but failed owing to the extreme dilution of the acid used, thus making the handling of the large volume of liquor produced uneconomical.

Some time later Classen developed a process in which sulphur dioxide was used as the hydrolyzing agent. This process is interesting for it marked the beginning of the development of this industry in America, for the American rights of the Classen patent were acquired by a Chicago concern in 1903, which, after experimenting, erected a plant at Hattiesburg, Miss., costing about $250,000 to operate on longleaf pine sawdust.

Process Successful if Correctly Used

This plant was a failure for a number of mechanical and technical reasons. Ewen & Tomlinson, who were associated with the Classen enterprise, then struck out on their own and after experimenting with sulphur dioxide in different forms as a hydrolyzing agent, finally abandoned it and went back to dilute sulphuric acid. They erected a plant at Georgetown, S. C., which was later acquired by the DuPont Powder Co. who operated it intermittently until the sawmill in connection with the plant was burned in 1913. While a new mill was being erected they devoted a considerable amount of time and money to research on the problems involved and the result is evidenced by the fact that they are now producing over 2,000,000 gal. per annum of absolute alcohol at a nice profit. Other plants have been built in the west by men without knowledge of the requirements of the process and without adequate technical supervision, and have met their inevitable fate. In fact, as long as the development of this process, which requires the highest type of engineering and chemical skill, is left in the hands of men



Diagrammatic layout of a plant for the manufacture of alcohol suitable for automobile fuel from wood waste

of the stock promoting type, the various attempts made will be failures.

Cost of Production

The Forest Products Department, Madison, Wis., has got up as the result of its experiments, an estimate of the cost of production which is given below. The estimate assumes a yield of only 20 gal. of alcohol per ton dry waste, costing 40 cents per cord of 1800 lb. and a location where the supply of waste is uniform and constant for a period of 20 years, with good water facilities and a fairly close supply of sulphuric acid and lime. In such a place, a plant properly designed and constructed, of 2500 to 3000 gal. daily capacity, will yield alcohol of 95 per cent purity at a cost of 13.7 to 19.5 cents per gallon. These figures certainly seem to justify their serious consideration by lumbermen and capitalists, for there certainly seems to be all the necessary factors for successful exploitation here. Some impetus is required though, to get things started and, as stated above, that impetus will surely come when gasoline sticks too long at an inordinately high figure.

The tests and results referred to were for engines designed for the use of gasoline as a fuel, the use of alcohol not having been considered. Were this done, however, and engines capable of taking advantage of the various factors favoring alcohol used, particularly taking into account the greater efficiencies possible, using an engine capable of working at compressions up to 200 lb., it is very likely that after as much time and study had been devoted to perfecting such engines as has been hitherto devoted to those using gasoline, a comparison even more favorable to alcohol might be the result.

Numerous other tests have been performed using mixtures of alcohol with other substances, the most important being benzine. It has been found that such mixtures are superior to either alcohol or benzine used separately, the most effective mixture being that formed by mixing one part of alcohol with one part of benzine. As evidence of this two series of tests may be quoted.

Germans Use Alcohol

In Germany since the war began a considerable shortage of gasoline has developed and substitutes had to be devised. Alcohol is fairly plentiful there, being made from potatoes, while benzine is recovered in a very thorough manner from their by-product coke ovens. It was natural then that they should turn to these for a gasoline substitute. From a series of tests with a Mercedes car of the 1914 touring model having an ordinary carbureter, the following results were obtained.

Fuel	Speed per Hr. (Miles)	Distance Covered on 1 Pint Fuel (Miles)
Gasoline	44	3.60
Benzine	42	3.79
1 pt. benzine 1 pt. alcohol	42	4.66
1 pt. benzine 2 pt. alcohol	41	4.47
1 pt. benzine 3 pt. alcohol	39	4.34
1 pt. benzine 4 pt. alcohol	38	4.10
1 pt. benzine 5 pt. alcohol	36	3.72

Difficulty was encountered in starting the car on the above mixtures and this was overcome by carrying a small auxiliary tank containing gasoline for use in starting. The mixture of alcohol and benzine in equal proportion was found to be decidedly superior to gasoline, and calculated at before-the-war prices, was more economical, too.

W. T. Ormandy ran a series of similar tests on a four-cylinder Maudesty engine (90 by 130 mm. with compression space about 25 per cent of total cylinder volume) and expressed his results as follows:

Fuel Used	Power Gasoline = 100	Volume of Fuel Used Gasoline = 100
Benzine	98.25	84.5
1 benzine 1 methyl sp	99.0	96.3
1 benzine 2 methyl sp	92.0	108.9
1 benzine 3 methyl sp	91.5	124.5

Sp. gr. gasoline 0.710. Sp. gr. meth. sp. 0.815. Benzine used 90 per cent. Sp gr. 0.885. Engine run at 1000 and 2000 r.p.m.

These tests are typical of a number of others and show that mixtures of alcohol and benzine make eminently suitable fuels for even engines built to use gasoline, and that were it possible to produce sufficient benzine the most favorable mixture would be that containing equal amounts of the two.

Possibilities of Benzine

Benzine has long been known as a possible automobile fuel and it is ready to step into the breach as far as possible. The chief factors militating against its use alone are first of all, the unfortunate fact that it solidifies at 5.4 deg. Cent., or 41.7 deg. Fahr. and would thus be useless in cold weather and, secondly, that the maximum possible production at present is about 100,000,000 gal. annually or less than 10 per cent of the amount of gasoline now used. This is not because more could not be produced, for the raw material, coal, is here in abundance, but is due to the fact that only a small percentage of the coal burned annually is burnt in such a way as to allow of the recovery of the benzine from it. If the coal consuming public could be educated to the use of coke for heat and power production, thus allowing of the burning of coal at central stations, as is now being suggested in England, with the recovery of all the by-products, coal gas, benzine, toluene, carbolic acid, naphthaline, creosote anthracene, etc., that now go up in smoke, there could be produced sufficient gas to materially reduce its present price to consumers, benzine enough to use in conjunction with alcohol to replace gasoline and still enough left over, along with the other products, to put the budding American dye industry on a firm independent footing.

Before the war benzine was selling in the neighborhood of 17 cents per gal. and would therefore reduce if anything the price of alcohol with which it were blended. The raw materials for both these, wood and coal, exist here in abundance, both could be obtained as by-products of some other industry, and both at present are produced in insignificant amounts, owing to the lack of initiation and enterprise that are necessary for their production in worth while amounts. If properly developed to their fullest possible extent they would effectively lay the ghost of the failing gasoline supply.

Piston Progress Illustrated

The advance in piston design made in the past five years is brought out strikingly in the two pistons illustrated above. That at the left was used in the six-cylinder Oldsmobile Limited for 1911 and 1912. It was of cast iron and weighed 6 lb., 14 oz. That at the right is the 9 oz. aluminum piston used in the new eight-cylinder Oldsmobile.

Constant Pressure Cycle Truly Efficient

Criticisms of Suggestions Founded Upon Unsound Basis—A Reply to J. L. Napier

By Arthur B. Browne and Herbert Chase

THE criticism written by James Langmuir Napier entitled "The Truth about the Constant Pressure Cycle," which appeared in the August, 1916, issue of *The Automobile Engineer*, and was reprinted in THE AUTOMOBILE, attempts to promulgate so many half truths and contains such wholly unwarranted attacks upon statements made in papers read before the (American) Society of Automobile Engineers and the (British) Institution of Mechanical Engineers, that we cannot permit it to go unchallenged.

Holding up to ridicule what he terms a "quasi-scientific" statement made by Mr. R. M. Neilson,* a former associate of Mr. Dugald Clerk and a member of the Institution of Mechanical Engineers, and charging "neglect of elementary principles" in our paper entitled "Possibilities of the Constant Pressure Cycle," Mr. Napier proceeds to ignore every detail and refinement of the proposed constant pressure cycle save those which, by wholly impracticable comparisons, could be made to subserve his own arguments. He then closes with a diatribe against a "burner" which by actual operation, under conditions more exacting than those of its application to a reciprocating engine, is daily proving the superficiality of his judgment. In order that the truth may prevail we offer the folowing:

*The reference cited was taken from a paper entitled "A Scientific Investigation Into the Possibilities of the Gas Turbines" which was presented in October, 1904, before the Institution of Mechanical Engineers, of which Mr. Neilson was then an associate member. Among those who discussed Mr. Neilson's paper were Mr. Dugald Clerk, Prof. F. W. Burstall, Mr. James Atkinson, Col. R. E. B. Crompton, C.B. These gentlemen would hardly have allowed Mr. Neilson's figures on the constant pressure cycle to go unchallenged if they were not well founded in fact.

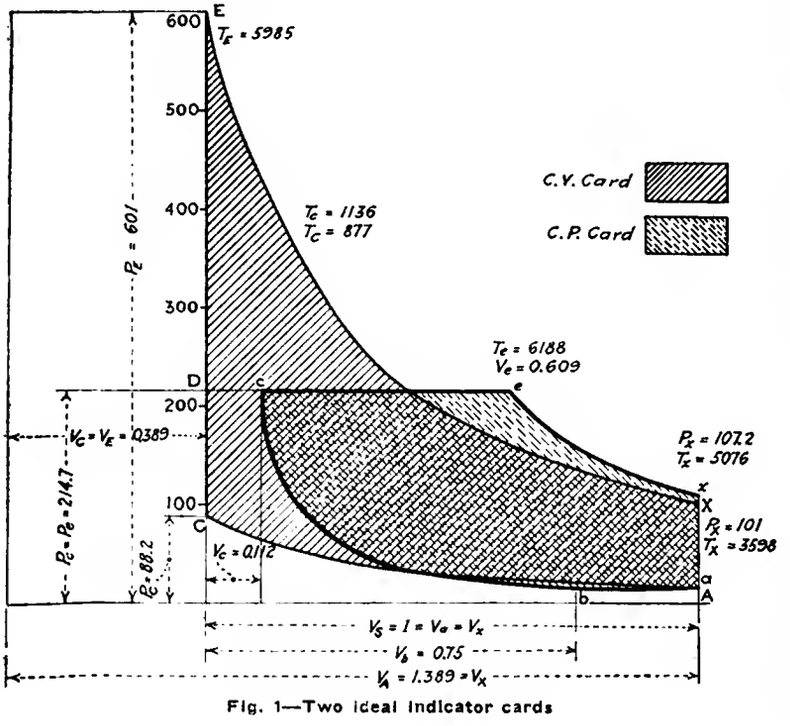


Fig. 1—Two ideal indicator cards

Engines operating upon the constant volume cycle have practical limitations of compression pressure, owing to preignition difficulties and high maximum pressures which do not occur in engines of the proposed constant pressure type.

In the proposed constant pressure cycle the thermal efficiency increases as the load decreases, a most important condition not found in the constant volume cycle.

The proposed cycle renders practicable the utilization of exhaust heat by which means its ideal efficiency is rendered higher than that of any cycle now in use, a fact entirely overlooked by our critic.

The proposed constant pressure cycle is so well adapted to a two stroke cycle that its power output may be made greater for a given bore and stroke than that of the constant volume cycle whether the latter operate on a two or four stroke cycle.

Engines operating upon the proposed cycle are readily adaptable to the use of the heaviest and cheapest liquid fuels which are wholly unavailable in constant volume engines.

The proposed cycle provides means for proportioning the negative work to the work of the cycle. This permits of its use under widely variable loads and enables use of a variable cut-off without throttling.

The proposed cycle also permits of manual modification of two dimensions of the P V diagram. It is thus more flexible than the constant volume cycle.

These conclusions are best proved to practical engineers by comparing the cycles in engines of equal bore and stroke. With petroleum fuels so largely used in modern constant volume oil engines, a compression pressure much is excess of 75 lb. gage is seldom used because of the danger of preignition. Hence an absolute pressure of 6 atmospheres (88.2 lb.) is taken for the purpose of comparison as representing a rather high average. As opposed to this a compression pressure of 200 lb. gage is taken as being a very conservative value for an engine of the constant pressure type, since no serious structural consideration can be advanced against maximum pressures so far below those inherent in the constant volume type. To compare, as does our critic, engines using equal compression pressures is as impracticable as is the comparison of a Diesel engine with one of the constant volume type, using Diesel compression pressures. The constant volume oil engine is necessarily a low compression type while the constant pressure engine is essentially a relatively high compression type.

The two ideal cards shown in Fig. 1 are drawn to scale using strokes of equal length, the compression pressures mentioned above, and starting compression from one quarter stroke in the case of the constant pressure card. That the unloading valve specifically described in our paper provided means for automatically starting the compression at any point of stroke desired, was a point conveniently overlooked by Mr. Napier. The table given herewith shows the varying work areas and efficiencies obtained in other ideal cards with different compression pressures and with compression starting from different points of stroke.

From this table it is at once evident that the ideal efficiency of the constant pressure cycle increases rapidly as the load decreases. In the constant volume cycle the *ideal* efficiency remains constant at all loads but in practice it is a well-known fact that the *actual* efficiency decreases very rapidly as the load decreases. At light load the actual efficiency may fall below-one-tenth that at full load.

As to the question of efficiency, the figures given prove conclusively that in this particular the proposed constant pressure cycle under the conditions outlined has a decided advantage over the constant volume cycle when the saving resulting from the perfectly feasible use of a portion of the exhaust heat* is taken into consideration. Entirely practicable means for such utilization were clearly shown in the description and diagram of the proposed engine. Since the saving in heat thus obtainable will render the ideal efficiency from 25 to 80 per cent higher *than it would otherwise be*, how utterly worthless are the conclusions reached by our critic when he deliberately disregards this saving and then uses this faulty premise as a basis for redicule! In fact if substantially the same arguments advanced by our critic had been carried to a logical conclusion he would have proved that the efficiency of the Diesel engine is less than that of the constant volume type of engine, whereas we know from long experience that the reverse is true.

The table and cards given herewith show that the net work areas are somewhat less for the constant pressure than for the constant volume cycle. The difference is however almost nil if a somewhat higher compression pressure be taken than that assumed in the constant pressure card shown. This higher pressure *cannot be* used in practice in the *constant volume* cycle without involving difficulties (such as pre-ignition and exceedingly high explosion pressures) not encountered in the constant pressure type.

Furthermore the constant pressure engine lends itself readily to a two stroke cycle. Its power output *per stroke* in this type is substantially the same as in the four stroke type. Hence when running two cycle the power output of a constant pressure engine is greater than that of a constant volume engine of equal bore and stroke, whether the constant volume engine run two cycle or four cycle.

It is a well-known fact that the two stroke constant volume or Clerk type of engine has a power output *per stroke* which is little more than half that per stroke in the four stroke type. This is due in part to difficulties in scavenging without loss of fuel. On the other hand, in the two stroke constant pressure type, running as it does with practically zero clearance, the scavenging may be made nearly perfect, and this without any loss of fuel, since the latter is not added until the beginning of the working stroke. On this basis our contentions that the power per unit of weight of a constant pressure engine may be made greater than that of a constant volume engine of equal bore and stroke, and that for this and other reasons the engine is better suited for automobile propulsion

(*Continued on page* 948)

*Mr. Neilson, in obtaining the figure of 84 per cent ideal efficiency quoted in our paper, contemplated saving a large proportion of the heat in the exhaust gasss.

Table I—Comparative Data for Two Automobile-Engine Cycles

Item No.	CONSTANT-VOLUME CYCLE		PROPOSED CONSTANT-PRESSURE CYCLE							
	Symbol	Num. Value	Symbol	NUMERICAL VALUE						
1	$P'a$	14.7	Pb	14.7	14.7	14.7	14.7	14.7	14.7	14.7
2	$V's$	1	$Vs = Va = Vz$	1	1	1	1	1	1	1
3	$V'a = V'z$	1.389	Vb	0.96	1	0.75	0.50	0.25	1	1
4	$P'c$	88.2	$Pc = Ps$	164.7	214.7	214.7	214.7	214.7	264.7	314.7
5	$I'a$	522	Tb	522	522	522	522	522	522	522
6	$V'c = V'e$	0.389	Vc	0.173	0.1490	0.1118	0.0745	0.0373	0.128	0.1136
7	R	0.0391	R	0.02703	0.02816	0.02112	0.01408	0.00704	0.02816	0.02816
8	$T'c$	877	Tc	1052	1136	1136	1136	1136	1207	1269
9	H	91	h	87.5	91.2	68.4	45.6	22.8	91.2	91.2
10	$M'a$	0.1056	Mb	0.073	0.076	0.057	0.038	0.019	0.076	0.076
11	$T'e$	5985	Te	6102	6188	6188	6188	6188	6260	6322
12	$P'e$	601	Ps (see Pc)	.....	.....	.....	.....	.....	.....	.....
13	$V'e$ (see $V'c$)	.....	Ve	1	0.81	0.609	0.406	0.203	0.666	0.566
14	$P'z$	101	Pz	164.7	160	107.2	61	23	149.8	141.7
									5320	5034
15	$T'z$	3598	Tz	6092	5676	5076	4316	3271		
16	$W'g$	233	Wg	164.7	209	189.6	152.6	95	242	269
17	$W'c$	35	Wc	65.1	75.2	60.2	44.9	29.9	81.8	87.7
18	$W'n$	198	Wn	99.6	133.8	129.6	107.7	65.1	160.2	181.3
19	.....	.....	hz	43.7	41	26.7	14.4	4.8	.37	33.9
20	E	0.399	e	0.421	0.494	0.575	0.638	0.669	0.550	0.586
21	*M.E.P.*	198	*m.e.p.*	99.6	133.8	129.6	107.7	65.1	160.2	181.3

EXPLANATION OF SYMBOLS USED IN TABLE I

The results given in this table are purely theoretical and apply only to ideal cards. The C. P. cycle figurss given in Fig. 1 refer, as will be readily seen, to the calculations made for the third column of figures shown under the heading "Proposed Constant Pressurs Cycls." All pressures in the table ars given in pounds absolute and the temperaturs in absolute degrees Fahrenheit. The comparison between the two cycles is for engines of equal displacement with a stroke of 1 ft. and a piston area of 144 sq. in. Exhaust is assumed to take place at the end of the stroke. Certain assumptions have been made in calculating these results. These ars explained in the following paragraphs, the figures given at the left referring to the corresponding number under the heading "Item No." in Tabis I.

1. Both the pressures are assumed; $P'a$ is the initial pressure for the C. V. cycle and Pb is the pressure at the start of compression for the C. P. cycle.

2. Stroke volume is assumed as unity for both cycles. It will be noted that in the C. P. cycle this volume (Va) includes Vc, the volume of the point where delivery to the receiver begins, there being no clearance in the cylinder.

3. The volume $V'a$ is the total cylinder volume and equals also the exhaust volume for the C. V. cycle.

4. Compression and expansion are assumed to be adiabatic. In the C. P. card the unloading valve remains open from a to b, so that the compression (above atmosphere) starts at b. Also $Pc = Ps$ are the pressures at the end of compression and at cut-off respectivsly.

6. For the C. V. cycle $V'c$ is the volume at both the end of compression and the start of expansion. For the latter $V'c = V'e = V' \div [1 - (P'c \div P'e)]^{0.71} = Ve$. The volume at the end of compression (Vc) equals $Vb\,(Pb \div Pc)^{0.71}$.

7. The constant R for the C. V. cycle is $P'a\,V'a \div T'a$. For the C. P. cycle $R = Pb\,Vb \div Tp$.

8. $T'c$ and Tc are the temperatures resulting from adiabatic compression. $T'c = P'c\,V'c \div R$ and $Tc = Pc\,Vc \div R$.

9. Heat added in C. V. cycle is assumed to be that resulting from complete combustion of a quantity of fuel having a weight equal to one-fiftsenth the weight of air present. Calorific value of fuel is assumed to be 18,000 B.t.u. per lb. In the proposed C. P. cycls a portion of the heat added is recovsred from the exhaust gases. (See note 18.) H and h ars expressed in British thermal units. $H = 18{,}000$ wt. area $\div 15$ and $h = 1200\,Mb$.

10. Wsight of gas hsatsd in C. V. cycle includes products of combustion rsmaining in clearance space, the specific weight of which is *assumed* for convenience to equal the specific weight of air, approx. 0.076 lb. per cu. ft. at 60 deg. F. and 14.7 lb. abs. pressure. In the C. P. cycle gas heated is all air in a cylinder with zero clearance-volume. The volums of gas heated is controllsd at will by varying point of cut-off. $M'a$ and Mb ars the pounds of gas and air respectively heated. $M'a = 0.076\ V'a$. $Mb = 0.076\ Vb$.

11. For convenience in figuring, $T'e$, Te and he (see note 19) ars determined on the *assumptions* (a) that the specific heat of ths products of combustion is the same as the specific heat of air, and (b) that the specific heat remains constant throughout the temperature range. The specific heat of air at constant volume is taksn as $Kv = 0.1689$ and at constant pressure $Kp = 0.2375$. Ths temperature of expansion ($T'e$) equals $T'c + (H \div M'a\,Kv)$. The temperature of cut-off (Te) equals $Tc + (h \div Mb\,Kp)$.

12. Whils $P'e$ is high in the ideal card, its actual value in practice is known to bs much lower than 600 lb. Pc, the maximum pressure attained in the C. P. card, can be controlled at will by simply varying ths prsssure on the unloading-valve spring. The explosion pressure is $P'e = R\,T'e \div V'e$.

13. The volume at cut-off (Ve) in the C. P. cycle equals $Te\,R \div Pc$.

14. $P'e$ and Pe will both be much lower in practice than the theoretical value noted. Ths pressurs of exhaust in ths C. V. cycle ($P'e$) equals $P'c\ (V'c \div V'e)^{1.4}$. For the constant pressure cycle $Pe = Pc\ (Ve \div Ve)^{1.4}$.

15. The theorstical values of $T'z$ and $T'e$ (as well as $T'e$ and Te) are also much higher than in practical engines. The temperatures of exhaust for C. V. and C. P. cycles are respectivsly $P'z\,V'z \div R$ and $Pe\,Ve \div R$.

16. Ths gross area is the total area undsr upper lines of respective cards. The gross arsa of the C. V. cycle is $2.5\ (P'e\,V'e - P'z\,V'z)$. For ths C. P. cycle it is $Pc\,Ve + 2.5\ (Pc\,Vc - Pz\,Vz)$.

17. Negative work is the work of compression in C. V. card and work of compression and dellvery in C. P. card. Ths negative area for the C. V. cycle is $2.5\ (P'c\,V'c - P'a\,V'a)$ and for the C. P. cycle is $Pc\,Vc + 2.5\ (Pc\,Vc - Pb\,Vb) + Pb\ (Va - Vb)$.

18. In the third C. P. card the net work is close to its maximum value when $Vb = 0.75$, hence little is gained, with 214.7 lb. compression pressure, by starting to compress sarlier and by cutting-off later. The net work area for ths C. V. cycle is $W'g - W'c$ and for the C. P. cycls $Wg - Wc$.

19. Piston area = 144 sq. in. One B.t.u. = 778 ft. lb. hz is detsrmined by assuming that the exhaust gases will heat the air supplied to a temperature midway between Tc and Te. The heat recovered from the exhaust (hz) in the C. P. card equals $0.5\ (Te - Tc)\ Mb\ Kp$.

20. Thermal efficiency is the ratio of net work dons to *net* heat added by fuel. The C. V. thermal efficiency is $144\ W'n \div 778\ H$. For the C. P. cycle e equals $144\ Wn \div 778\ (h - hz)$.

21. Ths mean effective pressures equal $W'n \div V'e$ for the C. V. cycle and $Wn \div Ve$ for the C. P. cycle.

The Automobile and Truck Industry In Switzerland

War Has Exerted Marked Effect on the Country—Occupations of People Greatly Changed—Many Plants Have Turned to Motor Vehicle Construction—Sales Opportunities

By E. A. Langdon

ALTHOUGH not involved in the world war, Switzerland, like many other neutral countries in Europe, has been doubly busy since August, 1914. The effects of the war are very clearly visible on life in Switzerland, which is surrounded on all sides by belligerents; and, while officially this Helvetian republic is identically in the same situation as during the first six months of 1914, as a matter of fact the past two and one-half years have witnessed striking changes in the life, occupation and methods of work and business of the people of Switzerland.

To begin: There has been considerable change in the occupation of the people. Before the war a great division of the nation was kept busy attending to the many tourists who visited the country. These people were reduced to idleness almost immediately by the outbreak of the war. Then there were a great many industries, such as lace making, which from the first day of the war on found it difficult both to dispose of the products and to obtain new raw materials for carrying on the work. Thus, thousands of people were forced to look for a different mode of occupation.

Practically No Car Imports

As for importing automobiles into Switzerland, this trade is at present practically nil, because there are sufficient facilities for making all the machines the country requires. Moreover, any merchant wishing to import automobiles would find this a very difficult matter, and practically impossible, for he would be required to furnish a more than ironbound guarantee that the vehicle would in no way be made serviceable, directly or indirectly, to the Central Powers. This is, at the present involved state of Swiss industries, almost an impossibility, because the bulk of Swiss industries are occupied with war contracts of some kind or other, and, all denials to the contrary notwithstanding, the relations between manufacturers supplying the Allies and those working for the Teutons are extremely amicable; hence, the country being anything but divided along lines of the two sides in the war, it would be very difficult to promise that a machine would never be used by someone tied up with the opposite belligerent.

However, while, as just stated, there is practically no importation of automobiles into Switzerland, it is safe to prophesy a considerable trade of this nature for the post-bellum period. The reasons are:

Modernization Going On

Switzerland is being modernized by the war more than it was during the twenty-five years preceding it; industry will be much enhanced; modern ideas will enter the minds of the people, who up to a short time ago were still, in some ways at least, rather conservative. Such a development cannot help creating an increased demand for automobiles. The machines required will have to be well adapted to the peculiar local conditions of this alpine country; the cars will have to be built with low center of gravity, good hill-climbing ability, and a view to the greatest possible fuel economy; they will have to be medium-priced, light, and strong; they will have to be covered by a reliable maker's guarantee; the purchaser will require the presence, within a few hundred miles, of a supply station of reserve parts; the machines will be expected to have complete equipment; they will be easier to sell if they are fitted with large-size tires; they will, considering the standard of quality, have to compare well with French and German makes, which are well known in Switzerland, and which, even if a little dearer, will be given preference in many instances—other things being equal; in short, American automobile makers working for Swiss business will have to win the confidence of the shrewd population of that country.

A Cosmopolitan Center

It would seem, perhaps, that the results of such endeavors could never be proportionate to the efforts, because of the small size and population of the country. This is, however, a very narrow view to take of the situation. In normal times Switzerland is a meeting ground of all Europe, at least at certain times of the year; and an automobile displayed and doing good work in Switzerland serves to advertise one's products to Danes, Poles, Russians, and inhabitants of the Balkan territories. There is nothing which counts as much in European eyes as "the proof of the pudding," and the work of a machine which stands up well under the strenuous requirements of Swiss touring is bound to impress a prospective buyer of automobiles.

In one respect Swiss business is much easier than in other continental countries. Due to the intense contact with foreigners, the number of Swiss who have a command of English is surprisingly large, and it is hardly necessary for a salesman to speak the native language of the particular section of Switzerland he visits.

A Good Light Car Market

It is also possible that after the war there may be a pretty good market for light automobiles, specially suitable for doing occasional dairy work, which can be jacked up and connected to a separator or such implements. As to plowing machines, hoes, etc., the industries requiring such machines are so small that it would hardly pay to carry on a sales campaign for the introduction of such machinery.

All in all, there is no doubt that Switzerland, too, will be a much more important market after the war than before.

The Call for Cars

Speaking of the call for automobiles: The demand from belligerent countries requires no further elucidation. All belligerent nations are anxious to get into their possession as much automobile equipment as possible. Money is no object. The requirements in Switzerland are also created directly by the war. The first circumstance calling for

automobiles is that the supply of freight cars on Swiss railroads is none too ample to transfer the much-increased output of the nation's industries. Motor trucks are needed. Furthermore, there is also an increase of passenger traffic, and while it is almost impossible to obtain statistics at present, when the figures will once be given out they will in all likelihood exceed the foreigners' traffic of peace times. Everyone knows what these remarks refer to. Switzerland has not only become, during these months of war, a highly industrial and efficient manufacturing country, but it has rendered splendid service as an enormous hospital for wounded prisoners who are either sent there to stay or pass through the country to be exchanged as invalids. These men number by the myriads, and naturally require very large transportation facilities.

Troop Transport Requirements

But there is another circumstance which adds to the demand for automobiles. While at peace, Switzerland is at present really on a war footing; many thousands of citizens are continually on border duty. This service includes a very large number of military posts on the alpine peaks on every side of the country, and as the men on duty are there only for short periods the transport of these troops, as well as the supply of food, necessitates the use of numerous motor vehicles.

Thus, in spite of the paralyzing of some industries, the whole population of Switzerland is kept busy, and the automobile is not the least factor responsible for this agreeable state of affairs.

Mention has been made of the difficulty of obtaining raw materials, because each belligerent supplies Switzerland with some materials, but insists that this must be used in no way advantageous to the enemy.

The Allies make the supply of cotton, rubber, etc., dependent on this condition.

The Central Powers take much the same stand with regard to the coal, steel, and oil they supply to the Swiss.

Vehicles of the Truck Type

Time and again the Federal Government has received notes on this subject from both sides; but it would seem—and this opinion has been voiced unofficially by a number of people who are in well-informed places and with whom the writer had interviews—that these notes are sent out by the belligerent governments with the chief intention toward home consumption, while every government in Europe is very glad that Switzerland is neutral and in all probability will remain so until the end of the war.

The machines, as already indicated, are principally built along truck lines, even where they are used for transportation of wounded or invalid prisoners, and where motor vehicles of this type are used they are, as a rule, built on the sightseeing style, which allows for a great number of passengers on one machine. However, there are also special bodies, such as large ambulance wagons, permitting the transport of eight, ten, or twelve men on stretchers. All these trucks are covered and equipped with doors or gatework.

Many Passenger Cars

In spite of the large number of trucks, however, there are a great many passenger vehicles proper being built and used. These machines vary in design and construction, depending on the purpose for which they are destined. Automobiles constructed for field work are as a rule constructed as lightly as is possible for the work they will have to do, and are distinguished by simplicity of design and ample ground clearance, seeing that they will have to do a great deal of work on very poor roadways.

It is a different matter with Swiss trucks. They are built along lines somewhat similar to those existing before the war and are heavy and solid in construction. The reason may be that Swiss engineers have not as yet been benefited by and drawn conclusions from the frontal experiences; but one of the reasons, no doubt, is that the powers purchasing these trucks realize the careful selection of material and labor used in constructing these trucks and order them with a view to specially hard work, such as transporting heavy ordnance, etc. Among the factories specially well adapted for such manufacture are a number of locomotive plants of international repute, although in their case it is not a matter of a factory having changed its complete character, for, of course, there is still a great market for railroad engines in all countries surrounding Switzerland. It would seem, however, that the making of automobiles, especially at the present, is more profitable, offering a fine incentive to all such plants which possess modern machine tool equipment.

Little Munitions Produced

One reason why automobile making has become such a big industry in Switzerland since the beginning of the war is the fact that the Swiss turn out very little munitions, properly speaking. Certain industries, such as watchmaking, which has lost a good deal of its export trade on account of the rise in transportation rates throughout the world, has taken up the making of munition accessories and parts, but none of these is assembled in Switzerland itself; they are sent to the countries of the Entente or Dual Alliance, as the case may be, where they are put together, or fitted together with products of the countries which purchase them. Therefore, the practice of fitting up any old blacksmith shop as a munition factory, as has been done in some countries, does not hold good in Switzerland.

Difficulty in Securing Materials

As mentioned above, there is always a certain difficulty about getting the materials for making automobiles, although this holds true of all kinds of materials, whether they are produced in Switzerland or imported from outside. Hence, the prices of automobiles are very much higher than before the war and seem to be continually on the rise; and, to make matters worse, the sources of materials imported by the Swiss for the purpose of manufacture and export are continually being restricted so as to raise the price of the articles sold to the enemy of the country which happens to sell to Switzerland. The prices of tires and of gasoline are in no way behind those of automobiles, and, if possible, rise more rapidly.

People Want Peace

These facts explain that, while every man in Switzerland is employed and making splendid money, compared with the ante-bellum days, there is not one in the republic who does not hope for the earliest possible close of the war. The Swiss seem to have their doubts as to whether their war-born prosperity will survive the war; but even so, they consider that the general expense of living among a crowd of fighting peoples is far in excess of the benefits. When you ask a Swiss business man for figures he shrugs his shoulders and tells you how many hundred per cent. the national debt per head has increased during the war, due to the need of preparedness all along the border.

Roads Greatly Improved

One of the blessings of the war is a general improvement of Swiss roads. There are now much more motorable roads than before the war. Not that Switzerland was poor in good roads before the war; but there were not enough in proportion to the attractions that country offers to motoring tourists. Furthermore, there were before the war a great number of roads shut to automobile traffic. The war has, in this respect as in so many others, been a great educator to the people in dispelling some old-fashioned prejudices; and in all likeli-

(*Continued on page* 944)

The FORVM

Horsepower Curves for Tractors

By B. W. Moses

THE necessity for an accurate and simple rating for tractors is a subject that is attracting considerable attention at present. When the term 20 hp. is used it may mean almost anything, one manufacturer takes it to mean the actual power at the draw bar, another to mean the number of horses the tractor will actually displace, another the brake horsepower of the motor, while another may even take the A. L. A. M. rating.

In the computation of power the two quantities that must be measured each time are the pull at the draw bar and the speed of the tractor (not of the engine). These two quantities can easily be obtained, the first by some kind of spring scale and the latter by the expedient of laying off distance stakes.

Knowing then that mechanical horsepower is the result obtained by dividing the product of pull in pounds and the distance traveled in feet per second by 550 it is very easy to obtain:

Hp. = 2.666 × pull in thousands of pounds × M.P.H.

And as an approximate rule it might be taken that the horsepower is equal to five times the pull in tons, times the speed in miles per hour.

In the accompanying diagram the draw bar pull in thousands of pounds is laid off horizontally and the mechanical horsepower is laid off vertically, while the radial lines are speed lines. To obtain the horsepower follow the line vertically that corresponds to the draw bar pull until it intersects the proper speed line, then the horsepower is on the horizontal line passing through that point. For example: What is the horsepower of a tractor pulling 5000 lb. and traveling at the rate of 3 m.p.h.? Answer: 40. Follow the lines *A*—*B*.

On the extreme left of the chart the equivalent horse pull is laid off. This horse pull is based on an animal that will exert a pull of 185 lb. while traveling at the rate of 2¼ m.p.h., and is equal to 1.08 mechanical horsepower. If for example it is desired to know what the equivalent horse pull for the above case is, simply extend the line *B* to the left, obtaining a little over 36 horses.

Another feature of the diagram is that of converting feet per hour to miles per hour or vice versa. On the extreme right the speed is laid off in thousands of feet per hour. And through the center of the diagram running vertically is a heavy line. This line might be called the speed line. The speed in feet per hour can be converted into miles per hour by simply finding the radial line passing through the point of intersection of the line expressing the thousands of feet per hour and the speed line. If in the above example the speed had been given as 15,840 ft. per hour instead of 3 m.p.h., the line *C* converts the distance into miles per hour and the problem is the same as before.

The diagram can be used for any power machine at any speed. If however the speed or the power is too great to be found on the diagram, it should be divided by some factor that will bring it down onto the chart and the result is to be multiplied back by the same factor, thus giving the correct power or speed required.

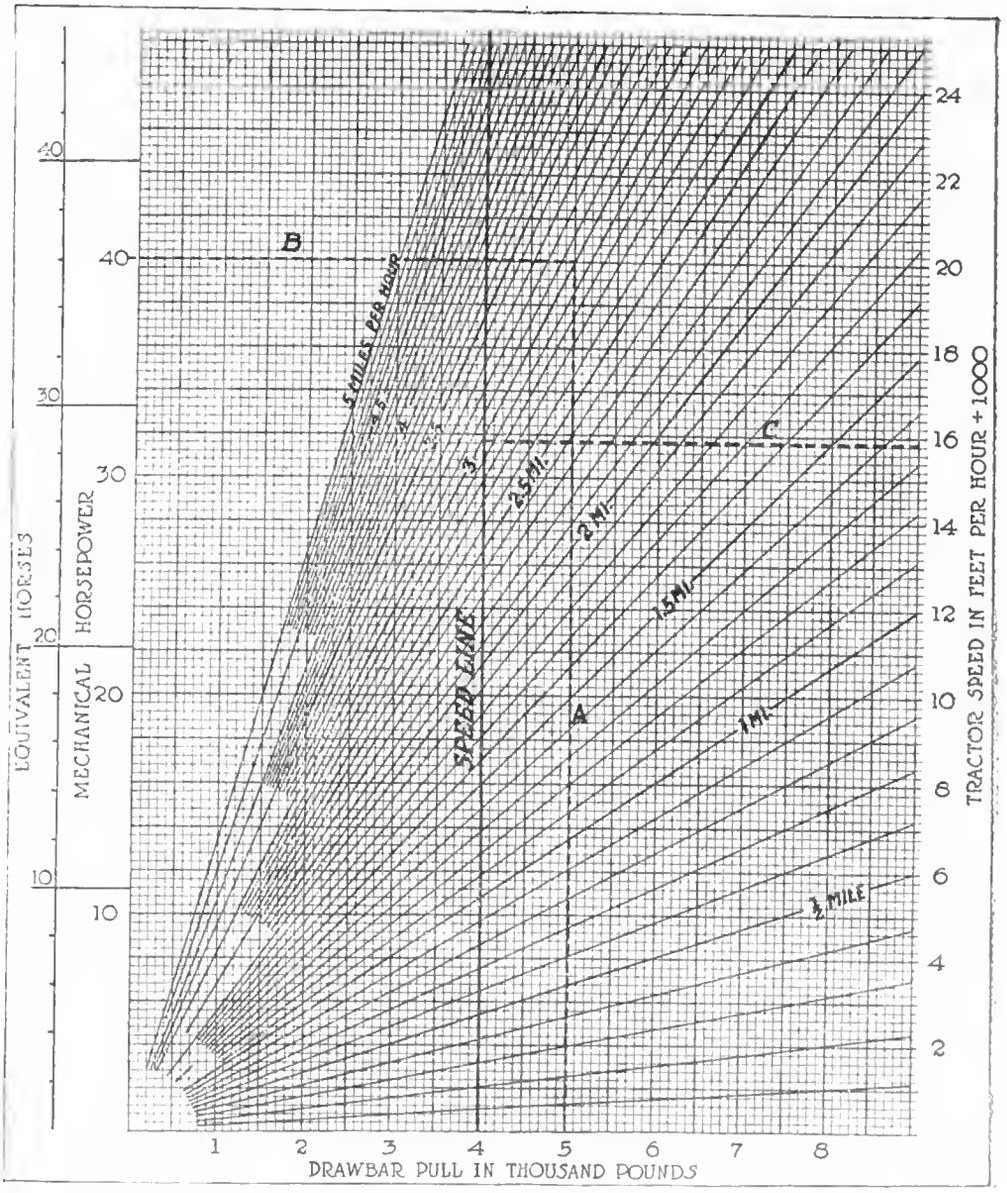
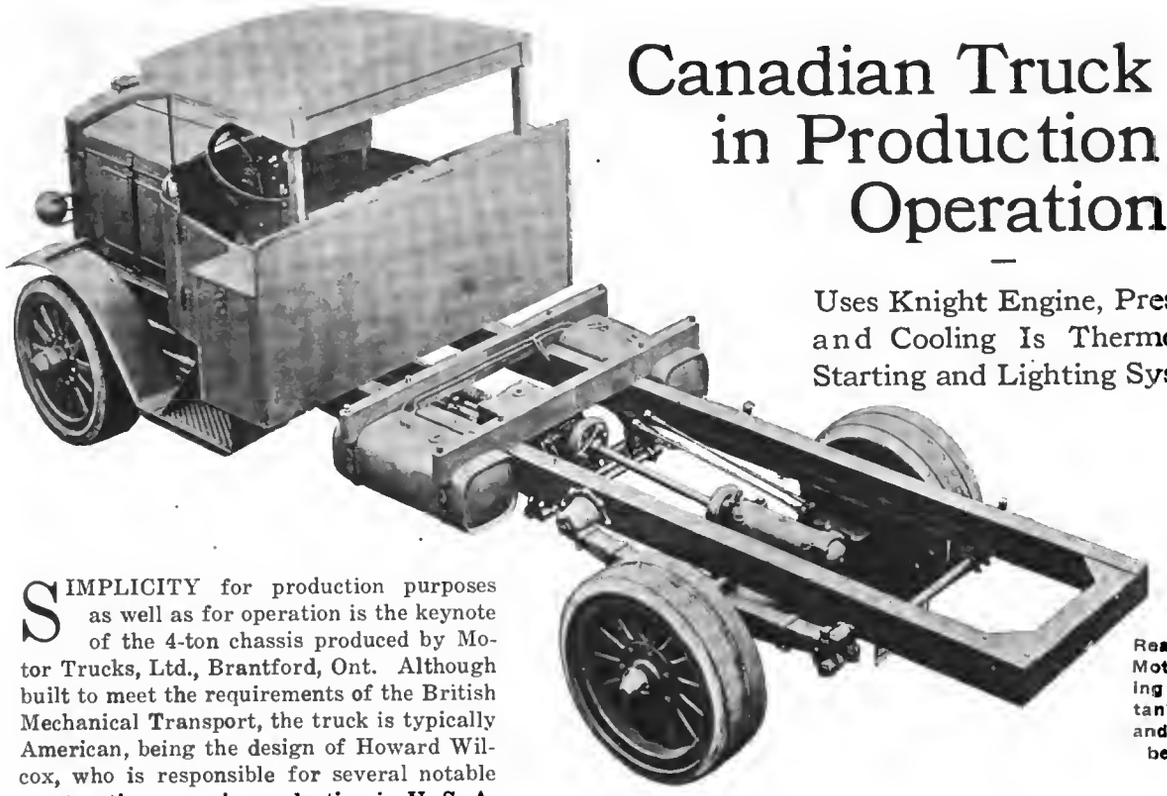


Diagram showing relation between horsepower and speed of motor tractors

Canadian Truck Simple in Production and Operation

Uses Knight Engine, Pressure Oiling and Cooling Is Thermo-Syphon—Starting and Lighting System Fitted



Rear of chassis built by Motor Trucks, Ltd., showing the two 20-gal. fuel tanks, overhead worm and strong frame members. Note roomy cab

SIMPLICITY for production purposes as well as for operation is the keynote of the 4-ton chassis produced by Motor Trucks, Ltd., Brantford, Ont. Although built to meet the requirements of the British Mechanical Transport, the truck is typically American, being the design of Howard Wilcox, who is responsible for several notable constructions now in production in U. S. A.

A Knight four-cylinder 4 by 6-in. engine is a feature of the design, which is a worm-drive construction with a 159-in. wheelbase and a gear ratio in high of 8¾ to 1. Tires are 36 by 5, dual in the rear.

Fundamentally the chassis is simple. It is also silent and embodies a high degree of flexibility. In the frame—the very backbone of the truck—there is primarily simplicity, since there are no rigid cross-members save at the extreme rear end, where there is one large one to carry large gussets to maintain the rectangularity of the frame. It is cold pressed of ¼-in. stock, 7 in. deep, with 4-in. flanges.

This simplicity makes for ease and economy of assembly, it makes for accessibility to the parts and it makes repairs less difficult. By this simplicity the third characteristic of the design—flexibility—is secured, for with all of the cross-members, and only a few at that, of the tubular type, the frame becomes a true De Dion form, which, continuing the chain of cause and effect, permits the use of very flat springs.

These flat springs are accountable to a large measure, according to Mr. Wilcox, for the success of the Hotchkiss drive.

The greatest contribution to silence, as well as the most distinctive feature of the truck, is the Knight engine which is of the same type as adopted by the Fifth Avenue Coach Co. for its new buses, and built by the Moline Motor Car Co., Moline, Ill. It has four cylinders, 4 by 6, giving a formula rating of 25.6 hp., but having shown 65 hp. at 1800 r.p.m. on the block.

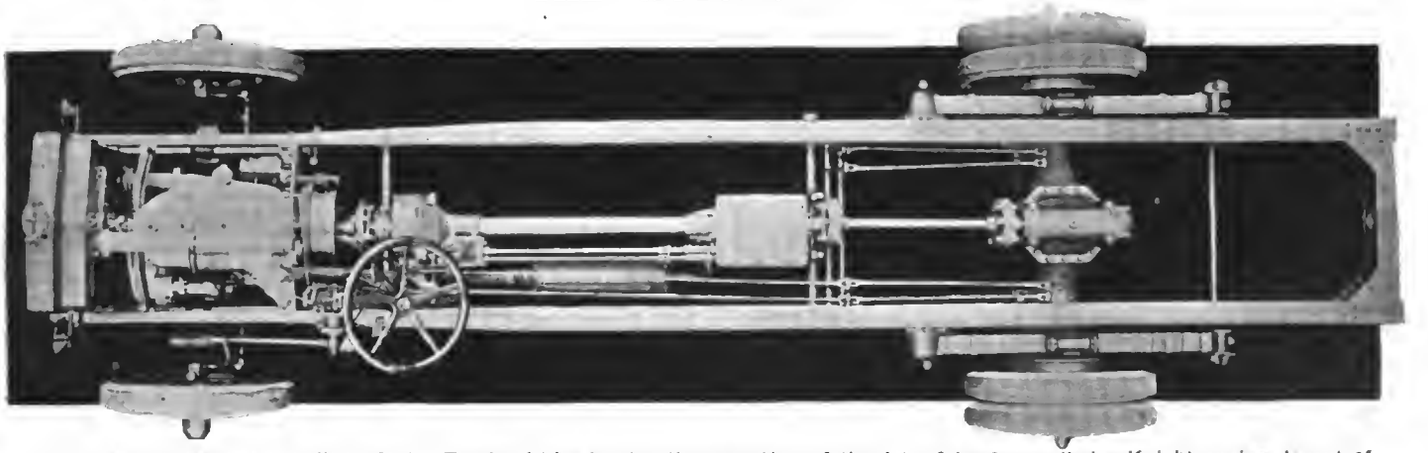
Cylinders are cast in block, together with the inlet manifold, which is completely water-jacketed. The sleeves are so placed in the cylinder that their upper ends are incased by waterjackets on both sides, and they are operated by eccentrics in the usual manner.

Pressure lubrication is secured from a gear-pump, forcing the oil through the drilled crankshaft to main and connecting-rod bearings at pressures up to 50 lb. per sq. in., which vary with the speed, thus providing automatic gradation of the oiling. There is no splash, but the spray from the cranks serves to lubricate the eccentric shaft and the wristpins. The wristpins are hollow and serve to convey the oil to the sleeves, which are oil-grooved and drilled and which in turn work the oil thoroughly between themselves and the cylinders.

Thermo-syphon water circulation is used and by dint of exceedingly liberal water spaces in the cylinder block as well as unusual radiator capacity, a somewhat sluggish circulation is made to have a cooling effect equal to a more rapid forced system through smaller passages. The radiator has unusual height, so that an excellent head of water is secured. Besides this, the top tank extends some distance above the top water header, so that an increased head is provided. The lower headers are two in number, one conducting the cool water to the front of and the other to the back of the cylinder block.

The radiator casing is entirely cast, comprising four pieces, the large top tank, a smaller bottom tank and two side plates.

A complete truck climbing a difficult grade. Note the high radiator and hood, the searchlight mounted on the dash and the substantial bumper bar



Plan view of the chassis built by Motor Trucks, Ltd., showing the mounting of the 4 by 6-in. four-cylinder Knight engine, layout of transmission system and overhead worm drive. Note mounting of electric units, amidship gearbox, etc. Springs are very flat, and this renders the use of Hotchkiss drive a logical feature

The cooling system has the unusual capacity of 17½ gal., most of which is in the radiator. The core of the radiator is of helically-finned copper tubes, individually demountable and sealed by cork gaskets without solder. The top and bottom plates are of copper or brass plate.

A high-tension single magneto with fixed spark cares for ignition automatically. The auxiliary electrical system consists of a Wagner starting and lighting outfit, with the generator and motor separate. The generator is driven from the same shaft which drives the magneto, this shaft being driven from within the timing gearcase by the same silent chain which drives the eccentric shaft gear from the camshaft. It also drives the V-belt for the 20-in. three-bladed cast aluminum propeller-type fan.

The starting motor, which drives the flywheel through teeth milled on it, was selected by testing for a motor powerful enough to start the Knight engine after being in cold storage at a temperature below zero for 24 hr.

The carbureter is a Zenith, which harmonizes very well with the rest of the chassis, since it has no adjustments, valves or springs. Incorporated with the carbureter is the Monarch gas-velocity governor, which operates without outside mechanical connections of any kind. The adjustment of this governor is easily made and is locked with a padlock, so that the driver cannot change it. In its setting, established precedent has been set aside, since it permits the motor a speed of 1800 r.p.m. It is said that the truck may safely be driven for a distance not to exceed 10 miles at 30 m.p.h., and for an indefinite time at 25 m.p.h.

The carbureter is fed by pressure from two tanks, mounted in an original manner. These tanks are 12 by 14 in., of bolster shape, each made of two seamless drawn steel shells, telescoped and welded. Each holds 20 gal., and they are suspended by steel straps from two yoke-like wood beams laid across the frame, so that the tanks lie just outside the frame side-members back of the cab. Pressure is automatically maintained by an air-cooled two-stroke air pump driven by the engine.

Gearbox Is Amidships

Unit power plant construction is not used, since on long wheelbases it is desirable to divide the shaft into two lengths to avoid whipping. This can be done with the best distribution of weight by placing the gearbox amidships. This also permits of greater accessibility and also allows the unit transmission embodied in this design to be employed. The engine is therefore independently mounted on three points, direct from the main frame.

Between it and the transmission unit is a fabric disk universal. The transmission unit comprises the clutch, gearbox, control unit, intermediate driveshaft and brake rocker-shafts assembled into a rigid unit, independent of the rest of the power and driving system. It is suspended on three spherical joints, one at the front, on a tubular cross-member and two at the rear, on the side members. At the front is the clutch housing.

The clutch is a Brown-Lipe dry-disk type, designed to run without oil and of such proportions as to be uninjurable through slipping. It connects with the Brown-Lipe gearbox by a long tube, inclosing the driveshaft.

The gearbox is square with a light removable cover on top. It affords four speeds and one reverse. The gears and shafts are nickel steel, heat-treated and the gears are of 5-7 pitch with 1¼-, 1½- and 1⅝-in. faces. An interlocking arrangement is provided to prevent engagement of more than one pair at a time.

A Rigid Assembly

Back of the gearbox is a tubular cross-member, rigidly attached to the back of the gearbox and, paralleling it are two brake rocker-shafts. Just back of the clutch at the front end is the selector or control unit for the gearset. The shifter-rods connect it with the gearset, and, due to the rigid assembly of the whole transmission unit, correct alignment is assured.

To a bracket at the side of the clutch the hand brake lever and the pedal are attached, their pull-rods to the brake rocker-shafts extending back in straight lines. The single pedal is mounted on the clutch throw-out shaft direct and carries a brake pull-rod besides, so that it fulfills the double duty of clutch release and foot brake.

Behind the gearbox the final or secondary drive is taken by a 26-in. solid shaft with two fabric-disk universals, to the worm-driven rear axle. This is essentially a Sheldon type, except that it has some special features of its own. One of these is the M & S worm self-locking differential. A number of trucks have also been built by this concern without any differentials. These axles have cast steel housings, side-by-side internal brakes and are of semi-floating construction.

The springs through which the torsion and propulsion are transmitted are of the banded type, steel bands being shrunk on at their middles in lieu of a center bolt, thus avoiding any weakening hole at this point. They are flat under load and have three reversed leaves on top to resist rebound. These rebound springs are equal to about one-fourth the thickness of the main springs. The front springs are 44 in. long and 3 in. wide and their eyes are bushed for ¾-in. diameter bolts. Rear springs are 56 in. long and 3½ in. wide, bushed for 1¼-in. bolts at their fronts and for 1-in. ones at the rear, or shackled end. Three rebound clips are used on each spring.

The axle clips are of the round type, bent in an arch over the springs without sharp bends, an iron filler block being inserted between them and the tops of the springs. The

(*Continued on page* 944)

Westinghouse Club of Practical Value

Technical Education of Employees Developed by Special Classes—Athletic Activities and Social Features Provide Ample Recreation

WELFARE work at the plant of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has grown to a high state of efficiency in regard to educational, social and physical benefit to the employees. Organized in 1902, primarily for the educational benefit of the engineering apprentices, the Westinghouse Club has widened its scope so as to include membership not only from the above company, but also from the Westinghouse Air Brake Co., the Westinghouse Machine Co., Pittsburgh Meter Co. and the Union Switch and Signal Co. The membership now includes something like 850, mainly of the younger engineering students. Membership, however, is open to any factory employee, but owing to its having been organized primarily for the benefit of the technically trained students this class has so far predominated in the membership.

When the club was first organized its activities were mainly lectures on technical subjects, and the establishment of a reading room. Subsequently the club expanded and quarters were purchased where reading rooms, billiard and pool parlors and a completely equipped gymnasium were installed.

Membership in the club is recruited from all of the Westinghouse companies in the Pittsburgh district. The club offers an increasing scope of acquaintanceship among men other than those whom the average member meets in his business relations. It is interesting to note that the club membership during the current year includes men from over 160 different colleges and universities.

Committees Handle Activities

The activities of the club throughout the year are taken care of by specially appointed committees covering athletics, entertainment, technical sections, house, lecture, library, music, excursion and smoker.

The club also extends its operations beyond the factories in an endeavor to afford educational and instructive advantages. The work of the excursion committee is the best exemplification of this and is probably the most interesting work of the club to the new members. Excursions are made to the various manufacturing plants in Pittsburgh. These excursions cover a variety of different classes of manufacture and are conducted under the guidance of experts in the various lines. Provision is made for men on night turn to take these trips on Mondays.

Technical Work Important

One of the most important works of the club consists in the organization of regular classes for the systematic study of the theory, design, and application of the Westinghouse apparatus. Organized primarily as an educational institution, the club management has always felt that the opportunities for study and technical lectures and discussions could not be made too great. No other branch of the club work has been so popular, the enrollment in all the technical sections through the year totaling 951, some men taking work in two sections. The object of the sections is to supplement work in the factory classrooms and in the shops. The classroom work during the first part of the graduate students course takes up the construction and manufacture of apparatus, while shop work covers its actual manufacture. It is the intention of the club to have the members of the section prepare the papers or lectures and enter into the discussions and thus learn by actually performing the work. Beginning this year, a time allowance of 25 hr. per each half term toward completion of the apprenticeship course is made for each graduate student who does the work of a technical section to the satisfaction of the leader of the section.

Gymnasium Completely Equipped

For 2 years now, the club has had its present large gymnasium facilities and has thus been able to develop various athletic teams. The gymnasium room is 65 by 140 ft. and is equipped with the latest forms of athletic apparatus. The floor is also laid out for basketball, indoor baseball, three removable handball courts, and a banked running track with sixteen laps to the mile. Outdoor athletic activities are centered in baseball, tennis, and field sports.

The library has become an important part in the club life. Daily newspapers from all sections of the country are on file, so that every club member can keep in touch with the section from which he comes. A complete file of technical magazines is available. Sectional bookcases are added from time to time as the number of books secured increases. The reading room is visited, according to statistics, by more members than any other room in the house.

As a means of furthering acquaintance and good fellowship among its members, the entertainments held during the year are of great importance. This year in order that those in charge of entertainments could give more attention to the dances and special events a Smoker Committee was appointed to arrange for Apprenticeship Nights and Monthly Smokers.

The lectures have proved a feature of the club life due to the wide range of popular subjects. The idea of these lectures is to afford the members and their friends a means of keeping posted on the topics before the public, and to avoid technical subjects.

The technical man's ability along musical lines is demonstrated by the active interest taken in the various musical organizations fostered by the club.

Club Organization

The club is operated by a board of directors, three of whom are appointed by the company and three elected by the members, one each of three appointed by other companies and the president, vice-president and junior past-president who are elected by the members to these respective offices and thereby become ex-officio members of the board.

A paid manager and assistant manager are employed who devote their entire time to the club. It is the hope of the management that some time the company will have a building devoted to all of the welfare interests, including both the workmen in the shop and those in the offices. In the meantime the company is providing a number of different welfare methods, as told in previous paragraphs. One of the most active and beneficial is the Casino Technical Night School operated under the auspices of the company which affords instruction in the evenings for those employed by the company and others as well, at purely nominal rates. This is open to girls as well as boys. A banner attendance in this department has been made this year, something like over 850 students having matriculated.

Educational Activities of the Westinghouse Club

Below — Practical instruction supplements the work of the classroom in the technical educational courses of the Westinghouse Club. The illustration shows one of the sections at work in the machine shop where the students can see the working out of the theoretical matter which they have studied

Above—One of the technical sections at work in the drafting room, receiving instruction in the preparation of details of construction of apparatus produced in the Westinghouse plant

Above—The gymnasium is 65 by 140 ft., and is equipped with the latest forms of athletic apparatus for regular class and exhibition work. The floor is also laid out for basketball, indoor baseball, three removable handball courts, and a banked running track with 16 laps to the mile

Right—One of the technical sections of the club at work in testing out electrical apparatus

The Automobile Industry in Switzerland

(*Continued from page* 938)

hood the automobile restrictions will be completely removed after the end of the war. There will be other progress in this respect, too, unless indications are misleading. Most likely there will be far-reaching license reciprocity with the neighboring countries, especially France and Germany, so that touring in Switzerland will be still easier, and foreign tourists will be attracted in numbers to make up for what the country has lost in this regard during the war. Already there is a good deal of discussion regarding more modern methods of coping with tourist business; plans are being made for construction of garages where before the war automobiles were kept out, and an intense automobile traffic is confidently looked forward to.

This analysis of the automobile situation shows to what an extent it has been necessary for the greater part of the population to find new occupations and for a great deal of manufacturing capital to turn to new fields of endeavor.

Turn to Car Building

To take up the last point, a number of factories whose entire or chief output consisted in embroidery and knitting machines have devoted practically all their attention to the manufacture of automobiles. In this course they have followed the example of one maker in Arbon, who during the past ten years had turned out quite a number of automobiles, especially commercial cars, which were highly successful, not only in Switzerland, but throughout Europe, and even outside the continent. At present this company makes automobiles only and has quite suspended the manufacture of textile machinery.

Smaller Manufacturers Interested

Such an example could not help stimulating kindred efforts on the part of smaller manufacturers, and this accounts for the great increase of automobile making in Switzerland. Needless to say that the call for automobiles, both in Switzerland and especially in belligerent countries, is so great that the automobile industry is very profitable, and that whoever is in possession of suitable machine tools endeavors to produce motor vehicles. There is, however, one important limitation to these endeavors, namely, the difficulty of obtaining raw materials.

Canadian Truck Simple in Design

(*Continued from page* 941)

shrunk-on bands are machined to accurate size to fit grooves in the spring perches, so that they transmit the propulsion instead of the clips.

Wheels are of wood, with square spokes, fourteen on the rear and twelve in front. The same sizes of tires are used front and rear, namely, 36 by 5, single in front and dual behind.

The steering gear, is on the left side. It is attached to the main frame side-member and has a steering column angle of 35 deg.

Great pains have been taken in the finish of this job. The hood is made of 16-gage steel in three sections. The top section is hinged to the dash and the side sections to the frame sills and detachable. The hold-downs are two in number, being forged and connected with the frame sills by springs to keep the hood tight and prevent rattling and at the same time allow for the movement of the radiator on its flexible mounting in response to frame weaving.

Fenders and steps are of 14-gage steel, pressed from one piece and held in place by heavy cast braces riveted to the tops of the fenders. A simple bracket of bent sheet steel supports the running board. The headlights are attached to forks extending horizontally on each side of the radiator.

The cab is constructed entirely of steel and has a seat wide enough for three large men. On each side of the seat is a large tool box and across the back is a wide bulkhead.

Some of the other ratios, speeds and dimensions are:

Gearset Ratios

First	4.84 to 1
Second	2.84 to 1
Third	1.50 to 1
Fourth	direct
Reverse	5.81 to 1

Total Gear Reductions

First	42.35 to 1
Second	24.85 to 1
Third	13.12 to 1
Fourth	8.75 to 1
Reverse	50.84 to 1

Truck Speeds in M.P.H.	R.P.M. 1,800	R.P.M. 1,000
First	4.57	2.54
Second	7.76	4.31
Third	14.68	8.16
Fourth	22.05	12.25
Reverse	3.78	2.10

Dimensions

Loading space back of driver's seat	12 ft. 3 in.
Track, front	60½ in.
Track, rear	67 in.
Chassis overall length	20 ft. 3 in.
Height to top of frame	32 in.
Overall width	7 ft.

Scripps-Booth Detachable Winter Top

THE detachable winter top illustrated at the right on the eight-cylinder Scripps-Booth is designed to appear as an integral part of the car, although it may easily be removed and the regular top mounted. The detachable top fits closely to the body of the car, with flush sides and will not rattle. Windows are removable and the interior is finished in gray whipcord with a dome light. Both the winter top and the regular top are furnished with the eight-cylinder model for $1,350, the price without the winter top being $1,175.

Detachable winter top mounted on the Scripps-Booth eight-cylinder chassis

ACCESSORIES

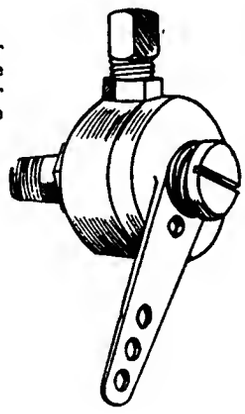
Primolite Headlight Lens

BY a prismatic construction this lens throws the greater part of the light upon the road straight ahead but diffused in such a manner that the driver can see cars coming from the opposite direction and also the road on both sides of the car, so that the danger of passing is eliminated. Light rays run to each side almost at right angles from the face of the lens, so that objects on both sides of the driver are distinguishable at a distance of 50 ft. back from the road. Each lens is divided into a series of vertical divisions, each of which is a convex lens, and as the face of the lens is frosted the convex divisions each throw the rays at diverging angles, these rays crossing and re-crossing those shining through the frosted portion, thus mellowing the light. For 8 to 9-in. headlights the lens sells for $2.90; for 9 to 9⅞ in., $3.50, and for 9⅞ in. up, $4.20.—Primolite Company, 945 Lemcke Annex, Indianapolis, Ind.

Primolite headlight lens which is designed to throw light upon the sides of the roads as well as straight ahead without glare

Hydrovaporizer

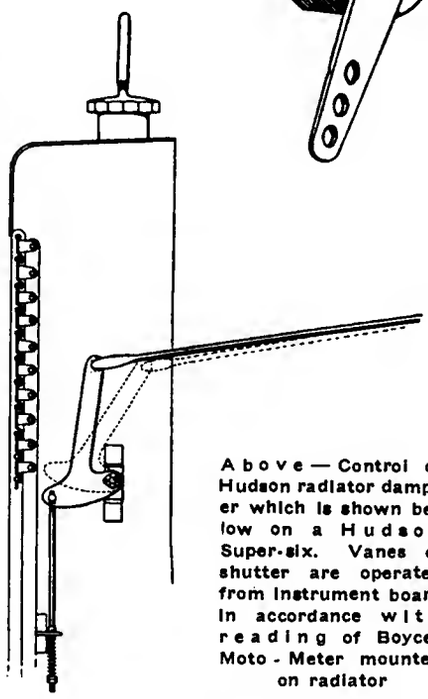
A mixture of water and air is injected into the intake manifold by this device. Water is drawn from the engine and air from the outside, mixed in the chamber of the device, and carried into the combustion chamber in a fine spray, it is claimed. The proportion of air and water may be controlled from the seat, and it is said that the efficiency of the engine is bettered and carbon prevented. Price, $6.—Accessory Mfg. & Sales Co., 1507 Hennepin Avenue, Minneapolis.



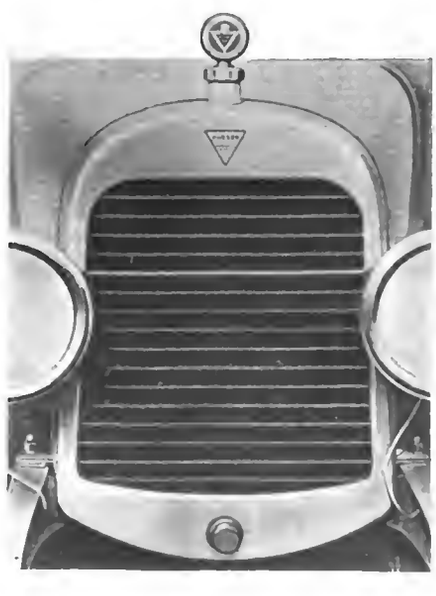
Hydrovaporizer for injecting a mixture of water and air into the intake manifold

Hudson Radiator Damper

By replacing the standard radiator shell of the Hudson Super-six with a special shell housing a shutter mechanism, as shown in the illustrations, the running temperature as indicated by a Boyce Moto-Meter may be controlled from a plunger on the instrument board, the operation consisting in throttling the air passing through the radiator. The vanes of the shutter may be left completely open, as in warm weather; completely shut, as in very cold weather, or at any point between these extremes which the Boyce Moto-Meter indicates as securing the best running temperature. In installing, it is only necessary to change the radiator shell, drill a hole in the instrument board and another in the dash, and then to connect the operating plunger on the instrument board with the bell crank of the shutter by a control rod. No machine work is required in the installation, which may be made in 2 to 3 hr. With the Boyce Moto-Meter, which is a necessary part of the device, the price is $25. If the car is already equipped with a Boyce Moto-Meter the remainder of the equipment sells for $15.—Hudson Motor Car Co., Detroit.



Above — Control of Hudson radiator damper which is shown below on a Hudson Super-six. Vanes of shutter are operated from instrument board in accordance with reading of Boyce-Moto-Meter mounted on radiator

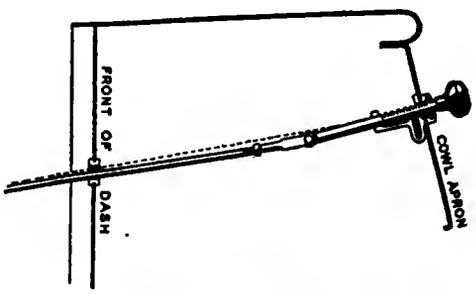


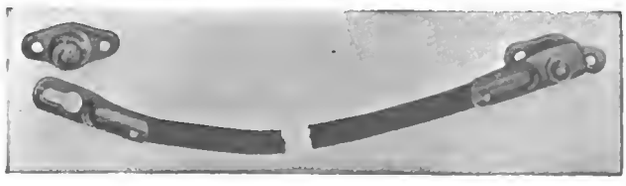
King Anti-Rattler

This anti-rattling device is made for attachment to the steering spindle of Ford, Overland and Dodge cars. A hanger is secured to each end of the tie-rod, the lower end rigidly supporting the spindle and carrying a spring that is said to automatically take up wear. It is easily attached by anybody. Price, $1.50 per pair.—King Specialty Mfg. Co., 207 Washington Street, Brookline, Mass.

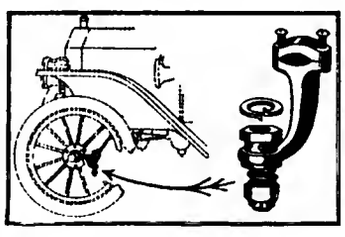
Ideal Robe Rail

The Ideal rail is detachable at one end to facilitate placing coats, robes, etc., in position. The center of the rail is leather over cord and the ends are nickel plated. It is regularly furnished in 18½-in.



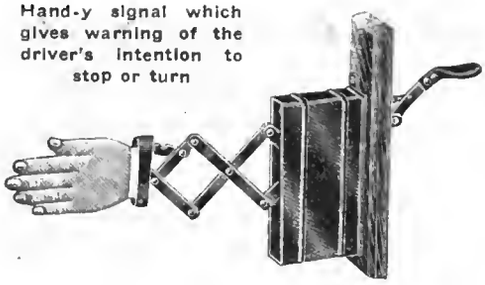


Ideal robe rail which is detachable at one end



King spindle joint anti-rattler

Hand-y signal which gives warning of the driver's intention to stop or turn



lengths although other lengths are made to order. There is a special rail 24 in. long for Ford cars. The rails sell for 75 cents.—Ideal Brass Works, Tenth Street and Canal, Indianapolis.

Hand-y Signal

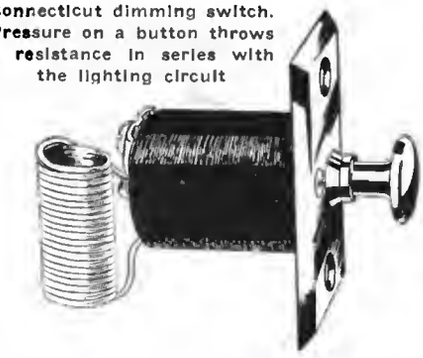
Extending a hand from the side of the car on a lazy tongs device operated by the driver, this device gives warning of an intended stop or turn. The signal consists of a bright-red metal hand fastened to the end of steel folding members that fold into a metal case attached to the side of the car. The hand is swung to the extended or closed position by a lever on the open-car model; on the closed-car model it is operated by a chain. It may be attached to any car in 5 min., it is said. Special emphasis is laid on the simplicity of its installation on closed bodies. For open cars the signal costs $3; for closed cars, $3.50.—Kaenjay Sales Co., 105 Chambers Street, New York.

Nitrojector Spotlight

This searchlight has an adjustable focus mounted on the windshield by means of a swiveled clamp. The rays of the light are controlled by a shutter around the bulb of the lamp and controlled by a thumbscrew placed in the handle of the lamp. The rays may be controlled from a small ribbon having a diameter of 4 ft. at 500 ft. to the general illumination common to all lights, it is claimed. Another advantage claimed is that the lamp is entirely free from glare. Price, $10, complete.—Hawthorne Mfg. Co., Bridgeport, Conn.

La French Spark Plug

These plugs are claimed to enable the car owner to get the same mileage under similar conditions of load, road and distance with a mixture of 60 per cent kerosene and 40 per cent gasoline in the tank as with gasoline only. A feature of the construction is the use of porcelain baked inside the independent steel shell. The porcelain is also protected above the shell by Bakelite. An asbestos packing around the independent steel shell provides for heat expansion and a twin conical porcelain prevents short-circuiting. The construction of the plug is clearly shown in the accompanying illustration. The manufacturer claims that it is never necessary to take this plug apart to clean it,



Connecticut dimming switch. Pressure on a button throws a resistance in series with the lighting circuit

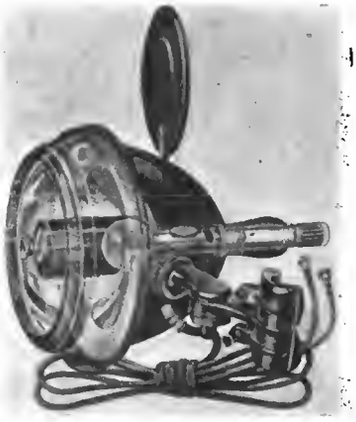
and the spark gap, which is ⅛ in. wide, is unusually accessible besides having the advantage of extending well down into the combustion chamber. Plugs are made in ½ in. and ⅞ in. S. A. E. sizes and sell for $1.—La French Spark Plug Co., 206 Meredith Street, Dayton, Ohio.

National Safety Signal

The driver's intentions are manifested by electrically lighted semaphores attached at each side of the windshield. The light carried at the end of the left arm is red, the one at the right green, and either or both may be swung from the vertical to the horizontal position by means of a knob attached to the dash at a point convenient to the driver. As the light drops to the horizontal position it lights automatically, pointing the direction that the driver intends to turn. Price, $15, installed.—National Auto Signal Co., 251 West Seventh Street, St. Paul, Minn.

Connecticut Dimming Switch

A button switch located at a point convenient to the driver throws a resistance in series with the lighting circuit, causing the lights to grow dim. The resistance consists of a small coil of special wire connected at each end to two binding posts secured in the end of a hollow fiber cylinder. On the interior of this cylinder are two brass brushes, secured at one end to the binding posts, the other ends resting on the switch plunger. The inner end of this plunger

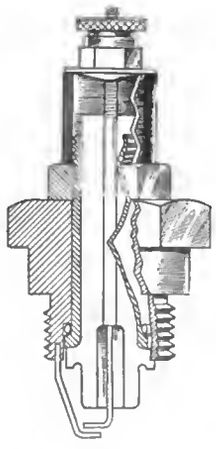


Nitrojector spotlight

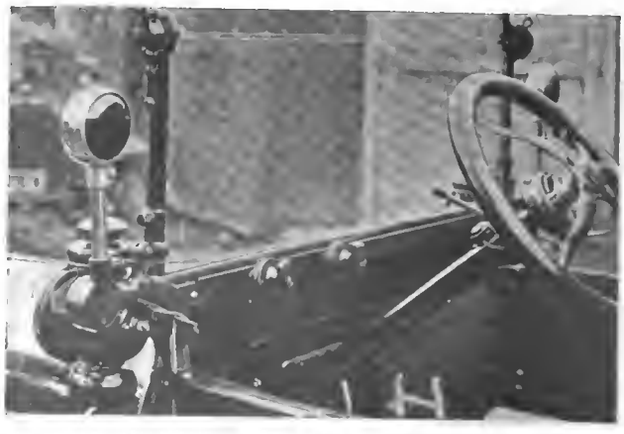
is uninsulated and grooved, the balance of the plunger being insulated so that when the plunger is pressed in as far as possible the ends of the two fiber brushes are disconnected and the current forced to pass through the resistance wire. By pulling on the plunger the two brushes come into contact with the metal end, are short-circuited, and the lighting current allowed to pass unrestricted. The installation requires only that a ⅞-in. hole be drilled in the dash, the insulating cylinder slipped in place and the plunger plate screwed onto the face of the dash. One wire of the lighting circuit is then cut at any point and each of the two ends attached to its respective binding post on the dimming switch.—Connecticut Telephone & Electric Co., Meriden, Conn.

Steering Gear for Fords

A steering gear installation for Fords. The operating member is a hollow sphere, having a spiral groove cut in its surface. A boss on the yoked shaft bearing the steering arm rides in this groove, and is moved or held by the metal sphere. The gear works on roller bearings, and is said to be exceptionally easy to operate. It is also claimed to be exceptionally easy to operate, and to require but one turn of the wheel to throw the wheels from one extreme to the other.—Price, $12.50.—Nash Mfg. Co., 1723 O Street, Lincoln, Neb.



La French spark plug



National Safety semaphore signal mounted on a car

Industrial Miscellany

Factory

Dupont Fabrikoid Co., Toronto, Ont., is erecting new buildings. Estimated cost of buildings is $75,000 and estimated cost of machinery $175,000.

Crown Tire & Rubber Co., Ralston, Neb., is planning a factory to consist of six buildings.

Field Motor Co., Grand Rapids, Mich., has purchased the Brown & Sehler factory in this city for $14,000 and will manufacture a motor under patents owned by E. A. Field.

Auto Specialties Mfg. Co., Joliet, Ill., will build a two-story, 80 by 400 ft., factory on Edgewater Field at a cost of $25,000.

Canton Auto Parts Mfg. Co., Canton, Ohio, recently incorporated with a capital of $300,000, is planning a 50 by 200 ft. plant.

Mayo-Skinner Mfg. Co., Chicago, is now in its new home at 2115 Elston Avenue, Chicago. This company manufactures hand pumps, spark plug pumps, air compressors, electric garage pumps.

Doehler Die-Casting Co., Brooklyn, N. Y., has let a contract for the construction of a steel and concrete addition, 50 by 100, seven stories, and costing about $150,000.

C. A. S. Products Co., Columbus, Ohio, manufacturer of automobile gears, has completed alterations at its plant, which has more than doubled in capacity. The company is employing 130 men.

Sheller Wood Rim Manufacturing Co., Portland, Ind., which is capitalized at $25,000, has been formed. The company will manufacture single-piece wooden automobile steering wheel rims, the patents on which are held by H. E. Sheller. Directors of the company are Mr. Sheller, E. J. Minch, A. F. Blowers, E. M. Haynes and Carl Bimel. Plans are under way for the erection of a new plant for the company.

H. and M. Auto Parts Co., Cambridge City, Ind., has been incorporated with a capitalization of $10,000 to manufacture piston rings and piston heads. The officers are O. E. Huddleston, president; C. J. Marson, vice-president, and C. J. Marson, secretary-treasurer. The company has set no date for beginning operations.

Mitchell Motors Co., Racine, Wis., is building several thousand feet of new sidetracks and loading platforms, the existing system of more than three miles of trackage in and around the plant being inadequate to handle the record-breaking shipments of Mitchell cars. Both the Chicago & Northwestern and Chicago, Milwaukee & St. Paul lines run directly into the big works and provide unusually good facilities for shipping.

Personal

A. J. Miller, president; J. H. Wells, vice-president, and E. P. Humphreys, secretary-treasurer, are the officers of the recently formed Bellefontaine Automobile Co., Bellefontaine, Ohio, to manufacture automobiles.

D. J. Hayden, formerly sales manager of the Marion Motor Car Co., Indianapolis, Ind., is the head of a new company, the Hayden-Steele Co., which will handle the retail sales of Hupmobiles in Indianapolis and Marion County. The new firm has headquarters at 544-546 North Meridian Street. Associated with Mr. Hayden is J. P. R. Steele, secretary of the firm, who for several years has been Southern manager for the D. L. Auld Co., Columbus, jewelry maker.

E. E. Russell has been appointed general purchasing agent of the J. I. Case Threshing Machine Co., Racine, Wis. His appointment takes effect Jan. 1. Mr. Russell has been with the Case Company since 1889. For the past 12 years he has been in charge of foreign sales. Prior to that he had served the company as salesman, collector, branch house manager and assistant sales manager; later was engaged in opening up a number of foreign branches, which led up to the position of manager of foreign sales. He has also been connected with the cost department.

Capt. Oliver Hezzelwood has resigned his position as manager of the Toronto branch of the McLaughlin Motor Car Co., in order to devote all his time to military work. Captain Hezzelwood was president of the Citizens' Recruiting League and is now acting as a special recruiting officer in the Toronto military district. C. M. Ricketts succeeds Mr. Hezzlewood.

The Automobile Calendar

ASSOCIATIONS

Dec. 2-9—Electricians' Country-wide Celebration.
Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.
Jan. 9-11—New York City, Society of Automobile Engineers' Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.
Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.
Nov. 16—New York City, S. A. E. Meeting.
Nov. 23—Philadelphia, Pa., S. A. E. Meeting.
Dec. 7—Baltimore, Md., Safety First Convention of Safety First Federation of America.

CONTESTS

Nov. 24 and 25—Newark, N. J., 24-Hr. Endurance Run of N. J. Automobile and Motor Club.
Nov. 30—Uniontown, Pa., Speedway Race.
Nov. 30—Los Angeles, Cal., Ascot Speedway 200-mile Championship Race.

1917

April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship
June 23—Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 14——Des Moines, Iowa, Speedway Race, Championship.
July 4—Tacoma, Wash., Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15—Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race, Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13—Chicago Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Nov. 20-25—Worcester, Mass., Show, Worcester Casino; Worcester Automobile Dealers' Assn.
Dec. 2-9—Springfield, Mass., Show, Auditorium, H. W. Stacey, Mgr.
Dec. 9-16—Akron, Ohio, Show for Passenger Cars Only, Market Street Gardens, Akron Automobile Dealers' Show Assn.
Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel, I. R Gates, Mgr.
Dec. 30-Jan. 6—Cleveland Automobile Accessory Show, Dreamland Auditorium.
Dec. 30-Jan. 6.—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.
Jan. 6-13—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 7-10—Philadelphia, Show, Philadelphia Automobile Trade Assn.
Jan. 9-10—Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.
Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.
Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 22-27—Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jan. 23-27—Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 27-Feb. 3, 1917—Chicago Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 5-9—Boston, 8th National Good Roads Show, Mechanics' Bldg.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 12-17—Louisville, Ky., Show, First Regiment Armory, Louisville Automobile Dealers' Assn.
Feb. 12-17—Cedar Rapids, Ia., Show, Cedar Rapids Automobile Trade Assn.
Feb. 18-25—St. Louis, Mo., Show, Automobile Manufacturers' and Dealers' Assn.
Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.
Feb. 19-24—Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.
Feb. 19-24—Bridgeport, Conn., Show, Armory, Coast Artillery Corps.
Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.
Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.
March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co. Armory of the University of Ill.
March 3-10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 14-17—Davenport, Ia., Show, Coliseum Bldg., Tri-City Automobile Trade.

Personal

S. R. Scott has become district sales representative of the Denneen Motor Co., Cleveland, maker of the Denmo trucks. This company has appointed the Butler-Veitch Co., Berkeley, Cal., as its distributor in that territory.

George Price will handle the sales department of the J. A. & W. Bird Co., Boston, covering the entire territory south of New York, as far west as the Mississippi, and also including the states of Louisiana and Texas. He was formerly manager of its New York office.

C. T. Kenworthy has become vice-president and general manager of the Roamer Motor Car Co., Chicago. He was formerly distributer for the Rauch & Lang electric in New York.

T. E. Hanika, an Indianapolis newspaper man, has been appointed manager of the advertising department of the Gibson Co., Indianapolis, Ind., Overland and Willys-Knight distributor in Indiana, and automobile tire and accessory dealers. He succeeds R. T. Farrington, who has gone to San Francisco, Cal., to engage in publicity work.

James Coggeshall has been appointed manager of the wholesale department of the R. E. Taylor Co., New York, distributor for aGrford trucks in this city, New Jersey and New England.

W. P. Pollitzer has become sales manager of the Rock Island Mfg. Co., Rock Island, Ill. He was formerly Chicago branch manager of Edw. V. Hartford, Inc., Jersey City, N. J. The local company manufactures hardware specialties and automobile specialties. Mr. Pollitzer was with the Hartford company for 15 years. He takes up his new duties Dec. 1. Edward Leinbach will succeed Mr. Pollitzer at Chicago.

R. Adamson has been appointed manager of the Birmingham, Ala., branch of the Ford Motor Co. R. C. Ruggles, former chief clerk, has been made assistant manager. G. C. Nicholes, who came to Birmingham from Seattle, has been transferred to Cincinnati as manager of the assembling branch in that city.

A. E. Morrison has joined the staff of the Maxwell Motor Co., Detroit, as special sales representative. Mr. Morrison was formerly branch manager on the Pacific Coast for the Hupp Motor Car Corp.

Dealers

Nova Scotia Velie Co., New Glasgow, N. S., has been formed to handle the Velie car.

Southern Arizona Motor Co., Tucson, Ariz., has been made distributer for the Mitchell.

S. H. Blackburn and Edward Olson have been appointed Arizona agents for the Pullman, with headquarters at 235 West Washington Street, Phoenix.

G. S. Holvey, who has been operating as the Holvey Motor Truck Sales Co. in Rochester, N. Y., will, on Dec. 1, become city sales manager of the Selden Motor Truck Sales Co., Rochester. A local branch will be established in Rochester.

J. B. Crockett Co. has secured the exclusive sales rights for the Branford carburetor in South America, Australia, New Zealand, Tasmania, South Africa, Straits Settlements and Dutch and British India. The Branford carburetor, marketed by the Holt-Welles Co., 1790 Broadway, New York, is designed for Fords and other cars.

Boice Motor Equipment Co., Boston, is now handling the Heinze-Springfield starter for Fords, the Vesta Accumulator Co.'s products. It also represents the K. W. Ignition Co. and the Standard Thermometer Co.

Automobile Supply Co., Tacoma, Wash., has been appointed distributer for Rayfield carburetors for all of western Washington, Kittitas and Yakima counties in eastern Washington.

W. H. Wallingford, Portland, Ore., Ford agent, has moved into larger quarters at 908 Alder Street.

J. E. Tryzelaar, Portland, Ore., has been named distributer for Grus Spring Oiler and opened headquarters at 29 N. Broadway.

Richard Rinne, Tacoma, Wash., has purchased the Commercial Auto Co. He has also taken over the agency for the Velie.

E. M. Lang, Auburn, Wash., has secured the territory in Auburn and adjacent territory for the Maxwell, Oakland and Chalmers.

Kaenjay Sales Co., 105 Chambers Street, New York, which has taken over the exclusive distribution of the Hand-y signal, is composed of L. T. Kauffmann and R. L. Jones, both of whom have had previous connection with the industry. Mr. Kauffmann was sales manager and Mr. Jones factory superintendent of the Nonpareil Horn Mfg. Co., New York.

Van Cortlandt Vehicle Co., New York, has opened salesrooms at Sixty-third Street and Broadway to handle the Peerless cars, formerly handled by C. T. Silver. Walter Woods is manager and J. A. Clark sales manager.

Marathon Tire & Rubber Co., Ltd., St. Catherines, Ont., has appointed the following distributers: Wood Vallance & Leggatt, Ltd., Vancouver, and Wood Vallance, Ltd., Winnipeg and Calgary, distributers for Manitoba, Alberta and Saskatchewan.

Constant Pressure Cycle Truly Efficient

(*Continued from page* 936)

than constant volume engines, is entirely justified, our critic to the contrary notwithstanding.

Utilization of exhaust heat brings to the proposed cycle another advantage. It enables the use of heavy fuel which without this heat would be difficult to vaporize. At practical temperatures already actually obtained, it has proved possible to make a fixed gas of the heaviest oil and to thoroughly mix it with the proper proportion of air prior to combustion. On this account, if for no other reason, the proposed engine bids fair to fill a long felt want for a prime mover free from the inherent difficulties of the Diesel engine while not dependent on highly volatile fuels for satisfactory operation.

Concerning the question of flexibility it should be noted that it is possible to vary the point of cut-off exactly as in the case of a steam engine. When the point of earliest feasible cut-off is reached, a further modification of the card may be obtained by throttling. Thus both dimensions of the card may be varied by a simple control device, with corresponding accommodation to load. In other words the proposed engine must be exceptionally flexible.

We shall not here attempt a comparison of the constant pressure and constant volume cycles with expansion carried to atmosphere for the reason that no practical constant volume engine utilizing means for expanding to atmosphere has yet been recognized. We have however already shown the utter fallacy of Mr. Napier's deduction as to relative cylinder volumes by proving that the constant pressure engine will develop more power per unit of cylinder volume at full load than the constant volume engine is able to do.

We readily admit that at light loads (where expansion is carried to atmosphere) the constant pressure engine's cylinder volume is relatively great as compared to the work output. But (even though expansion to atmosphere is not practicable in constant volume engines) it is equally true that at light load constant volume engines also have a very large cylinder volume as compared to their power output.

In view of the foregoing it would appear that our critic had jumped to the conclusion that, whereas the old Brayton type of constant pressure engine had proven an unsuccessful competitor to the Otto type, all constant pressure engines suffer the same or similar limitations. In point of fact the proposed constant pressure engine eliminates the shortcomings of the Brayton type while still retaining the latter's numerous inherent advantages. It thus introduces a new type which bids fair to replace in time engines of the Otto, Diesel and semi-Diesel types.

Mr. Napier closes his criticism with the statement: "The burner described and illustrated in considerable detail will not, however, work as an igniting device for a reciprocating engine." We make no claim to this effect. In fact a spark plug with coil or magneto is expected to answer this purpose —as is the case with the constant volume engines. Concerning the functioning of the burner for the purpose intended, the opinion of Mr. Napier is valueless since experiments already concluded have established the practicability of the burner.

Featuring Ignition Systems

The AUTOMOBILE

Vol. XXXV
No. 23

NEW YORK, DECEMBER 7, 1916

Ten cents a copy
Three dollars a year

Editorial Contents, Page 3

Advertisers' Index

Stewart Products

Winter Business Leaders

Stewart Products are the leaders all the year 'round. They are 365-day-in-the-year sellers—sold 52 weeks running—straight through 12 months.

Stewart Products know no seasons—motorists *need* and *buy* them in winter and summer.

For example, there is the Stewart-Warning Signal—an absolute necessity for winter driving. In winter motorists are driving, all muffled up in heavy clothing, side curtains up, or with a winter top. Oftentimes the vision is obscured by snow and sleet. Then, the efficient, far-sounding Stewart Warning Signal is the only safe-guard.

Dealers can sell every motorist a Stewart Warning Signal by merely pointing out how necessary it is.

And the other Stewart Products—the Speedometer, Vacuum System, Tire Pump, Spark Plug—are all just as necessary in winter.

Live dealers will do a *big* Winter Business with Stewart Products.

Stewart PRODUCTS

PRESTIGE QUALITY SERVICE SATISFACTION

MADE IN U.S.A.

STEWART-WARNER SPEEDOMETER CORP.

Chicago, U. S. A.

Stewart Speedometer for Fords $10

Stewart Motor Driven Warning Signals $6

Stewart Tire Pump $12

Stewart Hand Operated Warning Signal $3.50

Stewart Speedometer $25

Stewart V-Ray Spark Plug $1

Warner Auto-Meter $50

Stewart Vacuum System $10

The Automobile

Vol. XXXV New York, Thursday, December 7, 1916—Chicago No. 23

Any State May Tax Non-Residents

N. J. Motor Laws Upheld by U. S. Supreme Court in Case Against F. J. Kane

Washington, D. C., Dec. 4—The United States Supreme Court in a decision to-day established the right of any State to tax non-resident automobile owners for the use of their roads. The decision is of national import in that it lays the way open to changes in the laws of those States which should decide to take advantage of to-day's ruling.

According to the decision, a State may impose a tax on the use of non-resident automobiles, rather than upon the machines themselves, to compensate for the wear and tear on highways.

The decision was the result of the arrest of F. J. Kane of New York for operating an automobile in New Jersey without registering his car there. The case was based on the violation of three provisions of the New Jersey law; first that Kane had failed to register his car in New Jersey; second, that he failed to pay the tax imposed on non-residents; and third, that he failed to file with the Secretary of State a power of attorney. The last provision was to enable residents who had suffered injury at the hands of non-resident motorists, to prosecute their claims for redress in that State instead of being compelled to follow the non-resident to his home State, wherever that might be.

Both New Jersey and Maryland impose a graduated license tax, on both residents and non-residents, based upon horsepower. In January, 1915, the Supreme Court upheld the Maryland statute as not burdensome on interstate commerce, but in the New Jersey case the contention was made that the taxes were not solely for adminstration costs of regulation and registration of automobile traffic, as was the case in Maryland.

The law in question is that of 1906, as amended in 1908 and known as the Freylinghuysen law, which has been since considerably modified. Though New Jersey has, since the litigation started, adopted reciprocal legislation as to visiting motorists, the decision, really a test case, may change the laws of the States, even going so far as to nullify all reciprocal relations between the various States.

Charles Thaddeus Terry, well known New York lawyer, who has been an able exponent of rational automobile legislation in the East, claims that this decision, relating to non-resident registration only, does not affect the greater argument as to whether a resident motorist should be required to pay a tax greater than the bare cost of registration. This question has yet to be settled.

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Collins Is Chevrolet Sales Manager

New York., Dec. 1—J. S. Collins has become sales manager of the Chevrolet Motor Co. of Michigan, with headquarters at the Flint factory. Mr. Collins succeeds F. K. Lane, resigned, and will have charge of the territory embracing the states of Michigan, Indiana and Ohio and portions of Wisconsin, Illinois, Kentucky, West Virginia, Pennsylvania and New York.

He spent 13 years with the International Harvester Co., passing through several promotions and reaching the post of assistant general agent at Jackson.

—

Promotions at Chalmers

Detroit, Dec. 4—E. C. Morse, vice-president in charge of the sales for the Chalmers Motor Corp., has been appointed general manager of the company. W. P. Kiser, treasurer, has been promoted to secretary and assistant general manager. D. T. Turnbull succeeds Mr. Kiser as treasurer.

White Four Has 16 Valves

Plain-Bearing Crankshaft, Unit Power Plant and Center Brake Lever Features

Cleveland, Dec. 4.—Summing up engine performance as a matter of valve efficiency, the engineering department of the White Motor Co., Cleveland, has evolved and is just about to start production on a sixteen-valve four. Accompanying the new model there are a number of other innovations on the chassis which are notable departures from previous White practice.

This is the first White unit power plant, and it incorporates a plain bearing crankshaft instead of the ball-bearing design which is continued on the other models. The cylinders have removable heads, the oil is carried in the lower part of the aluminum crankcase instead of in a dash reservoir, and the entire appearance of the unit does not resemble previous products in any way.

Many Refinements

All through the chassis are a number of alterations which mark advancement in design. There is a cane type of gearshift lever, with a standard gate instead of the cross-over shifting arrangement formerly employed. The brake lever is in the center instead of at the left side, allowing a clear passageway through the left front door. The springs are semi-elliptic and the spare tires, instead of being carried in a well on the running board, are now supported on a bracket at the rear. In fact, a score or more of altered details can be located at a glance.

Most of the interest in the new car is focussed on the power plant. Here the lessons learned on the race track

(*Continued on page* 978)

Five Car Companies Raise Prices

Winton, Mitchell, Saxon, Allen and Premier Announce Revised Lists

CLEVELAND, Dec. 4.—The Winton Co. will increase the price of all its models by $200. The raise becomes effective Dec. 15.

Mitchell Increases Prices $100

RACINE, WIS., Dec. 1—The Mitchell Motors Co., this city, increased to-day the price of the Mitchell and the Mitchell Junior $100.

Saxon Six Price Now $865

DETROIT, Dec. 5—The price of the Saxon six has been increased from $815 to $865, due to the increased cost of labor and materials. The raise takes effect Jan. 1.

Premier Raises Car Prices

INDIANAPOLIS, IND., Dec. 1—The Premier Motor Corp., this city, has raised its prices on the seven-passenger touring car and four-passenger roadster from $1,685 to $1,895, on the limousine and town car from $2,950 to $3,150, and on the sedan from $2,685 to $2,900.

Allen Raises Closed-Car Prices

FOSTORIA, OHIO, Dec. 5—The Allen Motor Co. will increase the price of its coupé and sedan $100, effective Jan. 1. The new price for the coupé is $1,175 and for the sedan $1,195.

Perry Again in America

DETROIT, Dec. 2—P. L. D. Perry, president of the Ford Automobile Co. of Great Britain, is again in this country, following a recent trip to England. Mr. Perry states that the British government has issued orders to automobile makers which prohibit them from manufacturing cars for private persons except under special license.

De Lorenzi Sails for England

JACKSON, MICH., Dec. 1—E. A. De Lorenzi, service engineer of the Briscoe Motor Corp., has sailed for England to enter the transportation department of the Allies.

Chase Joins S. A. E. Office Staff

NEW YORK, Dec. 5—Herbert Chase has joined the office staff of the Society of Automobile Engineers. He was formerly connected with the Automobile Club of America as laboratory engineer and chief engineer. His new capacity will be that of assistant secretary. He is at present treasurer of the society and a member of its council, and has taken a prominent part in the activities and conduct of the Metropolitan Section.

His preparatory engineering education was had at the Pratt Institute. He was graduated as a mechanical engineer at Sibley College, Cornell University, in 1908.

Duryea Forms $4,000,000 Company to Build $250 Car

WILKES-BARRE, PA., Dec. 5—The Duryea Motors, Inc., of which Charles E. Duryea is president, has been formed with a capital of $4,000,000 to build the Duryea Gem at $250. This car will seat three persons. Other features include the Duryea patented roller drive.

Negotiations have been closed for a factory site and the Cutlery Works plant in the southern part of the city has been leased to start manufacturing.

Plans are to open the factory in the immediate future, just as soon as 20,000 shares of the stock, par value $5, is bought by the people of this city.

Dennet Resigns from Packard

DETROIT, Dec. 1—M. S. Dennet, chief inspector of the Packard Motor Car Co., has resigned. Mr. Dennet will represent the Muskegon Motor Specialties Co. and the Ajax Forge Co. in Detroit.

Reo Earnings Total $4,031,070

Assets of Car and Truck Cost $11,978,307.98—Surplus $3,849,828.20

LANSING, MICH., Dec. 1—The net earnings of the Reo Motor Car Co. and the Reo Motor Truck Co. for the year ending Aug. 31, 1916, were $4,031,070.26. Current assets were reported as amounting to $7,610,501, with a surplus of $3,849,828.20. Total assets are $11,978,307.98, capital assets amount to $4,277,674.06, and current liabilities are $1,191,229.78. This strong financial position is stated in a balance sheet at the close of business, Aug. 31, 1916.

The current assets show an increase of $2,776,845.36, as compared with the current assets of $4,833,655.75 on Aug. 31, 1915. Other important items mentioned in the report are certificates of deposit of $320,000, cash on hand in banks $1,360,517.97 and inventories of finished product, supplies and materials on hand amounting to $4,904,511.23.

It is thought, among some of the stockholders, that the company's annual meeting on Dec. 19 will witness a large stock dividend distribution, because of the large residue of unissued stock and surplus. The balance sheet follows:

ASSETS

Current assets			$7,610,501.11
Cash on hand and in banks		$1,360,517.97	
Certificates of deposit		320,000.00	
Receivables		1,025,471.91	
Notes receivable	$121,162.00		
Accounts receivable	546,077.28		
Drafts outstanding	421,320.05		
Accrued interest	3,009.16		
	$1,091,768.49		
Less reserves	66,296.58		
	$1,025,471.91		
Inventories		4,904,511.23	
		$7,610,501.11	
Capital assets			4,277,674.06
Land		$235,999.92	
Buildings		1,136,458.34	
Machinery and equipment		2,905,215.80	
		$4,277,674.06	
Deferred charges			16,345.31
Interest in other corporations			73,787.50
			$11,978,307.98

LIABILITIES

Current liabilities			$1,191,229.78
Accounts payable		$1,025,313.68	
Accrued pay roll		82,416.10	
Reserve for taxes		78,500.00	
Other reserves		5,000.00	
		$1,191,229.78	
Capital			10,787,078.20
Capital stock authorized		$11,000,000.00*	
Less unissued		4,062,750.00	
Stock outstanding		$6,937,250.00	
Surplus		3,849,828.20	
		$10,787,078.20	
			$11,978,307.98

*This amount includes the Authorized Capital Stock of both Car and Truck Cos. The purchase of the Truck Co. by the Car Co. eliminated the Truck Co. Stock. Authorized Capital Stock is now that of the Reo Motor Car Co., $10,000,000.00 and Unissued $3,062,750.00.

Overland Men Take 25,925 Cars

2237 Dealers and Guests at Convention Inspect 1917 Models and Plant

TOLEDO, Dec. 6—Willys-Overland dealers closed contracts for 25,925 cars, aggregating more than $20,000,000 in value, during the first 2 days of their annual convention at the factory of the Willys-Overland Co., this city. The new Country Club model proved most popular with the thirty-eight distributors from seventeen States. Dealers and guests numbering 1027 arrived to-day from all parts of the country, bringing the total attendance to date up to 2237.

Anderson and Young Promoted

DETROIT, Dec. 6—Lee Anderson has been appointed vice-president of the commercial division of the Hupp Motor Car Corp., this city, Dubois Young has been appointed vice-president of the manufacturing division of the company. Mr. Anderson, who has been with the company for 2 years, was formerly advertising and commercial manager.

N. A. C. C. Export Conference in January —Nov. Shipments 17,250 Carloads

NEW YORK, Dec. 6—Directors of the National Automobile Chamber of Commerce at their meeting to-day voted to hold a meeting in January of the export managers of the companies holding membership in the organization. Exports have been increasing every year and the figures for 1916 will exceed $160,000,000.

Notwithstanding the shortage in freight cars, which has seriously affected the industry, shipments of automobiles for November were 17,250 carloads as against 17,138 for the same month last year. Report was made at the investigation of the Interstate Commerce Commission regarding the rules and practices of railroads taking interchange of cars, and it was clearly shown that this service has been seriously impaired by the cars being arbitrarily used in other services. It was also reported that a committee of presidents of the American Railway Assn. had agreed to establish at Washington a conference committee on car efficiency, consisting of five operating officials to co-operate with the Interstate Commerce Commission in an effort to relieve the freight car shortage.

It is expected that the railroads will soon advance their per diem charge for the use of freight cars by other roads from 45 cents to $1.00 or $1.25 per day.

Charles Clifton, president of the N. A. C. C., gave his annual complimentary dinner to the directors at the Hotel Biltmore last night.

Tener Maxwell Sales Director

DETROIT, Dec. 5—T. J. Tener has become director of sales of the Maxwell Motor Co. He was formerly Pacific Coast zone manager. C. E. Zebbins, formerly sales manager, is now assistant director of sales. Charles Gould, formerly service manager, is now sales manager. G. S. Gamble has been appointed assistant sales manager.

Herschell-Spillman Capital Tripled

NORTH TONAWANDA, N. Y., Dec. 1—The Herschell-Spillman Co., this city, will increase its capital stock on Jan. 1, 1917, from $250,000 to $750,000.

This increase in stock is made necessary in order to provide facilities to take care of the company's increase in business during the past year.

France Heavy Buyer in October

Leads European Countries in Purchase of Cars—United Kingdom Heads List

WASHINGTON, D. C., Dec. 2—Among European countries France was the heaviest buyer of American automobiles in October last, according to export figures compiled by the Department of Commerce. Five hundred and twenty-two cars, valued at $1,782,088, were shipped there during that month. During the corresponding month of last year France imported 298 cars, valued at $912,139, from this country. During the 10 months ended October the shipments of cars to France increased from 5183, valued at $13,038,767, in 1915, to a total of 7019 cars, valued at $18,311,-143, in 1916.

United Kingdom Purchases Decline

Exports of cars to the United Kingdom amounted to 684 machines, valued at $1,687,152, in October last, as against 2021 cars, valued at $2,730,468, in October a year ago. There was a big falling off in the exports during the 10 months' period, the shipments declining from 21,455 cars, valued at $31,379,217, in 1915, to 7959 cars, valued at $13,763,-990 in 1916, a result of war conditions and rulings.

Russia's Gain

Russia did not figure in the export returns last year, but during October last that country imported 116 cars, valued at $287,590, while during the 10 months of this year the imports amounted to 2968 cars, valued at $8,199,-

(*Continued on page* 959)

Exports of Automobiles, Trucks and Parts for October and 10 Previous Months

	October							
	1915		1916		1915		1916	
	Number	Value	Number	Value	Number	Value	Number	Value
Passenger cars	3,479	$2,749,255	4,880	$3,756,768	34,515	$29,543,227	51,699	$36,049,497
Commereial cars	1,596	4,307,190	1,144	3,635,291	18,865	52,076,406	15,917	44,006,346
Parts, not including engines and tires	....	1,819,950	....	1,949,060	.....	12,814,809	.....	20,091,793
	5,075	$8,876,395	6,024	$9,341,119	53,380	$94,434,432	67,616	$100,147,636
By Countries								
Denmark	....	.....	342	$241,020	.....	.....	1,305	$955,432
France	298	$912,139	522	1,782,088	5,183	$13,038,767	7,019	18,311,143
Germany	....	.....	....	.....	4	2,800	.....	.....
Italy	40	25,887	7	7,517	210	134,901	244	151,484
Russia	....	.....	116	287,590	.....	.....	2,968	8,199,997
United Kingdom	2,021	2,730,468	684	1,687,152	21,455	31,379,217	7,959	13,763,990
Other Europe	814	1,920,176	301	327,196	7,502	20,003,140	3,403	4,194,615
Canada	189	202,552	1,021	718,962	5,238	4,154,137	11,118	8,025,079
Mexico	13	12,250	129	94,089	88	84,141	539	467,976
West Indies and Bermuda	267	173,355	665	505,198	2,625	1,478,360	4,704	3,152,389
South America	383	210,840	....	.....	2,464	1,277,326	.....	.....
Argentina	....	.....	302	195,512	.....	.....	4,258	2,206,709
Brazil	....	.....	44	33,046	.....	.....	348	232,860
Chile	....	.....	195	158,719	.....	.....	1,075	712,748
Venezuela	....	.....	36	23,781	.....	.....	447	284,316
Other South America	....	.....	113	64,986	.....	.....	816	509,877
British East Indies	....	.....	329	223,543	.....	.....	3,430	2,507,789
Australia	....	.....	347	274,073	.....	.....	7,025	5,361,054
British Oceania	447	360,260	....	.....	3,594	3,041,852	.....	.....
Asia and other Oceania	295	284,063	595	554,648	3,245	5,474,001	7,402	8,550,494
Other countries	308	224,455	276	212,939	1,772	1,550,991	3,556	2,467,891
	5,075	$7,056,445	6,024	$7,392,059	53,380	$81,619,633	67,616	$80,055,843

$10,000,000 in Cars Held Up

Makers May Suspend Manufacturing if Relief Is Not Forthcoming

DETROIT, Dec. 2—More than $10,000,000 worth of automobiles are held up awaiting freight cars for shipment. Many automobile makers will be forced to suspend manufacture if relief is not immediately forthcoming. These were statements made yesterday at a meeting of the traffic committee of the National Automobile Chamber of Commerce held in Detroit.

The committee named two committees who will visit railroad officials throughout the Central Freight Association territory and in the East to urge compliance with the Interstate Commerce Commission's recommendation that automobile cars be returned promptly to their home lines.

Traffic men named on the committees include H. R. Moule of the Chalmers Motor Car Co., A. C. Westfall of the Cadillac Motor Car Co., C. W. Eggers of the Willys-Overland Co., J. R. Graham of the Reo Motor Car Co., H. M. Newlin of the Maxwell Motor Co. Mr. Eggers is chairman of the traffic committee.

"There are approximately 30,000 automobile freight cars in the Central Freight Association territory and on Eastern trunk lines that are being used for all kinds of shipments other than automobiles," stated Mr. Eggers, following yesterday's meeting, "and we shall try to obtain the return of these cars. We shall point out to the railroad officials the recommendation made by the Interstate Commerce Commission in connection with its order calling for a redistribution of freight cars, to the effect that automobile cars should be returned to their home lines. Unless we can get some action in this matter it is probable that many car factories will have to suspend operations for a time at least."

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Freight Car Shortage Necessitates Urgent Relief

NEW YORK, Dec. 4—Nation-wide redistribution of box cars is required by a new order agreed upon by the railroad conference committee on car efficiency in its campaign to relieve the car shortage which is seriously holding up freight in all parts of the country. By this order box cars will be diverted from parts of the country where they are not needed, to the West, Northwest, South and Southwest, where there is urgent need for them. The instructions issued refer to box cars, loaded or empty.

As an emergency measure the railroad authorities at Washington have authorized the railroads to establish and maintain until May 1 a new progressive demurrage scale higher than the present flat rate of $1 a day. Under the new scale 2 free days are allowed, and subsequent charges are $1 for the third, $2 for the fourth, $3 for the fifth day, and $5 for the sixth and each day thereafter.

Apropos of the redistribution plan, railroads in New England are to turn over to their Southern and Western connections 30 per cent more box cars than they receive from those lines. Railroads in what is known as the trunk line and central freight territory, regardless of the number of box cars on their lines, must deliver to their Southern and Western connections 20 per cent more box cars than received from them.

—

Car Shortage Felt at Flint

DETROIT, Dec. 4—The Chevrolet Motor Co. has been forced to double deck the ordinary freight cars, shipping cars in many pieces in order to load them, and putting six cars in a freight car instead of three as ordinarily, in its efforts to overcome the freight car shortage. Every automobile maker in Flint is suffering from the shortage. Incoming freight shipments are piled up at the various freight receiving sheds. Railroads are making every effort to relieve the congestion.

—

November Jeffery's Biggest Month

KENOSHA, WIS., Dec. 2—During the first 3 months of the Nash Motors Co. régime, all sales records have been broken. November was the biggest sales month in the history of the company. During that month, its books showed an actual increase of 381 per cent over the corresponding month last year.

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Batavia Rubber Complains of Discriminating Freight Rates

WASHINGTON, Dec. 6—The Batavia Rubber Co., Batavia, N. Y., has filed complaint with the Interstate Commerce Commission charging the Atlantic Coast Line Railroad, and connecting lines, with discrimination in rates with respect to its articles of manufacture on shipments meant for so-called Southern Classification territory by way of Ohio River crossings.

The complaint alleges that this discrimination extends to classes of tires as follows:

First class, on pneumatic tires, in any quantity; second class on solid tires, any quantity; and, first class, on all others, such as tires in steel casings.

The complainant asks the commission to order rates which will cause "a larger spread" between the carload, and less than carload lots.

Goodyear Profits $7,003,330

Sales During Company's 1916 Fiscal Year Total $63,950,399

AKRON, Dec. 6—Sales of $63,950,399.52 during the past year are reported by the Goodyear Tire & Rubber Co., this city, in the year ending Oct. 31, 1916. This compares with $36,490,651.64 for the preceding year. Net profits were $7,003,330 as against $5,189,528 for the preceding year. There remains an unappropriated surplus of $2,253,166.87. Cash dividends during the year amounted to $764,239.28 on the preferred and $1,261,332 on the common. Stock dividends amounted to $8,427,000. To meet the demand for its products, the company added more fixed capital, which was provided for by the sale of $17,500,000 of preferred, having previously retired $6,650,000 of preferred then outstanding. A stock dividend of 100 per cent out of accumulated surplus was distributed, after paying the regular cash dividends, 7 per cent on the preferred and 12 per cent on the outstanding common.

In its balance sheet the company shows total assets amounting to $49,217,794, total liabilities of $9,167,973, thus leaving an excess of assets over liabilities of $40,049,820.

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Reo Drives 70 Per Cent of Cars

LANSING, MICH., Dec. 4—The Reo Motor Car Co. is driving more than 70 per cent of its output to dealers within a radius of 1000 miles in order to overcome the scarcity of freight cars, and up to the present has been fortunate enough to escape great hardship. The company plans to use flat cars when severe Winter weather prevents driving.

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Post Tire Buys Plant

ST. LOUIS, Dec. 2.—The Post Tire and Rubber Corp, recently incorporated for $1,500,000, has bought the plant of the Union Tire & Rubber Co., this city, and will immediately begin operations. The plant consists of a two-story brick structure with a total floor space of 70,000 sq. ft.

—

Grant Moves to Cleveland

CLEVELAND, Dec. 1—The Grant Motor Car Corp. marks the opening of its fourth year of growth, by removal from Findlay, Ohio, to its great new factory at Coit and Kirby Avenues, Cleveland.

The new Grant home is a model of modern efficient factory construction

and arrangement. The length is 600 ft.; the width 250 ft., and the floor space, 150,000 sq. ft. It has an annual capacity of 35,000 cars.

The factory is a unit. Every department, while separate, and distinct, is within easy access of the other departments with which its work is closely connected. The car while building passes from department to department quickly. By means of a conveyor system, the final car assembly may be completed in less than 10 min. The factory stands on a 7-acre tract.

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Apperson in New Factory

KOKOMO, IND., Dec. 4—The Aperson Bros. Automobile Co., this city, has just finished moving into its new group of factory buildings. Its plant is modern in every respect.

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Turnbull Wagon Adds Bodies

DEFIANCE, OHIO, Dec. 4.—The Turnbull Wagon Co. has added an automobile body department. This will be operated independently of the wagon factory.

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Dorris Discontinues 1500-Pounder

ST. LOUIS, MO., Dec. 1—The Dorris Motor Car Co., this city, has discontinued the manufacture of its 1500-lb. delivery wagon.

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Fitch, Tractor Inventor, Dead

BIG RAPIDS, MICH., Dec. 2—John H. Fitch, inventor of the four-drive tractor and president of the Four Drive Tractor Co., Inc., Big Rapids, died Nov. 24, after a brief illness. His office is filled automatically by E. J. Jenkins, who will continue also as general manager.

Timken Co-Operative Store

Employees of Axle Company Organize to Secure Benefits of Wholesale Prices

DETROIT, MICH., Dec. 1—Employees of the Timken-Detroit Axle Co. have organized a co-operative store for the purpose of reducing the high cost of living. For the present the store benefits will be confined to married employees, but it is planned to enlarge the establishment in the near future so that any employee may participate. Married employees will, temporarily, have to be in the employ of the firm for 6 months to be eligible. Outsiders will never be allowed to make purchases in the store.

The business will be operated entirely by employees though sanctioned and furthered by the company. L. R. Judson, head of the welfare department and temporary chairman and manager of the store, originated the idea. His first step was to write a letter to each of the eligible workers, asking them if they would like to save from 7 to 8 cents a pound on coffee. The letter was sent to feel out the employees on the subject and they were given 1 day to respond. More than 250 lb. were ordered and the plan saved the employees the amount promised, thus effectually giving the scheme its needed impetus.

A temporary structure is being erected to be used for the store and a permanent one will be built later. Orders have already been filled for tea, saving 14 cents on a 50-cent brand, and on apples saving 20 cents on a regular $2 grade. Canned goods, butter, eggs, corn meal and other staples will also be sold. A large saving on everything will be effected.

The store will start with 200 employees for membership and includes in its organization L. R. Judson, chairman and manager; G. W. Veal (assistant to general manager), acting secretary and treasurer, and W. R. McKay (superintendent), E. Rutter (material superintendent), and G. E. Holmes (carpenter foreman), executive committee.

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Studebaker Plans 200,000 Car Output

DETROIT, Dec. 5—The Studebaker Corp. is making plans for a production of 200,000 cars yearly and the employment of 20,000 men, with an aggregate yearly business of $100,000,000, within the next 2 years. The company employs 8000 workers at present.

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Buick Builds 563 Cars Daily

FLINT, MICH., Dec. 5—The Buick Motor Co., this city, has been turning out 563 cars daily in the past 8 working days. During November, 10,430 cars were shipped and 10,700 manufactured.

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Stout Plans Aeroplane Clubs

DETROIT, Dec. 4—W. B. Stout, manager of the aircraft division of the Packard Motor Car Co., plans to organize model aircraft clubs in all of the Detroit high schools. Mr. Stout organized a similar club in Chicago under the name of the Model Aero Club of Ill. The organization developed aeroplanes from models. It is planned through the new club to be organized here, to bring all of the different Detroit organizations interested in aviation together annually in competition.

Aviation Experts Gathered Together on Joy Field

This illustration is from a photograph taken at the Aviation Field owned by Henry B. Joy of Detroit. The field is located near Mt. Clemens, Mich., on the shores of Lake St. Clair. From left to right the men are as follows: W. H. Hutton; Henry B. Joy; Charles B. King; Dr. H. C. Dickinson, Bureau of Standards, Washington, D. C.; Lieut. Col. George O. Squier, Officer in Charge of Aviation; Eugene Lewis; Dr. W. Stratton, Director of Bureau of Standards; Henry Souther, Consulting Engineer United States Army; Dr. Charles F. Marvin, Chief of Weather Bureau, Washington, D. C.; Howard E. Coffin; S. D. Waldon; Lieut. W. G. Child, United States Navy; Roy D. Chapin; Dr. Charles D. Walcott, Sec. Smithsonian Institute, and Russell Huff

Is Scare Advertising Potential?

W. B. Lashar, of Weed Chain, Advances Arguments in Favor of Such Copy

NEW YORK, Dec. 1—Whether scare advertising copy is potential copy or not is a question that may be settled in the not distant future. When the National Automobile Chamber of Commerce, Inc., appointed its committee to discourage scare advertising, one of the concerns it had in mind was the American Chain Co., manufacturer of Weed anti-skid chains. Walter B. Lashar, president of this concern, has taken up the defense of scare copy on the ground that it is positive advertising rather than negative, and he believes his advertising thus performs a public service.

One of the pertinent examples cited by Mr. Lashar is that a manufacturer of fire extinguishers that have real merit, who puts out scare copy does not thus make people give up living in houses, but makes them more keen for fire-proof construction. Mr. Lashar asks the question: "Does such copy make people scoff at the dangers of fire, make them more reckless than ever, or does it bring home to the individual a vivid realization of a fire in his home and make him insist that every possible precaution be taken to prevent fires?"

Continuing his arguments in favor of scare copy, Mr. Lashar says:

"Scare copy is like any other copy; it can be good or bad or merely negative. There is only one standard by which 'scare' copy can be judged: The criterion is not what it does *to* the public but what it does *for* the public.

"If scare copy plays upon the credulity, the superstition, the helplessness, the cupidity of people, merely to coin these weaknesses into money without regard to the harm that is being done; if this copy is a lie in spirit or in fact; if it increases real suffering and misery, by dwelling upon an evil for which there is no prevention and no remedy—then it is a crime to use such copy. But scare copy that is true, that brings home to each individual a consciousness of his own personal responsibility for a real evil that is a constant menace—a reality that exacts a frightful toll in human lives and in human suffering—and points out a direct and effective remedy that ordinary intelligence can use, such scare copy is doing a great public service.

"It is true that this 'scare' copy may make a few hundred neurasthenics a little more miserable, but the real evil is in the neurasthenia, not in the copy. The logical effect of this scare copy is to make a thousand people more careful to safeguard against troubles. The measure of the worth of such copy has not its effect upon a relatively small group of people but its effect upon the public as a whole.

"The manufacturer uses scare copy because it sells his product. Selling is the most important factor in his business. A manufacturer whose selling plan makes money for himself, and at the same time is of great and definite benefit to the public, including the part of the public that does not buy his product, seems to me to be a more real philanthropist, a more valuable philanthropist than one who gives a certain sum of money for a particular work.

"The simple truth is that scare copy is the only kind that jars some of us out of our complacent self-sufficiency, our fixed habits of carelessness, our blind delusions, that we will get through somehow, our disposition to take a gambler's risks."

Mr. Lashar finishes with the following: "These are some of the reasons why we continue to use intelligent, constructive scare copy, the object of which is to make motoring safe and secure, under all road conditions, for all those who use the road, whether they travel in cars, on foot, or by horse. So long as scare copy benefits the public infinitely more than it can profit any company, such a company can afford to let any interest that feels itself antagonized by such copy fight out the issue with the public."

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Moto-Meter Enjoins Heat-Ometer

NEW YORK, Dec. 1—A preliminary injunction prohibiting sale of the Heat-Ometer radiator indicator and use of the word Heat-Ometer has been granted on complaint of the Moto-Meter Co., Inc., maker of the Boyce Moto-Meter. Suit was brought against the Times Square Automobile Co., which had been selling Heat-Ometer, the Moto-Meter Co. alleging that the device infringed its product and that the use of the word Heat-Ometer infringed the trade mark Moto-Meter.

The Heat-Ometer, made by the Heat-Ometer Co., Inc., New York, consists of a diamond-shaped frame holding a glass indicator tube containing a sensitive liquid which is pink at normal temperature but turns deep purple when a dangerous degree of heat is reached. Like the Boyce Moto-Meter, the Heat-Ometer is mounted on the radiator cap. The suit was in the U. S. district court for the southern district of New York.

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Ford Suit in Judge's Hands

DETROIT, Dec. 1.—The suit instituted by Dodge Bros. against the Ford Motor Co. to restrain the latter from further expansion is now in the hands of the judges, who have taken the case under advisement for an early decision.

70% of Accidents at Crossroads

Sec. of State Hugo, of N. Y., Finds Fatalities Measured by Driver's Carelessness

ALBANY, N. Y., Dec. 2—That approximately 70 per cent of fatal automobile accidents are due to careless driving at street and road intersections, according to the coroner's report, is pointed out by Secretary of State Hugo, who has made a study of the traffic conditions accompanying such accidents.

There seems to have been little difficulty where cars travel along intersecting roads of unequal importance, owing to the established custom that the car on the less important road must approach the main highway with special caution, a practice expected by those moving rapidly on the more important thoroughfare. The real difficulty arises when crossroads are of equal importance with the result that drivers approach rapidly from both directions, each considering himself entitled to the exercise of caution by the other driver. There seems to be an increase in the number of instances where misunderstandings based on reasoning of this kind leave the driver to take chances by approaching intersections at high speed. Though the law requires drivers to slow down and signal for crossroads comparatively few observe these rules, thus enhancing the risk of accident. Secretary Hugo considers that too great reliance is frequently placed by automobilists on the power of their brakes to stop their cars quickly. This is unwise, he says, because the driver may, and frequently does, misjudge his speed and other surrounding conditions.

More Care Required

Dangerous crossroads or those of congested area are usually protected by traffic police during the daytime. After these hours, however, these points present problems in accident prevention which are constantly growing more difficult with the increasing number of automobiles and other vehicles traveling these thoroughfares.

Unless some steps are taken to compel all drivers to approach crossroads of equal prominence with the greatest care, Secretary Hugo fears that accidents of this kind will become more frequent and more serious. Warning signals might provide a certain amount of protection at such points, although these are not sufficiently effective in all cases, particularly, as there is nothing to prevent deaf persons from operating cars. The only satisfactory solution of the problem is the use of care by each individual driver when approaching such intersections.

Denmark Likes U. S. A. Cars

Consul General Winslow Reports Demand for Cars and Trucks Increasing

NEW YORK, Dec. 4—The automobile business in Denmark is in a brilliant condition at the present time, according to E. D. Winslow, consul general of the United States to Denmark. Mr. Winslow has returned only recently from that country and states that the demand for cars in that country has increased to such an extent during the past 2 years that the supply is entirely inadequate. People are prosperous on account of the high prices paid for their products due to the war, and the excellent road conditions and attractive touring possibilities of the country naturally make the purchase of a car the logical sequence.

Motor trucks have never before been in as great demand in Denmark as at the present time since the unusually high prices paid for horses by the belligerant nations have induced a very large percentage of the horse owners to part with their animals. Since the labor thus lost must be made up, motor trucks are being bought in large numbers to do the work formerly performed by the horses. On the farms the use of motor tractors has increased rapidly and it is very probable that these machines will be in still greater demand in the future.

The obnoxious laws, which formerly limited automobile touring in Denmark, have either been repealed or so modified that it is now possible to travel throughout the country just as freely as in other lands.

Most Cars Represented

Most of the leading American car manufacturers are now represented in Denmark and Mr. Winslow recommends that any car or accessory maker desirous of entering the Danish field secure special agents. There are now more dealers in Denmark than ever before, about fifty being located in Copenhagen. The people have taken kindly to American cars and accessories and at the present time our manufacturers have this market almost to themselves. If the quality of the American products is maintained and the service rendered by the manufacturers' representatives is satisfactory, this market should be continued after the war.

Very little data can be secured at present in regard to automobile imports into Denmark. The only statistics available, those for the years 1912 and 1913 appearing in tabular form below are in the form of weight of cars, chassis and parts in pounds, trucks not being segregated. These statistics serve to indicate how small these imports were before the beginning of the war.

Imported Into Denmark

COMPLETE CARS

From	1913 Lb.	1912 Lb.
Germany	979,000	765,380
Great Britain	264,000	214,500
Sweden	43,780	10,340
Belgium	36,960	7,480
France	240,020	221,320
United States	201,300	115,280
Other Countries	17,820	13,420
Total	1,782,880	1,347,720

CHASSIS

From	1913 Lb.	1912 Lb.
Germany	64,680	16,720
Great Britain	7,700	11,220
Sweden	6,380	0
France	38,500	5,500
United States	1,980	3,300
Other Countries	0	3,080
Total	119,240	39,820

PARTS

From	1913 Lb.	1912 Lb.
Germany	2,420	1,540
Great Britain	440	2,860
Sweden	11,880	1,100
France	10,560	440
Austria-Hungary	0	440
Total	25,300	6,380

To Raise Fire Insurance Rates

NEW YORK, Dec. 5—Automobile fire insurance rates will advance about 10 per cent Jan. 1. The new schedule has been issued by the Eastern and New England Automobile Underwriters' Conferences. In addition to this slight advance, policies will now be written under the non-valued plan, either with or without the theft clause. Heretofore this has not been possible. Policies under the valued plan will include the theft clause as usual. No car can be insured for more than its cost to the owner.

Wants U. S. A. Ideas

LONDON, ENGLAND, Nov. 15—At the last meeting of the Institution of Automobile Engineers, Mr. A. E. Berriman of the Daimler Co., made the suggestion that endeavors should be made to obtain each session a paper from a leading American automobile engineer, giving the latest views on designs, etc., in the United States. This was in discussion following the reading of a paper on American lighting, starting and ignition systems.

Cadillac Co. Starts Suit

DETROIT, Dec. 1—The Cadillac Motor Car Co. has started suit against the Cadillac Auto Truck Co., Cadillac, Mich., asking for an injunction restraining the latter firm from using the name Cadillac or Cadillac Auto Truck Co. or any other name prejudicial to the interests of the Detroit concern.

Electro-Pneumatic Gearshift

New Company To Erect Plant in Pittsburgh for Its Manufacture

PITTSBURGH, Dec. 4—The Electro-Pneumatic Gearshift Corp., of this city, has announced its intention to erect a plant for the manufacture of an electro-pneumatic gearshift. The actual power for shifting the gears is supplied by compressed air and contained in a reservoir and fed by a pump driven off the timing gears, there being an automatic valve for cutting in the pump when pressure falls below a predetermined amount. The air is used also for operating the clutch so that all the driver has to do is to move the switch lever mounted on the steering column.

It is stated that the magnetic operation of the valves controlling the air is such that the gears and clutch can be operated at any speed desired. This should eliminate the shock which would be bound to occur if the clutch were engaged automatically always at the same speed. It allows for smooth starting and it also enables the driver to differentiate between a change up and a change down on the gears, operations which should not be performed with quite the same celerity.

The inventor is John J. MacPherson and the company has been formed with M. F. Metcalf president and Joseph C. Baird, secretary and treasurer.

$10,000 for Fuel Research

NEW YORK, Dec. 1—A $10,000 prize for fuel research will be given by the Aero Club. By the will of the late S. H. Valentine, formerly Governor of the Aero Club of America, this sum has been given to the club to establish a prize, or prizes, for the encouragement of aircraft, which shall not use gasoline as a fuel. Mr. Valentine's bequest is expected to stimulate interest in the discovery of a new fuel, lighter than gasoline, which will make longer flights possible.

Richardson Chalmers Advertising Mgr.

DETROIT, Dec. 6—C. S. Richardson has been appointed advertising manager of the Chalmers Motor Co., this city. He was formerly with the Mahin Advertising Agency.

Travers Nash Advertising Mgr.

DETROIT, Dec. 6—E. J. Travers has become advertising manager of the Nash Motor Co., Kenosha, Wis. He was formerly with the Chicago *Herald*.

Winton Chauffeurs Get Prizes

25 Drivers Total 290,426.7 Miles at Repair Cost of $5.90

CLEVELAND, Dec. 6—The Winton Co., this city, has awarded chauffeurs $3,500 in prizes in its annual contest for those who drive Winton cars the farthest with the least repair expense. This year twenty-five chauffeurs drove their cars a total of 290,426.7 miles at a total repair expense of $5.90. George Felt of Minneapolis, chauffeur for H. D. McCord, won first prize, $500. W. C. Ball of Kalamazoo, chauffeur for F. F. Rowe, was awarded second money, $400. Alfred Shibley of Pittsburgh, driving for J. W. Lloyd, and W. M. Newsome of Atlanta, driving for M. R. Hirsch, won third and fourth prizes, respectively, $300 and $200. Prizes of $100 were awarded to the following:

A. H. Klein, chauffeur; S. J. Wilkins, Chicago, owner of car.
Ralph H. Lee, chauffeur; S. J. Franklin, Millville, N. J., owner of car.
G. M. Lewis, chauffeur; E. R. Caldwell, owner of car.
Henry Belanger, chauffeur; Mrs. D. B. Curtis, Manchester, N. H., owner of car.
George T. Macone, chauffeur; F. E. Coursen, Stockbridge, Mass., owner of car.
Thomas Murren, chauffeur; J. M. Anderson, Boston, owner of car.
Joseph Castellucci, chauffeur; Mrs. M. E. Bearse, West Medford, Mass., owner of car.
Edw. M. Armstrong, chauffeur; C. M. Godnow, Boston, owner of car.
Robert Clements, chauffeur; F. H. Jones, Andover, Mass., owner of car.
P. O. Hale, chauffeur; A. P. Friend, West Newton, Mass., owner of car.
F. H. Coyston, chauffeur; W. L. Porter, Pittsburgh, owner of car.
T. L. Quigley, chauffeur; J. J. Flanagan, Elmira, N. Y., owner of car.
Herbert Lewis, chauffeur; George Spottiswoode, Orange, N. J., owner of car.
Chris McDermott, chauffeur; Robert Fraser, Utica, N. Y., owner of car.
P. J. Farrington, chauffeur; M. H. Hellman, Los Angeles, owner of car.
Charles Schmidt, chauffeur; Thomas Lonergan, St. Louis, owner of car.
W. Desillier, chauffeur; Allen Arnold, Swampscott, Mass., owner of car.
W. L. Woods, chauffeur; Miss H. J. Silver, Brooklyn, owner of car.
A. P. Holst, chauffeur; Mrs. John Sexton, Chicago, owner of car.
E. P. Carey, chauffeur; William de la Barre, Minneapolis, owner of car.
Albert Hitchen, chauffeur; C. W. Tabor, Los Angeles, owner of car.

More interesting than the report for any single year are the grand totals for the entire period during which contests have been conducted—9 years, as follows:

Number of cars that traveled 5000 miles or more each	536
Total mileage made by these cars	5,509,049.3
Average miles per car	10,278
Total repair expenses for all cars	$5,640.64
Average repair expense per car	$10.52
Average repair expenses per car per 1000 miles	$1.03

Or less than 1-9th of 1 cent per mile.

The total distance traveled by these Winton Six cars, every mile of which was sworn to by both the car owner and his chauffeur, is greater than would be traveled on 220 tours around the earth at the equator. Five and one-half million miles certainly constitute an exhaustive test of the standing-up qualities of a motor car. And the average repair expense indicates that a Winton six owner traveling 25,000 miles per year would encounter repair expenses of $25.75 per annum.

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Detroit-Wyandotte Sells Stock

DETROIT, Dec. 1—The Detroit-Wyandotte Motor Truck Co. is selling its unissued treasury stock for the purpose of securing a larger working capital. The concern is going into foreign markets and is making shipments to Porto Rico and Cuba.

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Steel Prices Higher

NEW YORK, Dec. 5—This week's market activities were featured by the expected rise in steel. Both Bessemer and open-hearth rose $2.50 a ton to $55. Lead rose 45 cents per 100 lb. to $7.75. Kansas crude petroleum went up 10 cents a barrel on Thursday to $1. Rubber prices are higher, Para quoting at 79 cents a pound and Ceylon at 74½ cents.

The further rise of rubber will probably hasten the long-expected rise in tire prices, which, it has been reported, will probably go up in the early part of 1917.

Tin dropped to $45 per 100 lb., a net loss of 25 cents. Rapeseed oil rose 3 cents to 98 cents a gallon. Linseed oil dropped 3 cents a gallon to 93 cents.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.63	.63	.63	.63	.63	.63	...
Antimony, lb.	.14	.14	.14	.14	.14	.14	...
Beams and Channels, 100 lb.	3.17	3.17	3.17	3.17	3.17	3.17	...
Bessemer Steel, ton	52.50	52.50	52.50	55.00	55.00	55.00	+2.50
Copper, Elec., lb.	.35	.35	.35	.35	.35	.35	...
Copper, Lake, lb.	.35	.35	.35	.35	.35	.35	...
Cottonseed Oil, bbl.	12.77	12.75	12.71	12.75	12.73	12.70	— .07
Fish Oil, Menhaden, Brown, gal.	.68	.68	.68	.68	.68	.68	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.30	1.30	1.30	1.30	1.30	1.30	...
Lead, 100 lb.	7.30	7.40	7.40	7.50	7.50	7.75	+ .45
Linseed Oil, gal.	.96	.96	.96	.96	.93	.93	— .03
Open-Heartb Steel, ton	52.50	52.50	52.50	55.00	55.00	55.00	+2.50
Petroleum, bbl., Kans., crude	.90	.90	1.00	1.00	1.00	1.00	+ .10
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.95	.95	.98	.98	.98	.98	+ .03
Rubber, Fine Up-River, Para, lb.	.78	.78	.78	.78	.78	.79	+ .01
Rubber, Ceylon, First Latex	.72	.72	.72½	.72½	.72½	.74¼	+ .02½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	45.25	45.25	45.00	45.25	45.25	45.00	— .25
Tire Scrap, lb.	.06¼	.06¼	.06¼	.06¼	.06¼	.06¼	...

1% Extra Chandler Dividend

Earnings for Year Estimated at $1,715,000 or $24.50 Per Share

CLEVELAND, Dec. 5.—The Chandler Motor Car Co. has declared an extra dividend of 1 per cent in addition to the regular 2 per cent quarterly distribution, both being payable Jan. 2 to holders of record Dec. 18.

The company is earning approximately $24.50 per share this year, or around $1,715,000. Shipments of cars for 1916 are 115 per cent greater than in 1915, and orders now actually signed up amount to 20,381 cars.

It has been officially estimated that in 1917 net earnings should exceed $2,800,000, which would be equal to $40 per share. The net earnings this year, $1,715,000, allow a surplus of over $1,000,000, after the payment of the 10 per cent dividends which have been declared since Jan. 1.

Chandler shipments in October were four and a half times larger than a year ago; four times greater in November, and will be six times greater in December.

An important factor of the Chandler situation is that its dealers are without cars and are urging deliveries.

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Dividends Declared

Kelly-Springfield Tire Co., quarterly of 1½ per cent on 6 per cent preferred, payable Jan. 2, to stock of record of Dec. 16.

Edmunds & Jones Corp., $1 a share on the common and the regular quarterly dividend on the 7 per cent preferred, both payable on Jan. 2. This is the third dividend the corporation has declared since March 30, 1916.

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New Directors Proposed for Pierce-Arrow

BUFFALO, Dec. 5.—The transfer of the Pierce-Arrow property from the present company to the Pierce-Arrow Motor Car Corp. will be made to-morrow, when the new organization takes hold, under the presidency of Colonel Charles Clifton.

It is proposed to make the following persons directors of the new organizations: Charles Clifton, president; Henry May, vice-president; W. J. Foss, Buffalo; J. F. Alvord, president of the Torrington Co.; W. S. Cox, of J. & W. Seligman & Co.; C. J. Schmidlapp, vice-president of the Chase National Bank; J. G. Dudley, of Buffalo; Albert Strauss, of J. & W. Seligman & Co., and C. H.

McCullough, vice-president and general manager of the Lackawanna Steel Co., Buffalo.

The company was recently chartered in this State under the name of the Pierce-Arrow Motor Car & Truck Co., with 350,000 shares of capital stock, 100,000 shares of preferred, par $100, and 250,000 shares of common with no par value. The incorporators were L. D. Adkins, R. J. Trimble and E. S. Hemphill.

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Crow Likes Old Name Best

ELKHART, IND., Dec. 4—The Crow Motor Co., this city has changed its name to the Crow-Elkhart Motor Co. The company announced only a few weeks ago that its name had been changed from the Crow-Elkhart Motor Co. to the Crow Motor Co., and now the old name is effective again.

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Ford Tractor Capital Now $10,000,000

DOVER, DEL., Dec. 1—The Ford Tractor Co., Ltd., has filed a certificate changing its name to the Ford Tractor Co., Inc., and increasing the capital stock from $1,000,000 to $10,000,000. The company was first incorporated here Nov. 8, 1916.

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Porter Rubber Doubles Capital

SALEM, OHIO, Dec. 1—The Porter Rubber Co. will increase its capital from $125,000 to $250,000, to permit expansion and the probable construction of another plant.

Motor Issues Are Lower

General Motors Only One to Show Strength with a Gain of 140 Points

NEW YORK, Dec. 6—The automobile and accessory securities are at present in an apathetic market with a corresponding decrease in value. General Motors, with a gain of 140 points, was the only security to show strength. Last week, this stock declined 90 points on a fluctuating market. Fisk first preferred regained the 9 points lost the previous week by jumping 10 points to 110. Packard preferred gained 3 points.

Chevrolet declined 7 points more this week, making a total of 11 in two weeks. Firestone common dropped 6 points. Studebaker common went down 4 points more to 120 and Willys-Overland common 2⅛ points to 36⅜.

Quotations on the Detroit Stock Exchange were a little higher this week with gains ranging from a fraction to 4½ points. Studebaker common dropped 6⅛ points in sympathy with the New York quotation. It is reported in Detroit that United Motors stock will soon be listed on the New York Exchange.

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Control Three Tire Companies

COSHOCTON, OHIO, Dec. 5.—The interests who took over the plant of the McClurg Rubber Co. at Coshocton, Ohio, have organized a number of corporations, among which are the Midland Tire & Rubber Co., the Ben Hur Tire & Rubber Co. and the Peerless Tire & Rubber Co. The plant, which is now in operation, will be conducted by the Midland Tire & Rubber Co. The other corporations were chartered in order to preserve the names of the Peerless and Ben Hur tires, which were formerly manufactured at the local plant.

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Pennsylvania Crude Reaches $2.75

NEW YORK, Dec. 6—Pennsylvania crude oil was advanced 15 cents yesterday, making $2.75 a barrel paid producers, the highest price ever reached in the history of the oil industry. A year ago when oil prices went beyond the expectations of producers the price was $2.50 and $3 oil was predicted.

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Milwaukee Gasoline Up 1½ Cents

MILWAUKEE, Dec. 2.—Gasoline prices on the so-called 65-deg. test were advanced 1½ cents per gallon, and on the 70-deg. test 2 cents per gallon, by all oil companies operating in Milwaukee, on Dec. 1. The prices on the lower tests are undisturbed from the last change, effective Oct. 11.

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Parker Rust-Proof Issues Stock

DETROIT, Dec. 4—The Parker Rust-Proof Co. has authorized a capital stock issue of $600,000 7 per cent cumulative preferred stock—non-assessable, and $1,700,000 common stock—non-assessable. The present price of the stock is $100.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co	70	72	..
J. I. Case T. M. Co. pfd	87	90	..
Chalmers Motor Co. com	135	..	+1
Chalmers Motor Co. pfd	110	115	—1
*Chandler Motor Car Co	111	112	+1
Chevrolet Motor Co	165	175	—7
Fisher Body Corp.	38	41	..
Fisk Rubber Co. com	80	90	..
Fisk Rubber Co. 1st pfd	110	115	+10
Fisk Rubber Co. 2d pfd	90	100	..
Firestone Tire & Rubber Co. com	162	165	—6
Firestone Tire & Rubber Co. pfd	106	108	..
*General Motors Co. com	650	825	+140
*General Motors Co. pfd	120	121	..
*B. F. Goodrich Co. com	69⅛	69½	— ⅛
*B. F. Goodrich Co. pfd	111	113	—2½
Goodyear Tire & Rubber Co. com	293	296	—1
Goodyear Tire & Rubber Co. pfd	108¾	109½	+ ¼
Grant Motor Car Corp	8	9	..
Hupp Motor Car Corp. com	3¾	4¾	— ¼
Hupp Motor Car Corp. pfd	80	95	..
International Motor Co. com	48	..	—1
International Motor Co. pfd	23	..	..
*Kelly-Springfield Tire Co. com	75	76	—1¼
*Kelly-Springfield Tire Co. 1st pfd	95	99	—1
Keystone Tire & Rubber Co	15½	16½	— ¼
*Lee Rubber & Tire Corp	37	37½	—1¼
*Maxwell Motor Co. com	73½	74	— ½
*Maxwell Motor Co. 1st pfd	81½	82	— ¼
*Maxwell Motor Co. 2d pfd	49	51	— ½
Miller Rubber Co. com	255	260	..
Miller Rubber Co. pfd	108	109	+1
National Auto Corp	36	37	..
Packard Motor Car Co. com	168	173	—5
Packard Motor Car Co. pfd	104	106	+3
Paige-Detroit Motor Car Co	39	40	+1
Peerless Truck & Motor Corp	22	24	+1
Portage Rubber Co.	167	169	+2
Regal Motor Car Co. pfd	20	30	—5
Reo Motor Car Co	46	48	+ ½
Saxon Motor Car Corp	76	78	—2
A. O. Smith Corp. pfd	96¼	97	— ½
Springfield Body Corp. com	85	95	—5
Springfield Body Corp. pfd	120	130	..
Smith Motor Truck Co	6¼	6⅜	+ ⅛
Standard Motor Construction Co	6	7	—1
Stewart-Warner Speed. Corp. com	104	106	—2
Stewart-Warner Speed. Corp. pfd	..	..	..
*Studebaker Corp. com	120	120½	—4
*Studebaker Corp. pfd	109¼	112	..
Stutz Motor	63	64	—2
Swinebart Tire & Rubber Co	..	88	..
United Motors Corp	60½	60¾	—1
*U. S. Rubber Co. com	65¾	66	..
*U. S. Rubber Co. pfd	113¾	115	+1½
White Motor Co.	53¾	54	— ¼
*Willys-Overland Co. com	36¾	36½	—2¼
*Willys-Overland Co. pfd	98¾	99⅞	+⅜

*At close Dec. 4, 1916. Listed New York Stock Exchange.
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co	45½	..	+ ½
Chalmers Motor Co. com	..	150	..
Chalmers Motor Co. pfd	112	115	..
Continental Motor Co. com	43¼	44¼	+1¼
Continental Motor Co. pfd	9¾	10¼	..
Ford Motor Co. of Canada	293	305	..
General Motors Co. com	..	825	..
General Motors Co. pfd	119	122	+1
Maxwell Motor Co. com	71½	74½	—2½
Maxwell Motor Co. 1st pfd	80	83	..
Maxwell Motor Co. 2d pfd	48	51	..
Packard Motor Car Co. com	..	175	..
Packard Motor Car Co	101	..	—3
Paige-Detroit Motor Car Co	38¾	39¾	+ ½
W. J. Prudden Co	53½	56	+4½
Reo Motor Car Co	46¼	47¼	+1½
Studebaker Corp. com	118	122	—6½
Studebaker Corp. pfd	107	..	..
C. M. Hall Lamp Co	29½	31	..

INACTIVE STOCKS

Atlas Drop Forge Co	..	33	..
Kelsey Wheel Co	55	60	..
Regal Motor Car Co. pfd	25	33	..

Frontenac Wins at Uniontown

Race Marred by Death of Three in Accident—Winner Averages 102 M.P.H.

UNIONTOWN, PA., Dec. 2—The first race meet on the local speedway to-day was marred by a sad accident in which three were killed. Hughie Hughes, driver of the Hoskins, and Frank Galvin and his mechanician, Gaston Weigel, were killed when Galvin's Premier swerved in front of the pits and side-swiped one-quarter of the press stand, where Hughes was standing. Hughes and Wiegel were instantly killed and Galvin died later. That to-day's race was under the spell of a hoodoo is manifested in the fact that two others were killed a few days before the race when C. M. Heist and F. E. Bush were killed while in practice after they had been ordered off the track. The car struck the wall at the top of the speedway and went through. The accident was due to a crystallized axle.

That the accidents are not the fault of the new 1⅛-mile board speedway makes the death of five appear all the more under the spell of a hoodoo. The track was in good condition and fast.

Hughes in to-day's 112½-mile race was going at 91 m.p.h. when he pulled up on the Pugh car, which was going slowly, and in order to avoid hitting it Hughes ran his car through the guard rail and out into the field in the center of the track. He then went to the pits and was standing beside his car in front of the press stand, when Galvin's car, going nearly 100 m.p.h., suddenly, through some fault of the brake or wheel, swerved into him and the press stand.

Fully 21,000 people saw the races, the main event being won by Louis Chevrolet in a Frontenac, his time being 1:14:12 for 112½ miles, or 102 m.p.h.; Lewis, in a Premier, was second in 1:16:36½; De Palma, in a Mercedes, was third in 1:17:56 1-5, and Newgard, in a Crawford, fourth in 1:25. First prize was $1,000, second $700, third $500 and fourth $400.

The second race, a 54-mile event for dealers, was won by N. P. Fetterman in Peerless in 40:18. M. F. McCarthy in Murray second and H. L. Robinson in Haynes third.

Hughie Hughes, killed to-day, was an English racing driver. He came to the United States 10 years ago, and recently made his home here. Hughes is of the old school of automobile drivers. In 1904, in France, he drove a De Dietrich in the Gordon Bennett race. In 1911 he won the Savannah Trophy race in a Mercer. The same year saw him third in the Grand Prize race in an Ono. He won the Tacoma Potlach contest in 1914, driving a Maxwell. He also won several hillclimbs with the Allen-Kingstons. He took Christie's front-drive car and drove it 110 m.p.h. at Indianapolis. He was a member of the British Aviation Corps and was 31 years old.

Resta Confirmed as Champion

NEW YORK, Dec. 5—The champion automobile racing driver of 1916 is Dario Resta. The contest for points in the American Automobile Assn. championship standing closed with the running of the 150-mile race at the Ascot Speedway, Los Angeles, on Thanksgiving Day. Resta with his total of 4100 points has a lead of 660 points over Aitken, his nearest rival, and he will be officially crowned by Chairman Kennerdell of the A.A.A. Contest Board at a dinner scheduled in Chicago on Feb. 1 under the auspices of the Chicago Automobile Club.

When it was announced last spring that the American Automobile Assn. would officially designate the 1916 champion the Bosch Magneto Co. immediately offered to award a trophy and $2,000 in cash to the driver so selected, and $1,000 and $500 to the drivers ranking second and third in the final official standing. The B. F. Goodrich Co. added $10,000 to the purse thus created, to be split $5,000, $3,000 and $2,000. Resta will thus receive $7,000 and a cup, Aitken $4,000 and Rickenbacher $2,500.

There were fifteen races which figured in the championship standings and the number of points awarded each was governed by the length and character of entries.

The final scores of all drivers with a ranking in the 1916 championship standing follows:

Dario Resta	4100	George Buzane	210
John Aitken	3440	Eddie O'Donell	185
E. V. Rickenbacher	2910	Chas. J. Devlin	140
Ralph De Palma	1790	Arthur H. Klein	125
Earl Cooper	1405	Jack LeCain	120
Wilbur D'Alene	1120	Glover Ruckstell	100
Thomas Milton	690	Barney Oldfield	80
Pete Henderson	667	Earl DeVore	80
Frank Galvin	645	Omar Toft	75
Ralph Mulford	620	Ora Halbe	60
Howard Wilcox	618	George Adams	55
Josef Christiaens	540	Mel Stringer	55
Dave Lewis	500	Jack Gable	45
Ira M. G. Vail	450	Billy Chandler	40
Jules Devigne	350	Bert Watson	35
Hughie Hughes	275	M. Sorenson	35
Clyde Roads	270	Art Johnson	30
A. H. Patterson	270	Jas. A. Benedict	30
Eddie Pullen	260	F. McCarthy	25
Wm. Weightman, 3rd	240	Andy Burt	25
		W. J. Muller	20

Test Fisher Farm Tractors

INDIANAPOLIS, Dec. 6—Five experimental one-wheel farm tractors, of the type to be manufactured by the new company in which Carl G. Fisher is interested, are being tested to destruction with a view to improving the design, which should be completed March 15. It is planned to start production in July.

Stutz Finishes First at Phoenix

Delno, Winner of State Fair Century, Captures 100-Mile Track Race

PHOENIX, ARIZ., Dec. 1—R. H. Delno of Tucson, driving the same sixteen-valve Stutz with which he won the century grind at the State Fair Nov. 18, won the 100-mile Thanksgiving Day race at the State fair grounds yesterday in 1 hr., 38 min. and 29¼ sec. Delno's time was 4½ min. faster than in the State Fair race, which he won in 1:43:12. R. E. Lambert, driving a Spa, was second in the Thanksgiving contest, his time being 1:42:00½. Roy Meacham in a Mercer finished third in 1:46:12.

Mechanician Killed

W. M. Drennan of Oklahoma City, a mechanician, was killed almost instantly when the Hudson entry No. 5 crashed through the fence on the north turn while R. G. Armstrong, driver, was attempting to pass the car ahead. The accident, which occurred in the seventh lap, was caused by Armstrong swinging to the outside of the track in an effort to pass the car ahead, and as both right wheels went over the bank into the soft earth Armstrong and Drennan were hurled from the car. Drennan was thrown against a post, as the big racer crashed through sixty feet of fence. Armstrong's escape with slight injuries was miraculous.

Pete Thomason in a Ford finished fourth in 1:49:26 and Al Gladney's Overland fifth in 1:49:40. The performance of the Ford, which went 94 miles without a stop, was one of the features of the contest. Thomason threw a tire in the ninety-fifth lap, otherwise would have been in the money. Seven of the nine entrants were running at the finish.

A. A. A. Opens New Offices

NEW YORK, Dec. 2—The American Automobile Assn. is establishing a branch bureau in the Circle Building on Broadway near Fifty-ninth Street.

U. S. Cars Popular in Java

NEW YORK, Dec. 2—Of the 759 automobiles imported into Java for the first 6 months of this year, 668 cars came from the United States, fifty-three from Italy and thirty-two from the Netherlands.

Roads Built Under Federal Supervision

WASHINGTON, D. C., Dec. 2—Nearly 5,000,000 sq. yd. of roadway, the equivalent of 561.9 miles of road 15 ft. wide,

were constructed under the supervision of Federal road specialists during the last fiscal year, according to the annual report of the Office of Public Roads and Rural Engineering, of the U. S. Department of Agriculture, just issued. This is more than double the mileage so constructed in previous years. The roads constructed under supervision of the office include experimental roads, post roads, county roads, and roads in National Parks and forests.

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Boston Show Space Sold

BOSTON, MASS., Dec. 2—Practically all the space for the Boston show which opens in March has been sold. Provisions may be made later to take care of a few late comers, but they will have to share space with someone else, and possibly go in the basement. The first floor will be given over entirely to cars, and the balconies will have the accessories. There will be more space available this year because the big dining room has been taken over for the next show and this will give a big slice of room. A small section of hallway will be used for a luncheon space.

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75 Auto-Lite Men Convene

TOLEDO, Dec. 4—Seventy-five members of the Electric Auto-Lite Co.'s organization met here in convention to-day.

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Trumbull S. K. F. Advertising Manager

HARTFORD, Dec. 2—H. N. Trumbull has been appointed Advertising Manager of the S. K. F. Ball Bearing Co., this city.

Rickenbacher Wins at Ascot

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Duesenberg Takes 150-Mile Race—Cooper Is Second and Pullen Third

LOS ANGELES, Nov. 30—Eddie Rickenbacher in a Duesenberg to-day won the 150-mile Championship Award Sweepstakes race on the 1-mile paved Ascot Speedway, the final event in the American Automobile Association's contest for the title of champion driver of America. His time was 2:18:15.5. Cooper in a Stutz was second, Pullen in a Mercer was third, and Ruckstell in a Mercer was fourth. Cooper ran out of gasoline ½ mile from the finish, but coasted to the tape. Attendance was 30,000.

Pullen led at the 50th mile, with Rickenbacher, Cooper, Ruckstell and the field following. Pullen's time was 42:55 for the 50 miles, an average of 69.9 m.p.h.

Pullen, Rickenbacher, Cooper and Ruckstell were bunched in the lead in that order at 100 miles. Pullen's time was 1:28:18, an average of 57.95 m.p.h.

There were twelve entries and $5,000 in prizes, divided into $3,000 for first, $1,250 for second, $500 for third and $250 for fourth.

—

17 Exhibitors for Salon

NEW YORK, Dec. 2.—There will be seventeen exhibitors at the thirteenth annual Automobile Salon, Jan. 2 to 10, in the grand ball room of the Astor. Though the number of exhibitors is one less than the high mark established in 1912, the number of cars will be about 40 per cent greater, as the balcony of the ball room is to be used for exhibiting the overflow.

The list of exhibitors contains one which has heretofore exhibited at the National Shows, the Locomobile Co. of America. The other exhibitors are: White, Brewster, Daniels, Isotta-Fraschini, Lancia, Murray, Navara, Phianna, Rolls-Royce, Simplex, Singer and S-S-E. Custom body builders include Brewster, Holbrook, Locke and Rubay. In addition to these exhibits there will be a half dozen of tires and accessories.

The exhibition of the Navara marks the debut in the automobile field of the Herreshoffs, of Bristol, Conn., prominent builders of racing yachts.

—

Fritz Leaves Motor Appurtenances

NEW YORK, Dec. 1—George Fritz of Malverne, L. I., has resigned as vice-president and sales manager of the Motor Appurtenances Corp., this city, handling the J & B products, Jiffy jack and Wondertone horns. He will announce his new connection in the near future.

—

Feeley Supt. Pittsburgh Maxwell Branch

DETROIT, Dec. 4—C. R. Feeley has been appointed superintendent of the Pittsburgh service branch of the Maxwell Motor Co.

—

France Heavy Buyer of U. S. A. Cars in October

(*Continued from page* 951)

997. Denmark is another country that did not appear in last year's returns, while in October of this year 342 cars, valued at $241,020, were shipped there. During the 10 months of 1916 the exports amounted to 1305 cars, valued at $955,432.

During the 10 months of last year four cars, valued at $2,800, were shipped to Germany. Since then that country has not figured in the export returns. Italy bought seven cars from this country in October last, the value of which was $7,517, while in October a year ago forty cars, valued at $25,887, were shipped there. During the 10 months' period the shipments increased from 210 cars, valued at $134,901, in 1915, to 244 cars, valued at $151,484, in 1916.

Shipments of cars to other European countries amounted to 301 cars, valued at $327,196, in October last, and to 3403 cars, valued at $4,194,615, during the 10 months of this year. Last year the exports amounted to 814 cars, valued at $1,920,176, in October, and to 7502 cars, valued at $20,003,140, during the 10 months' period.

One thousand and twenty-one cars, valued at $718,962, were shipped into Canada in October last, while in October of last year the number was only 189 and the value $202,552. During the 10 months' period the shipments increased from 5238 cars, valued at $4,154,137, in 1915, to 11,118 cars, valued at $8,025,079, in 1916.

S. A. Shipments Increase

The exports of automobiles to all South American countries in October, 1915, amounted to 383 cars, valued at $210,840, while during the 10 months of last year the exports amounted to 2464 cars, valued at $1,277,326. This year the returns show that 302 cars, valued at $195,512, were exported to Argentina in October, while during the 10 months of this year the exports amounted to 4258 cars, valued at $2,206,709. Shipments to other South American countries were as follows: Brazil, forty-four cars, valued at $33,046, in October, and 348 cars, valued at $232,860, during the 10 months. Chile, 195 cars, valued at $158,719, in October, and 1075 cars, $712,748, during the 10 months. Venezuela, thirty-six cars, valued at $23,781, in October, and 447 cars, valued at $284,316 during the 10 months. All other South American countries 113 cars, valued at $64,986, in October, and 816 cars, valued at $509,877, during the 10 months.

Large gains are noted in the exports to the West Indies and Bermuda, the shipments increasing from 267 cars, valued at $173,355, in October, 1915, to 665 cars, valued at $505,198, in October last, and from 2625 cars, valued at $1,478,360, during the 10 months of last year to 4704 cars, valued at $3,152,389, in 1916.

There was also a large increase in the exports to Australia, Asia and Oceania during the two periods under consideration. Detailed figures appear in the tabulation on page 951.

The Automobile

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Ignition

IT seems rather remarkable that after so many years of development we should not yet have arrived at one, single, standard form of ignition for automobile engines. Yet this is really testimony to the automobile engineer's instinct never to be satisfied with what he has but always to want something better.

When the magneto came it was less reliable than the coil and battery, but for a short time only. Soon it was supreme. Then came the starter and its essential battery, so back once more to battery ignition and a general concentration of brains on the problems appertaining thereto; so that we have now battery ignitions which will do everything the magneto ever did, save only to supply their own motive force.

Ignition units of 1917 are vastly more refined in mechanical detail than they ever were before. The high-speed engine has found the weak spots in many a device, and the general redesign thus called for has led to the use of much better principles combined with better construction. The change has spread over several years, of course, but we have now a far wider choice of igniting mechanisms of high quality and great reliability than we ever had before.

Exactly what happens to the gas in a cylinder as a result of passing a spark through it is still unsettled. There is more than one scientific theory and various of the learned men of the world are still working on the problem. The things we may learn from these researches ultimately is the exact effect of different sorts of spark, different spark intensities, sizes and temperatures. Whether the construction of ignition apparatus will be affected when we do possess this knowledge cannot be said. It would certainly have been a help in the past, but cut and try methods have had such fine results that revolutionary changes are unthinkable.

Legal Confusion

A DECISION in the United States Supreme Court establishing the right of any State to tax non-resident automobile owners for the use of the roads opens up such possibilities of confusion that it throws into the spotlight once more the need for making automobile law a matter for the Federal Government.

Roads are a national asset. Easy transportation in the Far West affects prices in the Far East. Entirely apart from the military importance of roads, modern commerce demands that they be everywhere as good as possible.

The present situation with regard to road building is little short of absurd. The same questions are being debated over and over again by different legislatures. The same experiments in road building are being repeated many times in different States. There is an enormous wastage of energy, a prodigious throwing away of money.

The sums which have got to be spent in America in the next 20 years to provide a country with adequate roads are so great and the possibilities for waste of the present system so potent that common sense demands the centralization of authority as essential. It is the only way to get the work done properly and promptly.

Time was when a man's travels would rarely take him beyond the borders of his State. Then State boundary had a real meaning, which to-day it does not possess for the traveler.

100 M. P. H. on Roads

THE old saying, "a place for everything" is brought strongly to mind by the accident which marked the recent Grand Prize race held over the Santa Monica course. Road races over courses such as this are relics of the early days of the industry when speeds of 60 m.p.h. were something out of the ordinary and accidents were correspondingly less likely to be serious, but to-day when speeds of over 100 m.p.h. are possible on such courses an accident assumes possibilities hitherto inconceivable.

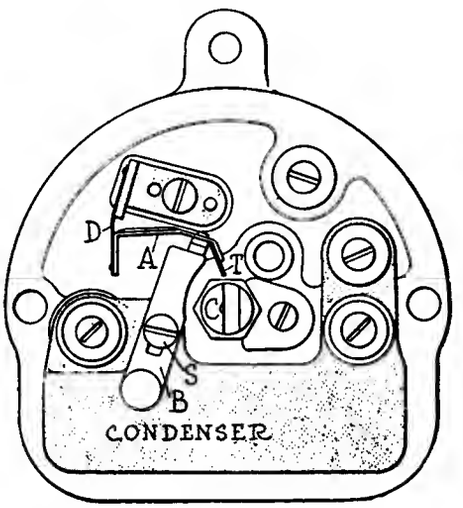
When it is realized that a 3000-lb. car traveling at 100 m.p.h. exerts approximately 2000 hp. at the moment of impact with a stationary body, and that the force of the blow is equivalent to that of a 1-ton weight falling through a distance of 500 ft., the killing of four persons, including the driver of the car, the serious injury of his mechanic and two other people, as well as the destruction of two trees and the car might be accepted as reasonably to be expected.

Ignition Is Much Improved

Battery Systems Are Stronger, More Durable and More Effective—Adjustments Are Easier and Replacement of Wearing Parts Simplified—Few Novelties in Magneto Construction

WITHOUT question the amount of development work done during the year with battery ignition systems has been such that the effectiveness of this form of ignition and its suitability for a permanent place on an automobile can no longer be doubted. The battery-vs.-magneto controversy is still with us, but there is every indication that it will remain in somewhat the same condition as the six versus four argument, and that the final analysis will show both magnetos and battery systems in continued use, each having its own definite sphere.

The real secret of a successful ignition device, whatever its principle, is the accuracy of its manufacture. A timing device, breaker or whatever it may be called, has to perform excessively rapid motions in quick succession and with extremely accurate spacing. Irregularity of operation renders the apparatus useless, and accuracy, especially at high speeds, can only be obtained by workmanship of an extremely high order of merit. Materials must be selected with great care and every process in manufacture watched and inspected with rigid adherence to the fine tolerances allowable. This means that it is a very difficult thing to make a good ignition distributer and coil or a good magneto, and it is only good ones that are any use. With greatly increased demand the ignition manufacturers have had to expand while beset with difficulties in getting the right materials and trouble in obtaining the requisite class of labor, but they have risen to the demand wonderfully.



Mechanism of the bearingless breaker of the Atwater Kent closed circuit system

So far as design is concerned, 2 years ago the coming of the high speed engine called for changes, but the ignition breakers operate to-day at much higher speeds than any engine requires; mostly the igniter is in possession of a capacity to ignite at a speed of from 500 to 1000 r.p.m. greater than the engine of any machine on the road.

Two entirely new systems have appeared recently, the Philbrin and the Pittsfield, both being quite different from any of the older varieties. Among the big producers, Atwater Kent has made the most prominent change by adding a closed circuit system, having previously made only an open circuit instrument. Connecticut, the closed circuit system with an automatic throw-out for the switch, should this be left on with the engine stopped, has been altered in detail but not in any principle. Remy, Westinghouse and Bosch, protagonists of the closed circuit, have made practically no changes, and the same is true of the many instruments produced in smaller quantities. A general bettering of mechanical detail is the chief thing noticeable.

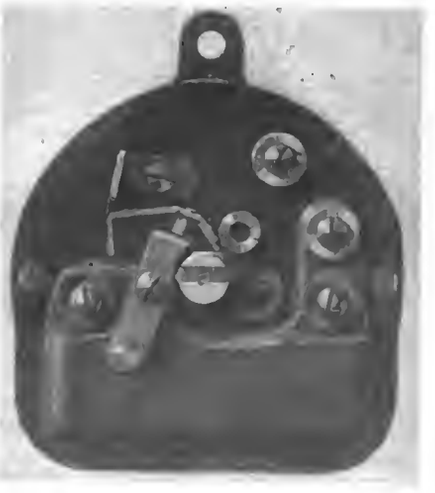
Atwater Kent Uses Closed Circuit

The closed circuit system which Atwater Kent will make in addition to its well known open circuit type is known as the CC and is quite different in construction from any other closed circuit distributer. Externally it is similar in appearance to the older model, and there are the same three units of distributer, coil and switch, but the similarity ends at this point.

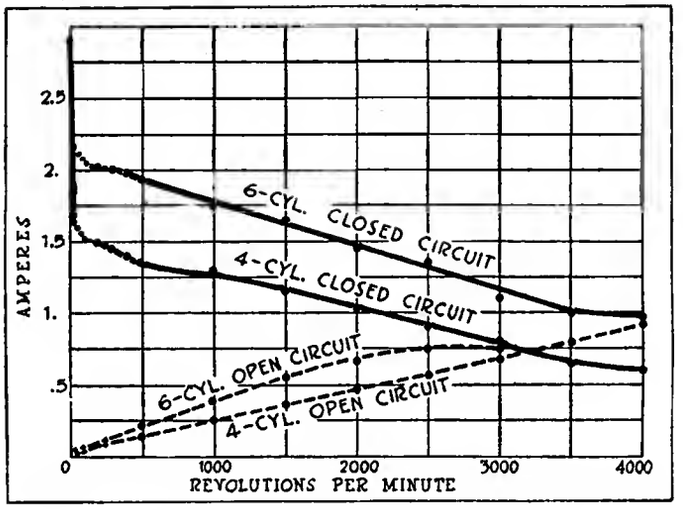
It is well known that the Atwater Kent Co. has one of the most up-to-date testing equipments for ignition devices, and it is mainly on the oscillograph and the current measuring instruments that this new ignition has been developed. The curves of current consumption for the closed and open circuit Atwater Kent igniters plotted side by side show that the difference at ordinary running speeds is quite small, and that the greater demand of the closed circuit only appears strongly at very low speeds indeed.

The most striking feature of the device mechanically, is its remarkable compactness and the use of a spring suspension for the breaker blade instead of a pin and socket or bearing of any kind. It would seem that the weight of the only

Atwater Kent closed circuit distributor with the coil mounted alongside



Six cylinder Atwater Kent type CC breaker mechanism



Comparative current consumption for the two Atwater Kent systems, the closed and open circuit types

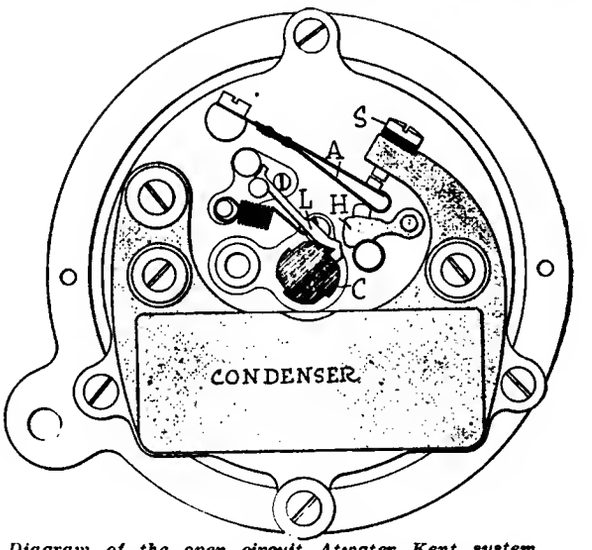


Diagram of the open circuit Atwater Kent system which has not been changed in design

moving part is as small as it could possibly be in any form of instrument, the object, of course, being to get rapid enough action for multi-cylinder engines and to eliminate lag almost completely.

The unit is built up on an iron base which carries the condenser also. The contact arm is a steel stamping tipped with fiber where it touches the cam, and is riveted to a short length of spring steel D which in turn is riveted to the block L. The distributer cover is Bakelite with the terminals molded in place. There is no wiping contact in the distributer, the air gap between the nickel alloy distributer blade and the terminals being 0.015—0.020 in.

The shape of the cam has been determined by the experiments which showed that even the slightest variation in the radius of the curved portions between the flats exerted a powerful influence on the character of the spark. In the four-cylinder cam the limits of tolerance across the corners is 0.002 in. and across the flats it is 0.0015 in.

The light weight of the contact arm is an important factor in the operation of the breaker. In addition to reducing wear to the minimum, it eliminates harmonic vibration and operates to intensify the spark at high speed. Another important point is that the contact is virtually in the center of the contact arm instead of one end, thus reducing inertia and increasing synchronism. Also, because of the location of the arm contact, the two points must come together absolutely squarely with reference to each other.

Revolution of the cam C brings its corners in contact with the fiber tip T of the contact arm A, thus separating the contacts and breaking the circuit. The contacts therefore are together for a considerable period, permitting the coil to be saturated thoroughly. The angular dwell, or the space during which the contacts of the four-cylinder instrument are together, is 47.9 deg. and the contacts open 0.006 in.

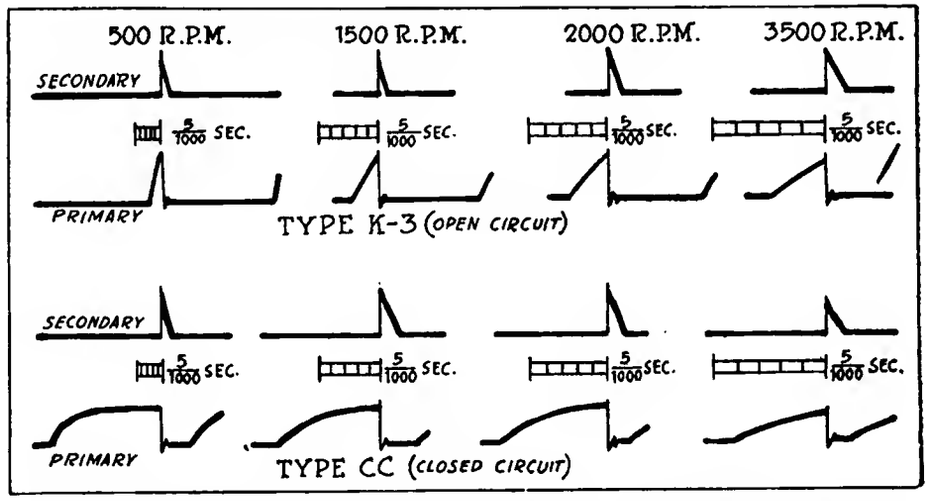
Tungsten is used for the contacts the one in the arm being forced in place, and there is but a single adjustment. To alter the size of the gap between contacts, the screw S is loosened and the arm B moved the required distance, this being slotted where the screw goes through.

Atwater Kent type K3 complete assembly

Owing to its proximity to the contacts the condenser requires to be only about one-sixth the size that would be required were it located in the coil container as has been previous practice. Furthermore the condenser in its new location now is instantly accessible, though cases where it is necessary to touch it are extremely rare.

The coils used for both Atwater Kent systems are practically alike except that the coil for the CC system carries a small series resistance for protection in case of very low speeds and in case the switch should be left closed with the engine stopped. These coils are slightly different from their predecessors as the primary and secondary windings are each continuous, instead of being in two sections each and this has permitted a slight reduction in the size of the unit. At present only hand advance is supplied though the instrument will be made with automatic advance.

The CC instrument is made in four-,



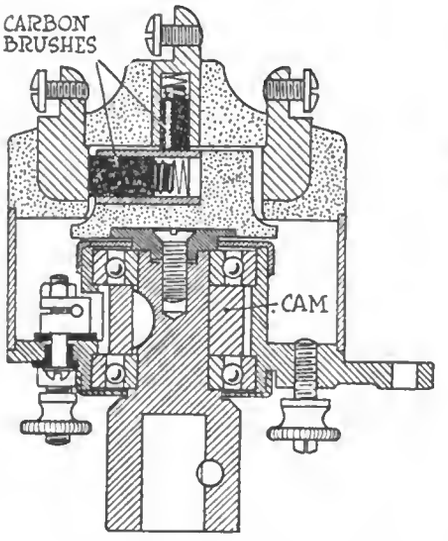
Oscillograms made with the two Atwater Kent systems run under the same conditions

six- and eight-cylinder types and the oscilligrams indicate that character and intensity of the spark up to speeds of 3500 r.p.m. are excellent.

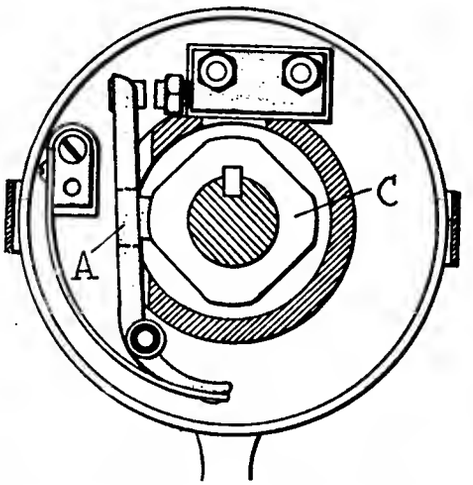
The open circuit, K3 instrument remains unchanged, except that the condenser has been located within the timer-distributer unit and in close proximity to the contacts. This has permitted a reduction in the size of the condenser and, at the same time, increased its effectiveness. In operation, rotation of the cam C draws the lever L forward until the movement of the cam trips the lever which in returning to its original position under the influence of a spring, strikes against the hammer H. The momentum of the hammer H striking the contact arm A instantaneously closes the circuit and opens it again. Here again the only part requiring adjustment is the contact, and even this should not need touching for 10,000 miles. To adjust the contacts the screw S is removed, the face of the contact dressed and one of the thin washers under the screw removed before the screw is returned to position. The standard automatic advance mechanism is provided for the K3 and it is made for four-, six-, eight- and twelve-cylinder engines.

No Change in Bosch Distributer

The Bosch battery ignition unit is modeled very much upon the magneto breaker and distributer. Rotation of the cam C presses a fiber block which brings the contacts together and a spring separates the contacts at the moment of ignition. Manually operated advance is provided. The distributer is mounted directly over the breaker and consists of the usual cover with the terminals molded in place. A radial arm carries a carbon brush which makes wiping contact with the terminals successively.



These two views of the Bosch timer-distributor show the very compact nature of the design and how access to the breaker is obtained by removing the distributor head

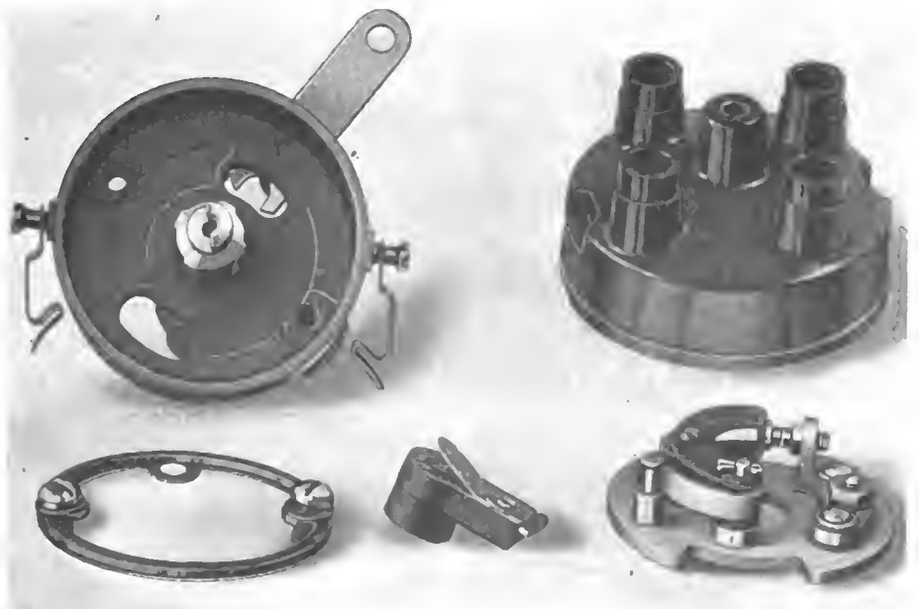


Details of the Bosch battery ignition breaker

The switch incorporates a vibrator attachment to facilitate starting; controlled by a button in the center of the switch plug. Under normal starting conditions momentary pressure on the button will produce a single spark at the plug. Turning the plug to the right and depressing it makes the necessary connection to provide a continuous stream of sparks at the plug and the button can be locked in this position until the engine has started.

There is only one adjustment, for the gap at the contacts. With the fiber block resting on the top of the cam the contacts should be separated about 0.01 in.

This Bosch battery system has been on the market a very long time, having been produced at a period when starting on the magneto was not as easy as it is now.

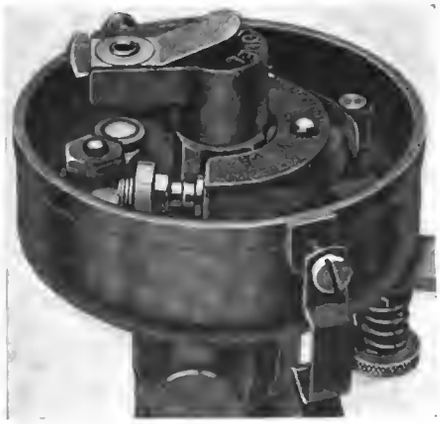


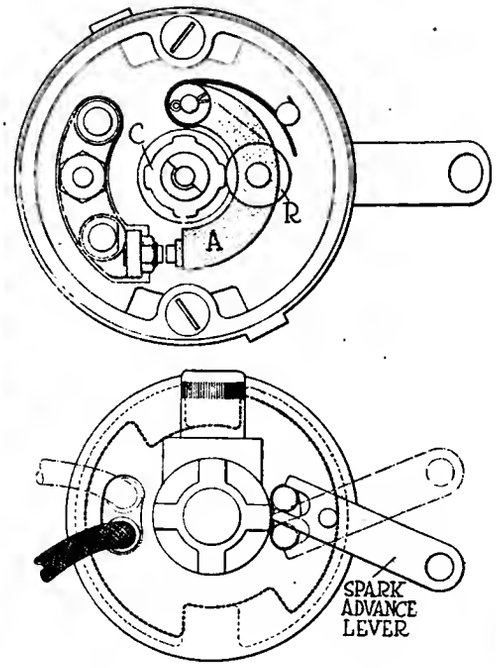
Connecticut breaker mechanism is mounted on a plate held by a spring ring under a solid ring. Removing two screws permits the breaker to be withdrawn complete

Connecticut Accessibility Improved

The closed circuit Connecticut instrument has not been changed in principle, the main alteration being in the advancing mechanism, which now is entirely internal and alters the relative positions of cam and breaker arm without moving the distributer or any of the wiring. The whole breaker as a complete unit can now be taken off for cleaning or adjustment more readily than before, as it is now retained by only two screws.

The new advancing device is particularly ingenious. The breaker is set upon a plate which can turn within the stationary outer case. In the bottom of the case is a small slot and through this a pin screwed into the breaker plate projects. On the bottom of the casing and outside of it, close to the slot, is a pin which forms the fulcrum for a short lever. The inner end of this lever is slotted and embraces the pin which comes





Left—The Connecticut complete assembly. Center—Removing the distributer head lays bare the breaker. Right—Diagrams of Connecticut breaker and of new advancing mechanism

through from the breaker plate, and the outer end of the lever is linked to the advancing rod.

The breaker carrying plate is held in place by a spring ring and a solid ring, the latter being held by the two screws mentioned.

The detail of the breaker mechanism remains unchanged. In operation, rotation of the cam C touches the fiber roller R in the arm A, thus separating the contacts and the arm is returned to its normal position by a spring.

The feature of the Connecticut system which eliminates the possibility of the battery being exhausted through the switch being left closed with the engine stopped is retained without change. This is effected by the use of a miniature thermostat which is in series in the primary circuit and which controls a mechanism similar to that in an electric door bell. If the engine is stopped with switch closed the primary current, in passing through the thermostat, heats it, thereby bending it and closing a circuit through the buzzer mechanism and this in turn automatically opens the switch. The action of the thermostat can be set for anything from 30 sec. to 4 min., the normal setting being about ¾ min.

There is a new type of high-tension lead connector using a brass ferrule. The wiring is stripped for about ¼ in. and the ferrule is slipped over and screwed into the insulation. Afterward a narrow portion of the ferrule is depressed, thereby locking it securely in place. The wiring fits snugly into tapered holes in the distributer cover, the assembly being completely waterproof.

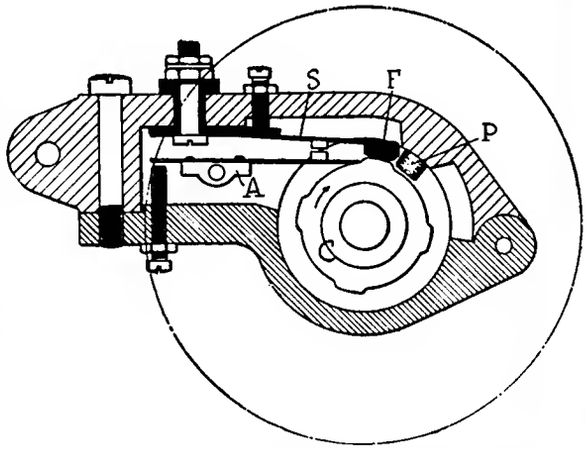
Another new feature is a simplification of the wiring to the coil, this now being so arranged, through the use of a hexagonal terminal, that it is impossible to put a wire on the wrong connection.

Philbrin Entirely New

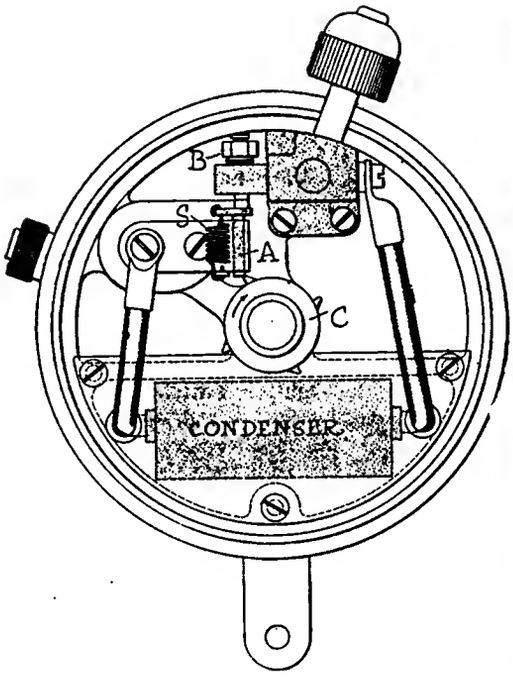
Described fully in THE AUTOMOBILE for Oct. 5, the Philbrin ignition is an entirely new dual system. Primarily it is a single spark ignition of the open circuit type, having a novel breaker mechanism. In addition there is, combined with the switch, a small vibrator which, when in use, sends a continuous stream of sparks to the distributer, providing a very effective ignition for a cold or poor gas. Either the single spark or the other ignition can be obtained by merely turning the switch.

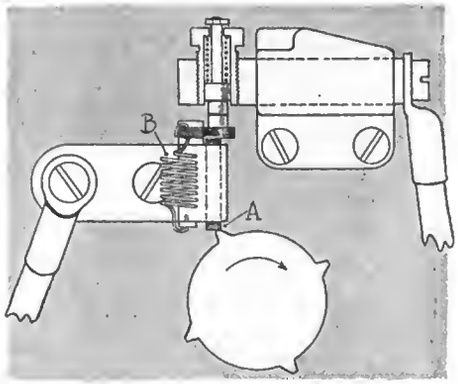
In the breaker there is what may best be called a plunger, carrying the contact at the outer end. The cam has a series of sharply pointed projections which hit the lower end of the plunger and lift it up against the fixed contact, the latter being backed by a small stiff spring. The contact remains closed long enough to saturate the coil, and the plunger is pulled back sharply as the cam passes on, by a coil spring. If the cam turns backwards the plunger gives way before it, being held in place by spring pressure, so the contacts do not close except when the cam is turning the right way. This breaker takes no part in the continuous spark, auxiliary system which sends its high-tension discharge to the distributer direct.

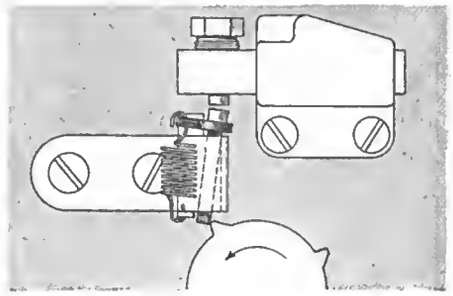
The distributer has a long arm with a blade of peculiar form which does not



Pittsfield ignition unit. The cam C first lifts blade A so closing the contacts, and then raises the fiber block F so lifting blade S and positively separating the contacts again. P is a wick for supplying oil to the cam





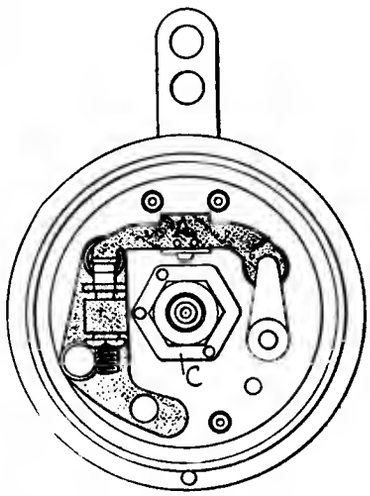


The Philbrin instrument and diagrams showing details of the breaker. The lower right hand view shows what happens when the cam revolves backwards, in which case the contacts are not brought together

touch the terminals molded into the Bakelite cover. It passes in very close proximity to the terminals and the spark passes a small air gap. The reason for the long blade is to insure a continuous stream of sparks at the plug during a considerable part of the piston travel. The current consumption under this continuous spark operation is about 1 amp.

The Philbrin switch also provides for two sources of current—the usual storage battery and an auxiliary set of dry cells. The arm is moved in one direction for the storage battery and the other way for the dry cells. The lever which controls the operation of the single spark or the continuous spark ignitions is a small, continuously rotatable plug. It is alternately marked M and S, designating whether the main or secondary systems are in operation. This switch also reverses the polarity of the current each time it is turned thus conserving the life of the contacts. The coil is contained in a metal case and is completely waterproof. It may be mounted on the dash and in some installations is mounted directly with the distributer mechanism. Two condensers are used, one for each system, and these are quite separate and both are amply protected.

There is but a single adjustment on the system this controlling the opening of the contacts on the main or single spark system. Naturally, improper running of the engine will suggest the advisability of dressing the contacts to smooth surfaces. The adjustment is plainly visible and the gap between the contacts should be 0.025—0.030 in. No adjustment is provided for the vibrator of the secondary, or continuous spark system, the manufacturers stating that it should never be touched.



Latest type of Remy ignition unit and diagram of the breaker. The arm A is a light steel stamping

Pittsfield Has Positive Action

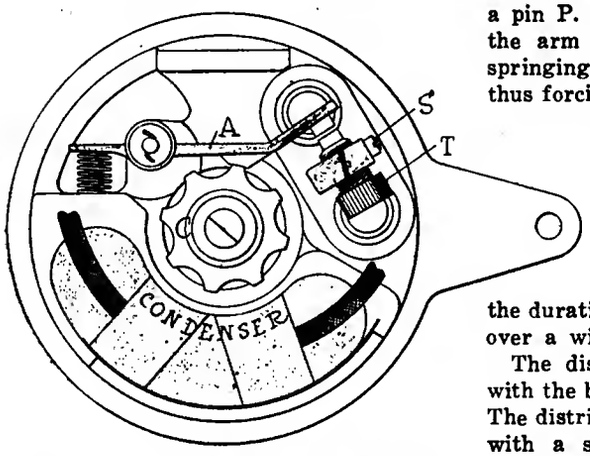
The Pittsfield open circuit system is unique in having the contacts both closed and separated by cam action, the timing not depending on a spring action. The contacts are mounted on two blades of stout spring steel, one having a steel and resting on the cam and the other a fiber block. Normally, with both spring blade ends on the flat part of the cam the contacts are held apart; then as the cam comes round, the shorter blade is lifted till the contacts close. Further movement causes the peak of the cam to pick up the fiber block on the longer blade, and this separates the contacts again. Since both these actions are mechanically performed by the cam there can be no lag due to hesitancy in spring action.

The contacts are permitted to remain together for the maximum length of time, thus assisting in the proper saturation of the primary winding of the coil.

The distributer and coil are in unit with the breaker and the cover is the usual Bakelite casing with the terminals molded in. The distributer arm does not touch the terminals, the spark jumping a small air gap. The coil is completely inclosed and is on top of the cover of which it forms a part.

It is exceptionally easy to disassemble the whole unit. The breaker mechanism is assembled in a sort of handcuff device which is simply clamped around the shaft. Removal of one screw permits the whole to be taken off for inspection. The only adjustment is for the opening of the contacts and this is easily accessible from outside the casing. Removal of the distributer cover and coil exposes the distributer mechanism and after the key

Above — Westinghouse unit comprising breaker, distributer and coil in one assembly. Below—Diagram of Westinghouse breaker. T is the point adjustment and S the locking screw



holding the camshaft has been withdrawn the whole shaft can be lifted out.

Remy Has Stationary Distributer

The breaker mechanism of the Remy battery ignition unit is very simple, and of magneto type, the cam bearing upon a fiber insert in the breaker arm. The circuit is normally closed and is broken only at the instant of ignition. In the sketch the fiber contact piece resting on the cam is designated by the letter F and it may be mentioned that the fiber is securely riveted to the breaker blade.

All the breaker parts are mounted on a plate which is rotatable within the fixed distributer head, the advancing lever coming out through the casing; there is no provision made for automatic advance.

The distributer mechanism has not been altered and consists of the usual Bakelite cover with the terminals molded in place. There is no wiping contact, the spark jumping from the radial distributer arm to the terminals.

The Remy coil has been altered slightly in the past year. The principle is the same, though certain refinements in the method of binding the high tension end of the winding have been made. On top of the coil there is a miniature resistance coil in series with the primary winding which protects this winding should the engine remain idle for any length of time with the switch closed. In short, it protects the winding and also prevents excessive drain on the battery.

Under ordinary conditions the contact points, which are iridium-platinum or tungsten, should not require attention more than twice a season. They should be adjusted so that the maximum opening is 0.020 to 0.025 in., or the thickness of the gage piece riveted to the wrench.

Rhoades Is Simplified

Sundry mechanical changes affecting the simplicity of the Rhoades open circuit igniter have been made during the year, but there has been no alteration in principle. In the sketch showing the latest type the cam C is loosely mounted on the shaft and rotated by contact with a pin P. As the cam rotates it presses the arm A outward and this arm, in springing back, hits against the lever L, thus forcing the contacts together for an instant. If the cam is rotated in the reverse direction it simply rides over the pin and does not bring the contacts together. The contacts are closed only by the momentum of the arm A so the duration of contact remains the same over a wide range of engine speed.

The distributer cover is conventional with the brass terminals molded in place. The distributer arm is keyed to the shaft with a set screw and cannot be improperly assembled, and the arm does not make contact with the terminals, the spark jumping a small air gap.

Westinghouse in One Unit

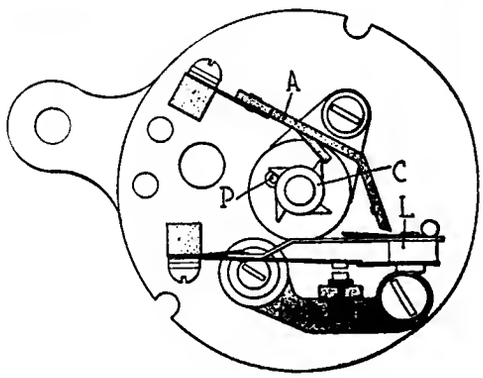
For its battery ignition the Westinghouse company uses the closed circuit principle, the breaker being about as simple as possible. It consists of a stamped steel arm with a contact at one end, and a fiber block about midway of its length, against which the cam strikes. At the other end of the arm there is a coil spring in compression, which keeps the contact points pressed together.

The whole unit is extremely compact, the condenser being mounted on the plate which carries the breaker, while the coil is contained in a chamber above the breaker, the distributer being at the top, above the coil. This means that the only external connection besides the high tension leads is the wire going to the switch.

The distributer arm, which is easily detachable, carries a double-ended carbon brush, the lower end thereof bearing on a ring of copper, and the upper making contact with the successive cylinder terminals. An opening in the casing can be uncovered for the purpose of trimming and adjusting contacts, while access to the distributer is obtained in the usual way. In adjusting the breaker the contacts should be dressed with a fine file and adjusted so that the maximum opening is 0.008 in.

The switch is combined in one mounting with the lighting switches, for attachment to the cowl board, and it is so constructed that the direction of the current is reversed each time the switch is turned. In the back of the switch plate there is what is termed a ballast coil. This is a small resistance in series with the final winding and is to protect the winding and prevent excessive drain on the battery should the motor remain idle with the switch in the "on" position. If this should be accidentally broken the ballast terminals may be temporarily short-circuited.

Rhodes open circuit timer-distributer with diagram of breaker below



Few Changes in Magnetos

Small Mechanical Details Refined But No Radical Alterations Made — Some New Models

PRACTICALLY the only changes which have taken place in magneto construction during the past year concern petty mechanical details. During 1915, when engine speeds were rising rapidly, several of the magneto makers modified their instruments to take care of the new condition. The work they did at that time, however, has proved so effective that there is no need for any further changes at the present time.

The condition affecting magneto manufacture which has changed for the better is the production of magnet steel in America. The bulk of this steel used to be imported and, when imports were cut off, most of the magneto makers had some trouble to discover a sufficiently reliable source of supply in this country. The steel makers, however, have done their best, with the result that satisfactory American magnet steel is now obtainable.

Whatever may be the ultimate outcome of the battery-vs.-magneto argument applied to passenger cars, it should not be imagined that the present predominance of battery systems in this field has caused a reduction in magneto outputs. The truck industry is using magneto ignition almost exclusively and cutting off the German supply has created a big export business, England and France both taking quantities of machines.

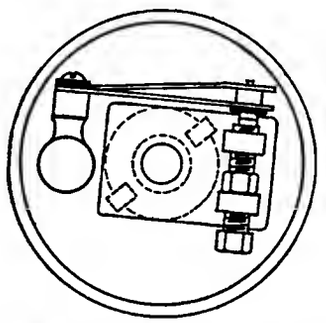
The immediate problem before the ignition industry in general, and the magneto part of it in particular, is the production of a satisfactory ignition device for aviation engines. The uninitiated would not anticipate any special difficulty in this connection. It would seem that a magneto that would operate for years in an automobile ought to be equally perfect for an aeroplane engine.

It has proved, however, that the continuous running at high speed, coupled with extra vibration, calls for a larger factor of safety both electrically and mechanically, while there is also, of course, a strong demand for a reduction in weight, despite the fact that the easy way to counteract the adverse conditions would be to make the machine larger and heavier. The problem is being met and several of the magneto manufacturers think that they have already solved it. Probably in another 12 months it will no longer be a problem.

There are two principles of magneto design; one has the coil wound upon the armature and the other has no wires on the armature whatever. The former type was evolved from the ordinary dynamo with, of course, permanent magnets. Some of the first machines had only a low tension winding in the armature and took the current from this through a separate coil which had both a primary and secondary winding. In other words, the current from the armature was merely substituted for current from the battery, the remainder of the system being identical for both sources of supply. A natural development was to eliminate the coil by placing the secondary winding directly on the armature.

In the Bosch type of circuit breaker a bell crank carrying the moving contact point turns with the armature shaft, the cam being on the inside of the breaker box

In the Dixie breaker a bell crank is used in conjunction with a cam which is fitted to the armature shaft



The Eisemann contact breaker consists of two springs separated by a fiber distance piece. The spring member nearest the center carries the movable, rotating contact point

The other system is entirely different. In it there is a small coil with high and low tension winding and this has a soft iron core. The core is so arranged that it forms a circuit passing from the north pole of the magnet through the core to the south pole and back to the north pole again through the armature. The armature is then so constructed that when in one position its iron part completes the magnetic circuit and when the armature is at right angles to this position the magnetic circuit is broken, since the armature then offers to the poles of the magnet surfaces of some non-magnetic metal such as brass or aluminum, or perhaps an air space.

Properly to appreciate the exact differences between the two types a considerable knowledge of electricity is essential, but a point in favor of the second system mentioned which is easy to appreciate is the mechanical simplicity of an armature with no wires on it. In other words, the wound armature type is not so easy to make.

No Changes in Bosch

In common with most concerns in the automobile industry, the Bosch Magneto Co. has been troubled considerably in the past year by shortage of raw material. In consequence of this the company has not considered the development of any new models, having devoted all its energies to an endeavor to maintain production of the existing types. It has been giving close attention to the requirements of the United States government for aviation engines.

There have been no changes in the Bosch system or in the mechanical detail for a good many years. Bosch was among the first to perfect the high-tension magneto with both the windings on the armature and also to develop successfully a system whereby a battery could be used in conjunction with the distributer of the magneto for starting purposes. In the days of large cylinders it was usual with battery ignition and vibrator coils to start the engine by merely switching on, as it would nearly always stop with a compressed charge in one cylinder. In order to provide a similar facility without the complication of a supplementary complete battery system, the Bosch company developed a small coil and vibrator which was combined with

Latest Dixie six cylinder

the switch and either a small storage battery or a dry battery. In these days of self starters the original need for the duplex system disappeared but it will give, of course, a strong spark at very low speed or will assist starting in cold weather or with poor grades of fuel. There is a very long list of Bosch models and the tendency in recent years has been to increase the production of the waterproof types.

Dixie Has No Armature

The principal exponent of the type with a wireless armature is the Dixie magneto, made by the Splitdorf Electric Co. This machine is unique in having the magnets placed the reverse way to the usual: at right angles instead of parallel to the rotative axis. Further, there is no real armature, but the poles of the magnets rotate. The pole pieces, as shown in the sketch above, are one-sided, so to speak, and the two are connected by a non-magnetic section. Each pole piece will have the same magnetization as the extremity of the horseshoe immediately behind it. Thus, we have two pieces of iron, one with north magnetism and the other with south magnetism revolving in a circle. Mounted in the horseshoe is a coil with a soft iron core and this coil has a "leg" at each end of laminated soft iron extending downward and embracing the rotating pole pieces. Thus, referring to the sketch, in considering one leg, it is easy to see that first the north pole is switched past it and then the south pole immediately afterward. This change causes alternations in the direction of magnetism through the core of the coil and this, in conjunction with the breaker action, sends current through the windings.

An ingenious feature of the Dixie instrument is the method of obtaining spark advance. Maximum efficiency is obtainable from a magneto if the break occurs when the pole pieces and the armature are in one particular relative position. In the case of the Dixie the break should occur always when the rotating pole pieces have reached just one position relative to the legs of the coil

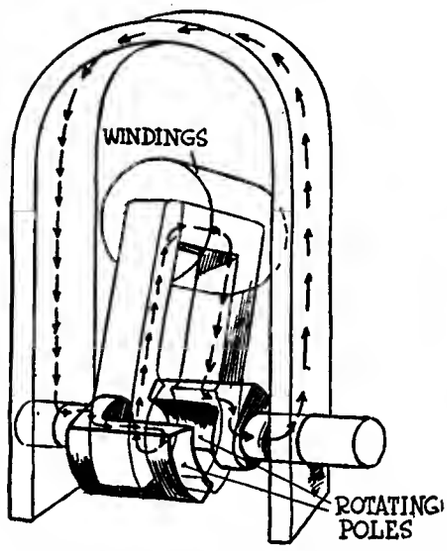


Diagram showing the path of the magnetic flux in the Dixie magneto. The windings are carried on a rocking field of laminated iron through which the magnetic lines are reversed twice in a revolution by means of the rotating poles which extend from the main magnet

core. To insure this movement the spark lever rotates the whole coil unit core, legs and all, exactly the same amount as it rotates the outside portion of the breaker. Thus the magnetic conditions are kept the same. It is possible to adjust the breaker of the Dixie while the machine is running, since the rotating portion is only a cam, the contacts, etc., being stationary.

There have been no changes in Dixie construction except a few small mechanical ones, mainly in connection with the detail of the breaker. The most important of these is a new way of arranging lubricating channels which allows just sufficient oiling to be supplied for the lubrication of the cam but prevents the accumulation of an excess. If a magneto is smothered with oil from the engine it merely drains off through an overflow channel. A slight increase in the range of advance is given on the four- and six-cylinder machines, this being changed from 30 deg. to 40 deg. and the distributer on the four-cylinder magneto has now only one carbon brush and resembles the distributer used on the six-cylinder. The present Dixie output of all types from four- to twelve-cylinder is about 1000 machines a day.

Strong at Low Speed

Unique in construction the Berkshire is another machine working on a somewhat similar principle is the Berkshire magneto, which was a new model during the year and was fully described in THE AUTOMOBILE for July 20, 1916. In this machine the magnets are arranged in the usual way and there is a rotating armature formed partly of iron and partly of aluminum. Referring to the section below, the two main poles of the magnets are A and B, while C and D are iron laminations running parallel with the armature, as shown in the other view. The iron parts of the armature are shown in black and when it is in the position shown the magnetic circuit flows from A to C through a segment in the armature, from C to D through an external circuit and from D to B through the other segment of the armature. Between the outer ends of C and D, joining them together, is a soft iron core upon which the coil is wound. Now when the armature turns so that the iron parts come opposite the poles, instead of bridging the gap between them as sketched, there is no complete magnetic circuit through the core of the coil. This means that revolving the armature continually makes and breaks the *magnetic* circuit, thus causing variations in the magnetic condition of the core of the coil. On the end of the armature shaft there is an electric current breaker of simple construction which is advanced and retarded in the usual way. A particular claim made for this machine is that it will produce efficient spark at as low a speed as 50 r.p.m., while the spark intensity does not become great enough to burn the spark plug points at high speed because the maximum spark occurs at a moderate speed. This is because it is impossible to magnetize the core of the coil beyond a certain degree, and this degree is soon attained. One of the Berkshire machines is made to deliver four sparks per revolution and this on a four-cylinder engine only needs to

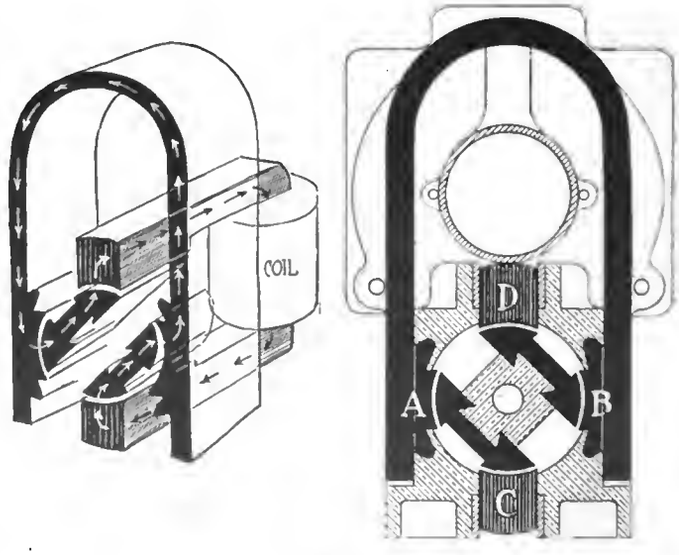


Diagram of Berkshire magneto system

run at half crankshaft speed. The four-spark type is made on six-cylinder engines to run at three-quarter speed and these two machines are applicable to eights, and twelves, by an alteration in the gearing and, of course, the distributer head. Two-spark machines are also made which will operate at the same gearing as that for most other magnetos. In the Berkshire magnetos the distributers have no carbon brushes, the high tension current being taken through brass segments projecting from a revolving cylinder of Bakelite. The outer part of the distributer is furnished with brass pins set so that there is a very small air gap between them and the segment.

Eisemann Has New Model

The Eisemann Magneto Co. is responsible for one of the very few entirely new magnetos, having added a machine which will be on the market early in January, and will be known as the G S. This is really very much the same as the G 4 in both external appearance and in principle. The mechanical detail has been changed considerably. The most important innovation is the use of a large die casting of an aluminum alloy in which the pole pieces are embedded. This single casting forms the end plates, carries the bearings of the armature and the distributer shaft, replacing eight large separate pieces and eliminating the need for a number of screws. This saving, coupled with the fact that the casting comes from the dies almost completely finished, effects a great economy in the cost of production. Therefore, the price of this new machine will be lower than that of the other Eisemann models.

Another new feature is the use of a compressed cloth gear for the distributer, this being used for the sake of quietness. The G S is a waterproof machine and has an extremely neat exterior.

For some years the Eisemann company has been making an impulse starter. This is a device which produces sparks at low speed without the addition of a battery. It may be described briefly by saying that a spring is interposed between the driving pinion in the engine and the armature shaft. When the engine is first turned over a catch holds the armature until movement of the starting crank has compressed the spring fully. As soon as this has occurred the catch is released automatically, causing the armature to fly forward very quickly. This is timed to take place just at the breaking of the contacts and a strong spark is thereby produced. As soon as the engine fires and starts to run a centrifugal device withdraws the catch and the magneto operates exactly as though the impulse starter was not there.

The company states that there has been a strong demand for this machine in the tractor field, and it expects to do a large business with the tractor manufacturers in the future.

Another Eisemann feature, which has been very successful, is an automatic spark control which is fitted to the armature of some of the machines. This is a centrifugal governor which operates a sleeve with a spiral groove cut in it which is interposed between the main portion of the armature and its shaft. As the engine speeds up the armature is therefore advanced relative to the driving gear, the breaker mechanism and the distributer, of course, being advanced a similar amount.

Remy Uses Separate Coil

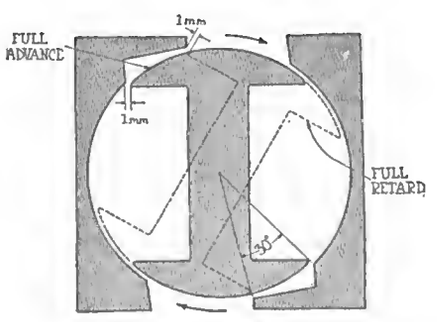
Remy magnetos have not been changed in any way this year and will retain all their present features. The Remy armature carries only one winding, this being a low tension coil of exceptionally large size. The distributer is mounted on the end plate of the machine in the usual way, the coil and condenser unit being entirely separate. The switch is built integrally with the coil so that the latter lies immediately back of the cowlboard, and all Remy machines are arranged to furnish dual ignition, the switch having a position which allows battery current to flow through the windings of the coil and of the armature. In this way the battery current supplements that produced by the armature and insures a satisfactory spark for starting.

A very useful feature of the Remy machines is the device known as the timing button. This automatically locates the armature and distributer in the firing position of No. 1 cylinder. To use this the magneto is disconnected from the engine and the crankshaft is set so that the piston in No. 1 cylinder is at the top of the stroke. The timing button is then pressed and the armature turned by hand until the button is felt to catch. The magneto is then in the correct position and if coupled to the engine without further movement the ignition will be set correctly.

Simms Has Four Models

Developed by some of the same individuals who designed the original Bosch machines, the Simms Magneto Co., with factories in America and Great Britain, originally built a magneto practically identical in system with the Bosch. In the course of years of manufacturing, mechanical differences have developed so that the Simms and Bosch machines of to-day have very little similarity. At present only four machines are being produced, two for four and two for six-cylinder engines, one furnishing single ignition and the other dual. The single ignition types can be converted to the dual by changing the breaker box and a few other parts.

A special feature of the Simms machine is the design of the pole pieces which have extensions on the edges following the direction of rotation of the armature. These extended edges keep the edges of the armature shuttle within influence of the pole in all positions from full advance to full retard. That is to say, that at the moment of breaking the current the edge of the shuttle is never widely separated from the edge of the pole piece. The possession of one very large contract has heretofore made it difficult for the company to accept much other business, but it is expected that the manufacturing facilities will be much enlarged within a few months.



Special pole piece used on Simms magneto to give equal spark intensity at all speeds

New Eisemann type G S magneto

Die casting used in Eisemann magneto The pole pieces are cast in place and hardly any machining has to be done on this whole piece, which replaces nearly twenty small parts used in the older designs

Spark Type Affects Power

Scientific Tests Show Character of Mixture in Cylinder Affects Quality of Spark Required to Insure Quick Ignition —Successive Sparks May Ignite Where a Single One Fails

By J. D. Morgan

THE following article from *Engineering* (London) although of an extremely academic kind, is none the less very interesting to all who have followed the spark controversy which has been raging more or less ever since the first days of electric ignition. The author is an independent investigator, and a member of several scientific societies, so his opinions are worthy of the most respectful consideration.

Two Contradictory Opinions

"There are current among engineers two opposed beliefs regarding the effects of spark intensity on ignition in internal combustion engines. According to the one, provided a spark is sufficiently strong to produce ignition, an increase of strength has no effect on either the rate of combustion or the maximum pressure attained; consequently such increase has no effect upon the power developed by the engine. According to the other the strength of the spark does have an effect upon the power, and it is therefore assumed that the spark strength influences both the rate of combustion and the maximum pressure attained. Obviously both assertions cannot be true, yet it is possible that the one which is untrue has some foundation in fact, and has arisen out of a misinterpretation of experimental results.

"Regarding the terms 'strength' or 'intensity' as applied to sparks for ignition purposes, no clear meaning is or can be attached to them. The terms are unsuitable because as ordinarily used they refer to the total heat energy of a spark, and this alone does not determine the ability of a spark to ignite a given gas mixture. To meet the difficulty the term 'incendivity' has been proposed by the writer* to denote the property whereby a spark produces ignition of a combustible gas. The term is convenient for descriptive purposes, but no quantitative definition can yet be given. In the absence of a standard of incendivity sparks are ordinarily compared by measurements of their heat contents, except in special cases where they are referred to the energy supplied to the circuit which produces the sparks.

Tests in Special Vessel

"The principal investigations on the subject of spark ignition in internal combustion engines have hitherto been carried out by means of engine tests, the effects of different sparks being observed either on explosion diagrams or brake measurements. For the purpose of the investigation here recorded it was decided to explode in a chamber of constant volume weak, quiescent gas mixtures at normal temperature and pressure, for the reason that the main facts can be more easily and definitely determined in this way than in engine tests, where the variable factors of the problem are less easily controlled. The sparking was in all cases at one position, this being approximately at the center of the explosion chamber.

"In carrying out the experiments a mixture was found by trial which produced explosions of moderate rapidity, as the indicator diagrams of such explosions can be more easily and accurately compared than those obtained by very rapid or very slow explosions. Using throughout a coal gas mixture of the same composition, sparks from the following sources were employed:—

(*a*) High-tension magneto.

(*b*) Induction coil with cam-operated make-and-break (primary supplied by 12-volt circuit).

(*c*) Induction coil with vibratory make-and-break (primary supplied by 4-volt circuit); 200 vibrations per second.

(*d*) Lodge condenser apparatus, vibratory make-and-break (primary supplied by 8-volt circuit); 70 vibrations per second.

"The above are the principal types of apparatus used in practice. The heat contents of the sparks measured by means of the author's thermal balance were as follows:—

(*a*) 0.01 joules per spark at 120 r.p.m.
0.03 joules per spark at 1000 r.p.m.

(*b*) 0.02 joules per spark at 80 r.p.m.
0.0018 joules per spark at 1000 r.p.m.

(*c*) 0.0005 joules per spark.

(*d*) 0.026 joules per spark.

"In all cases the diagrams were identical, both as regards the rate of combustion and the maximum pressure. From this it is evident that provided a spark is capable of producing ignition, increase of incendivity has no effect upon the power developed in the engine. This result confirms what has previously been ascertained from engine tests. The fact has not yet, however, met with general acceptance among engineers.

What Is Spark Strength?

"Having regard to the foregoing, the question arises: What ground is there for the belief that engine power is affected by the incendivity or so-called strength of the igniting spark? The experience is common among users of internal combustion engines that an increased spark sometimes results in improved operation of an engine, particularly when weak explosive mixtures are employed. The answer is to be found in the fact that an explosive gas mixture requires for its ignition a spark having not less than a certain incendivity, and the latter varies with the nature and proportions of the mixture. When the proportions of the mixture are at or near the upper or lower limits beyond which ignition is impossible the required incendivity is high. But as the proportions approach that of maximum explosibility the required incendivity rapidly diminishes. Hence for a given gas mixture a certain minimum incendivity is necessary in the spark. If the incendivity is near the limit a diminution in the explosibility of the mixture may result in no ignition, or only intermittent ignition. This can be rectified by employing a spark of higher incendivity, providing a greater margin for gas variations. In a gasoline engine, particularly when running at slow speed, weak mixtures requiring strong sparks for their ignition are often obtained, and when the ignition system is insufficient to provide suitable sparks defective operation of the engine ensues. On replacing the ignition system by another producing stronger sparks the engine works satisfactorily. Arguing from this, the user concludes that the better spark has

* "Notes on the Ignition of Explosive Gas Mixtures by Electric Sparks." Vol. 54, No. 254, Journal of the British Institution of Electrical Engineers.

increased the power of his engine by increasing the rate of ignition or the maximum pressure, whereas actually it has only eliminated misfires.

"From the practical standpoint the facts relating to 'single point' spark ignition in internal combustion engines are comprised by the statements (1) that provided a given spark is sufficient to produce ignition any increase of incendivity does not affect the power obtainable from the explosion, and (2) that as the mixture passes from the proportion of maximum explosibility toward the higher and lower limits the required incendivity of the spark increases.

No Theory of Ignition

"An outstanding and as yet unsolved problem in connection with ignition apparatus for internal combustion engines is that of defining the least sparks required to produce ignition of a specified gas mixture, and with this problem is associated in general that of spark measurement. In the absence of an established theory of ignition any attempt to define a spark must necessarily be tentative, but some satisfactory temporary expedient is not impossible. Obviously the procedure of defining a spark in terms of the current in some part of the apparatus used for producing the spark is highly unsatisfactory, because sparks defined in this way are not comparable when produced by different apparatus. Any satisfactory method of spark measurement must involve nothing more than the spark. The most obvious and up to the present best developed method is the thermal one. In this it is usual to heat a quantity of gas by a succession of sparks until a steady state is reached, that is, the heat imparted to the gas is equal to the heat lost by the container. The average heating effect of the sparks can then be calculated and the heat content expressed in joules per spark. At first sight it would appear that the incendivity of a spark could be expressed as a function of the heat-content, and if this were possible sparks could for practical purposes be defined in terms of joules per spark. There are, however, two facts which limit the usefulness of the thermal method. The first is that incendivity does not depend upon heat alone, but apparently on heat jointly with temperature, and the other that ignition seems to be the result of a cumulative action which can be set up by a succession of sparks when a single spark fails.

Temperature Important

"It is a matter of simple experimental proof that heat alone does not determine the incendivity of a spark. Using the same source of energy, say a magneto, two different types of sparks can be obtained, one by using the magneto normally and the other by connecting a condenser across the spark gap. The latter is contained in an explosion chamber which is filled with a weak gas mixture, and the magneto is adjusted so that working normally it produces a spark which will not ignite the gas. A condenser of suitable capacity is then attached across the gap, and by means of the resulting spark the gas may be exploded immediately. On measuring the thermal contents of the sparks it is found that the heat contained in the normal magneto spark is not less than that obtained with the condenser, and if a poor condenser is used it may be as much as 100 per cent more, as in one set of experiments carried out by the author. Yet the spark containing more heat failed to produce ignition where the other succeeded. The only apparent difference was the temperature. It might be suggested also that the duration was different, and the shorter duration of the condenser spark caused it to be accompanied by greater mechanical violence. But for this there is no experimental evidence. Both sparks are oscillatory, and the effective portion has apparently the same duration in both cases. It follows, therefore, that incendivity is not a function of heat only, but of heat and temperature. And as the heat-measuring instrument accounts only for total heat, the measurement of joules per spark is only useful for comparing sparks produced by similar apparatus.

"The second fact, that ignition appears to be the result of a cumulative action, is of less practical importance in connection with ignition apparatus for internal combustion engines, seeing that single sparks are now more generally used. But for purely theoretical work the fact is of importance. Using a magneto provided with a variable resistance in its primary circuit to permit large variations of the spark in the secondary circuit, and employing a needle point spark gap, very small sparks can be obtained. Keeping the gas mixture constant and varying only the speed or the primary current of the machine, it was found possible to arrange a condition in which the gas would never ignite with the first spark, and only after a number of sparks had been passed through could ignition be produced. Owing to the extreme difficulty of insuring perfect uniformity of conditions (a trouble which is common in work of this kind), the results were not sufficiently regular to permit of a quantitative deduction, but the persistence of the phenomenon was such at all times that only one conclusion was possible, namely, that succeeding sparks produced a progressive change in the gas which finally resulted in ignition, in other words, the ignition was the result of a cumulative action. The pre-ignition period could be shortened by increasing the strength of the spark (viz., by increasing the speed or the primary current), or by adding a condenser across the spark gap. The largest pre-ignition period noticed was about 2 seconds with the magneto running at 5 r.p.m. In a previous investigation* using low tension sparks the author observed a similar effect. The results obtained with the less active sparks were more regular and the pre-ignition interval was longer. Having regard to the foregoing, the difficulty of defining the least igniting spark for a given gas is apparent, but, as previously stated, where under practical conditions only one spark (or a plurality of simultaneous sparks) is used for igniting an explosive charge the difficulty disappears.

Condenser Effect Important

"The trend of scientific opinion concerning spark ignition is that the action is ionic. It is not suggested that the heat of the spark is unrelated to the process of ignition, but that the thermal and ionic conditions are intimately connected. A natural alternative, if not a substitute, for a thermal instrument for measuring incendivity is the electroscope. The application of the latter for this purpose is not easy, because a number of arbitrary conditions, such as the shape and position of the spark gap relatively to the charged surfaces, and also the magnitude of the charge itself, have apparently to be stipulated before measurements can be usefully compared. Nevertheless the electroscope appears to contain useful possibilities in this connection. It is a matter of simple experimental verification that the sparks of a condenser produce a larger discharge per spark than do sparks obtained when the condenser is removed, although the heat content of the latter may be the same or even greater than that of the former."

—

Goodyear Cord Tires Easy to Repair

WHEN a Goodyear cord tire has ben damaged it is not necessary for the automobilist to send the tire to the factory for repair, according to L. C. Rockhill, manager of the automobile tire department of the Goodyear Tire & Rubber Co., Akron, Ohio. Any tire repairman can repair one of these cord tires just as he would a fabric tire, using regular fabric, without impairing the efficiency of the casing. For this work no special machine is necessary. In the Goodyear construction six to ten layers of strong cords are used, the number of layers depending upon the size of the tire. The method of applying these cords gives rise to the name of the thread system by which it is widely known. The cords are held in place by a few very fine threads which break when the tire is used, leaving only the cords.

The FORUM

Correctly Figuring Valve Capacity

By E. H. Delling

IN reference to the article entitled Valve Sizes Need Definition on page 703 of THE AUTOMOBILE for Oct. 26, may I be permitted to criticize the suggestion that the area of the clear valve diameter minus the area of the stem should be given as a basis of comparison?

I am of the opinion that it is altogether wrong to consider the area of the valve port as an indication of the "valve capacity," if I may call it so. An example will illustrate my point very clearly. The full-size sketch, Fig. 1, shows the actual dimensions of a valve of the 22-70-hp. Mercer engine.

Employing these few figures we would have a clear valve area of $\frac{2.25^2 . \pi}{4} = 3.97$ sq. in. Subtracting the area of the valve stem, which is 0.110 sq. in., leaves 3.866 sq. in. as the value which your article proposes. Now let us see what actually offers the greatest restriction to the incoming charge. Considering the valve in the extreme, lifted position, the gas will follow the contour of the seat and escape through a slot the length of which is the clear diameter of the valve multiplied with π and the width of which is a line connecting the small diameter of the valve with the largest diameter of the seat. We will call this width h_1. We then obtain the following expression if we call the effective maximum valve opening O_{max}:

$$O_{max} = (d + b)\pi . h_1$$

In our case we would have

$$O_{max} = (2.25 + 0.125)\pi . 0.328$$
$$= 2.45 \text{ sq. in.}$$

This is the actual opening, and comparing it with the port area minus the valve stem, we find that it is only 63.3 per cent of what the former article assumed as correct.

Still this absolute value of 2.45 sq. in. does not permit comparisons and I think we should go a step further. I have always made it a rule to express such values specifically, *i.e.*, per liter or cubic inch of piston displacement. As the Mercer engine has 298 cu. in. displacement, we would have 0.033 sq. in. available for each cubic inch of gas taken in, assuming that the volumetric efficiency is 100 per cent. This value allows a direct comparison of any size and lift of valve for any displacement. The above consideration is the prime reason for double inlet valves. I have never seen this reason stated clearly in any article on that subject. H. R. Ricardo, in a treatise on High-Speed Engines in *The Automobile Engineer* for August, 1916, page 225, states:

"Now the effective area of opening of a poppet valve is equal to the area of the port when the lift is equal to one quarter of the diameter (this is not strictly true but is very nearly so)."

This statement in itself is correct, but it is based on an assumption which is out of the scope of everyday practice. I cannot recall a modern stock engine with such a tremendous lift except the Vauxhall Prince Henry model which, however, can hardly be called a stock product and which represents a very small percentage at any rate. Most valve lifts range from 5-16 to ⅜, very seldom more. So why assume something which is not the average but the exception.

He then proceeds to replace one valve of 2.2 in. diameter by two of 1.55 in. diameter, the combined port area of which would equal that of the single valve. With a lift of current practice, say ⅜ in., we would obtain by above formula for the single valve an opening of $O_{single} = 2.43$ sq. in., for the double valves $O_{double} = 3.45$ sq. in. It will be observed that the gain is appreciable, 42 per cent to be exact.

Some designers may object to using the same lift for the large as well as the small valve. But there is no reason why a small valve should not be lifted as high as a large one, in fact it is much easier to accelerate the small mass of the light valve. I always regarded the lift a factor of the cam shape, spring tension and timing and not so much of the valve size.

Assuming an intake opening of 5 deg. after D. C., a closing of 45 deg. after D. C. and a tappet clearance of 0.005 in., we will have a valve period of 120 deg., or 60 deg. is the included angle formed by the cam flanks. If we assume a base circle of commercial practice, say 1¼ in. diameter, we shall find that lifts over ½-in. are practically impossible due to the fact that the cam shape approaches a point.

To sum up we can come to the conclusion that the valve capacity of an engine changes in direct proportion to the diameter of the intake valves multiplied with the number of valves *and not with the square of the diameter* as is often assumed. That means, 12 intake valves of 1½ diameter have a certain capacity, and whether they are arranged as single valves in a twelve cylinder or as double valves in a six cylinder, is secondary consideration. This assertion is backed up by the high speed of the Sunbeam six-cylinder racing car with double valves and of the Packard racing car with twelve-cylinder aviation engine, having single valves. Both cars have twelve intake valves available for the passage of the inrushing charge; therefore their high volumetric efficiency. Whether the gas is burnt in six or in twelve cylinders is immaterial from the standpoint of valve capacity.

A New Semi-Diesel Engine

By Edwin S. Strickland

AS an experimenter on two-cycle and semi-Diesel engines I have developed a type of construction which entirely overcomes such defects as: Hard starting; backfiring; fouling; waste of unused fuel; accumulation of carbon; condensation of mixture before explosion; and bad or uncontrollable regulation

The first four defects existent in two-cycle engines of the carbureter type are due to co-mingling of fresh and exhaust gas which does not occur with clean air as a scavenger in the semi-Diesel principle.

The last three defects existent in semi-Diesel engines are overcome by varying the quantity and temperature of air compressed, in proportion to the oil atomized against the com-

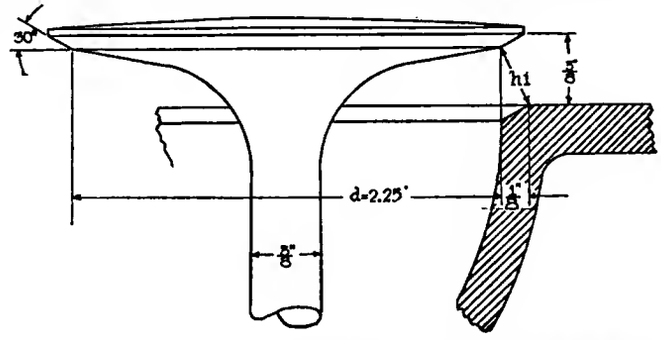


Fig. 1—Full-size sketch, showing actual dimensions of a valve of the 22-70 hp. Mercer engine

At the right are reproduced the two illustrations, Figs. 4 and 5, from an article on engine testing by W. Ferrier Brown in The Automobile Engineer, England, and reprinted in digested form in THE AUTOMOBILE *for Oct. 12. Fig. 4 gives four efficiency curves, viz., mechanical efficiency, brake thermal efficiency, indicated thermal efficiency and available efficiency (as compared with the air standard). Fig. 5 shows the relative values of the "air standard" and the "maximum available" efficiencies as a percentage of the total heat energy of the fuel consumed.*

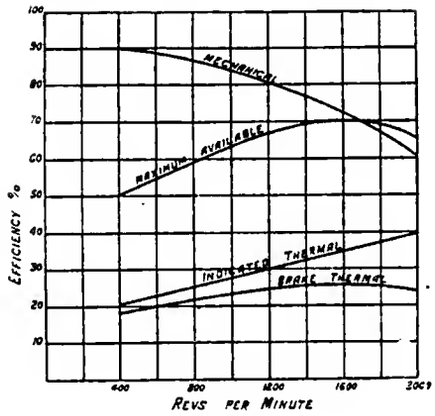


Fig. 4

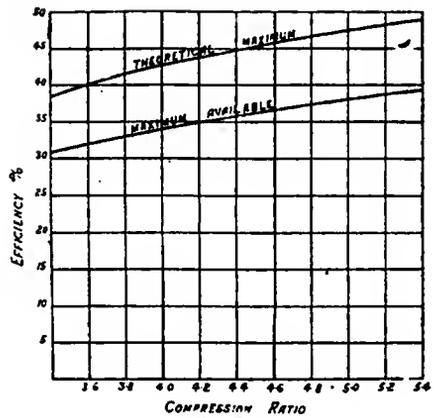


Fig. 5

bustion plate; no partial vacuum is formed in the cylinder.

Kerosene is used for fuel and will operate under idling conditions, while gasoline is used for starting purposes only.

Further improvements consist of a vacuum-breaking valve in the exhaust pipe to prevent drawing the scavenging air cut of the cylinder; a circulation of oil around the bearings, serving the double purpose of lubrication and of forming an oil-seal to prevent compression escaping from the crankcase; a bumped piston head is used to prevent sizing and also to protect the rings from the heat of the explosion; a small fly-ball regulator permits rapid advance of spark and compression by the operator without liability of stalling or reversing. The fly-ball regulator also varies the regulation of warm air to the intake pipe in order to maintain a normal temperature of air admission; and a water-cored exhaust port bridge prevents sizing of same against the piston, while an air passage of 45-deg. angle to the cylinder insures scavenging with no resistance to the air as in a right-angle passage deflector.

The above improvements in connection with the inherent advantages of 40 per cent reduction in parts and weight, cheaper fuel, less surface to lubricate, an explosion each revolution, with no valve in the combustion chamber, make this type of engine the ideal and ultimate motor.

Brake Thermal Efficiency Error

By R. W. A. Brewer

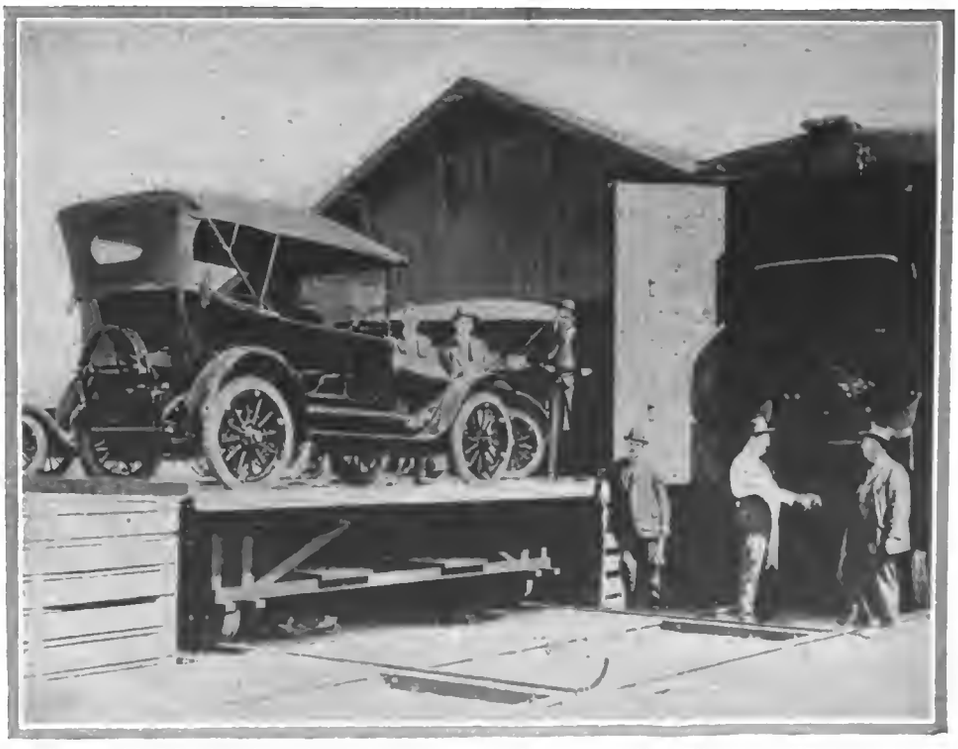
IN Mr. Clayden's abstract of W. F. Brown's article on testing engines, page 620 of THE AUTOMOBILE, Oct. 12, there is apparently an error in respect to the brake thermal efficiency.

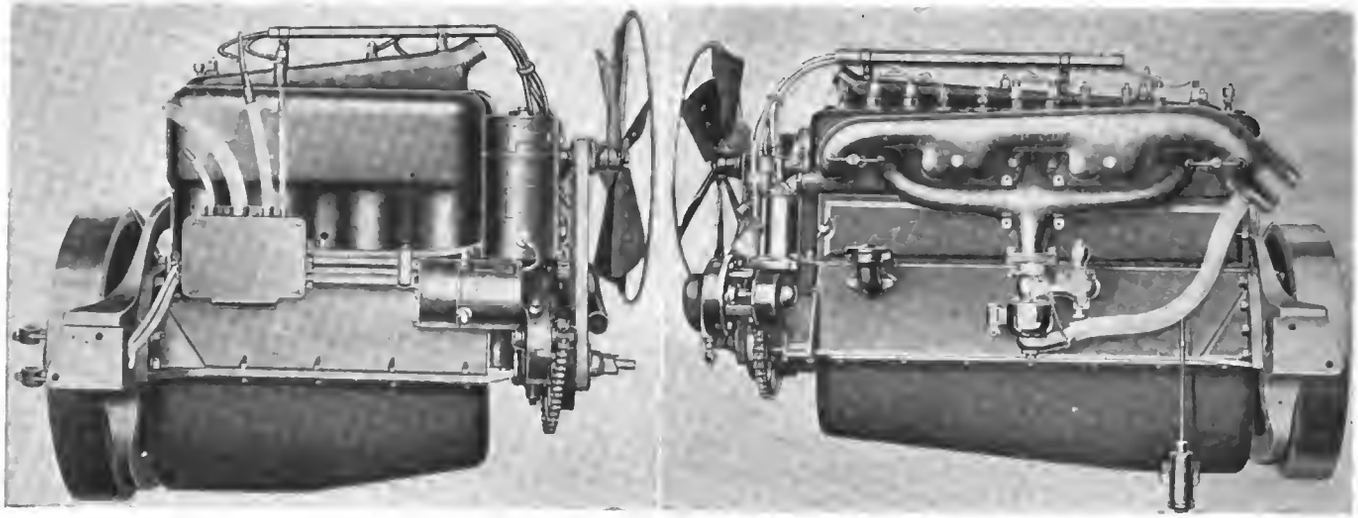
Direct Values Given

It is stated that Fig. 4 shows a "curve of the brake thermal efficiency taken as a percentage of the maximum available efficiency shown in Fig. 5." A study, however, of the curve in question would show that the values given are direct values and indicate the proportion of the total fuel which actually appears as work at the crankshaft of the engine, and this is of the order of 20 to 25 per cent of the total heat in the fuel. Going a step further, the curve in Fig. 4 shows 25 per cent as its best value and assuming the compression ratio of 4 to 1, the "maximum available" from Fig. 5 shows about 34 per cent, so that the ratio of the actual to the maximum available is about 73.5 per cent.

A Car Unloading Platform

AT the right is illustrated a unique device for saving time in unloading automobiles from freight cars. It is the invention of C. A. Dundas, Studebaker dealer in Riverside, Cal. It consists simply of a platform on a level with the height of the freight car floor, the platform being on wheels and moving over tracks. The automobile is rolled off the rear of the freight car and onto the movable platform, the illustration showing one car which has just been rolled on the platform and a second in readiness. The Santa Fé railroad officials thought so well of the scheme that they have made arrangements with Mr. Dundas, the inventor, to have the device installed. The unloading of automobiles at their destinations has long involved a waste of time, which is eliminated by this platform, the expense involved being small.





Left—Engine of the Studebaker four, illustrating junction box for wiring at rear, vertical generator mounting, and chain drive starting motor. Right—Carbureter side of engine shows the arrangement of manifolds on the Studebaker six

Studebaker Continues Four and Six

Redesigned Piston and Electrical System Chief Mechanical Changes—New Patent Auxiliary Seats

STUDEBAKER four- and six-cylinder cars are to be continued for 1917 with several minor changes. As far as the basic design is concerned, the cars are unaltered, but they are presented this year with better finish, better equipment, and better engine characteristics than last year, at a price increase of $130 on the six-cylinder touring car and $55 on the four. Both of these are seven-passenger cars selling respectively for $1,180 and $940.

From an exterior standpoint, the most striking alteration in the Studebaker cars is the use of a gunmetal finish. This is a twenty-five-operation job and the fender trim is in black, giving a distinctive appearance to the new model. Besides the change in finish, there have been a number of other body improvements designed to give more room and comfort to the passengers. The new auxiliary chairs have arms and are an exclusive Studebaker design. They are roomier than the previous auxiliary seats and instead of folding up behind the front seats or under the floor, they are carried beneath the back seat, thus when the auxiliary seats are out of sight, as far as appearance is concerned, this is a five-passenger car.

Another innovation is the use of a reversible front seat. With this the passenger seated beside the driver can sit facing the tonneau or facing forward as he desires. Both the front seats are covered with leather and are fitted with robe straps and are adjustable to all leg lengths.

Another comfort feature is the use of the Blackmore patented storm curtains which open and close with the doors, thus giving all the conveniences of an inclosed body when the side curtains are in place. For those who desire a permanent top in winter there is a new form of convertible which is made exclusively for the Studebaker product and which can be removed readily and the summer top substituted.

Along with the more comfortable body and the better finished exterior, the interior has been given a considerable amount of attention. There are now door pads on the doors. The upholstery is all in semi-glazed, straight-grained genuine leather with curled hair. The tonneau carpet is all wool and bound with leather. The top is silk mohair bound with leather edging, and in the way of interior equipment a new Yale switch lock of pin-tumbler type has been added to guard the car against theft.

New Studebaker auxiliary seats which fold beneath rear seats

Pistons 5 Ounces Lighter

Mechanically, the improvements are very slight and only of a detail nature. Probably the most important is a reduction of 12½ per cent in the weight of the pistons, making them 5 oz. lighter than in the 1916 cars. This reduction in weight has been accomplished by milling out the skirts.

The oil pump has been changed slightly in the way of making a tighter fitting pump which has increased its pumping ability. The rear axle has been stiffened and strengthened, giving a higher factor of safety in this part, and in the electrical equipment, improvements in the design have increased the cranking power by 12 per cent., this increase in the electric cranking effort being due to improved winding of the motor. The generator has also been improved by alterations in the wiring which give much better charging characteristics. About 3 amp. increased current is furnished the battery at a car speed of 15 m.p.h., while the maximum charging rate has not been altered. The practical result of this change as it concerns the driver is that the slow speed operator will get better charging performance and the battery will not be injured by the faster driver. Another detail change in the electrical equipment is in the headlamp mounting by means of which the lamp can be turned and fastened in any position.

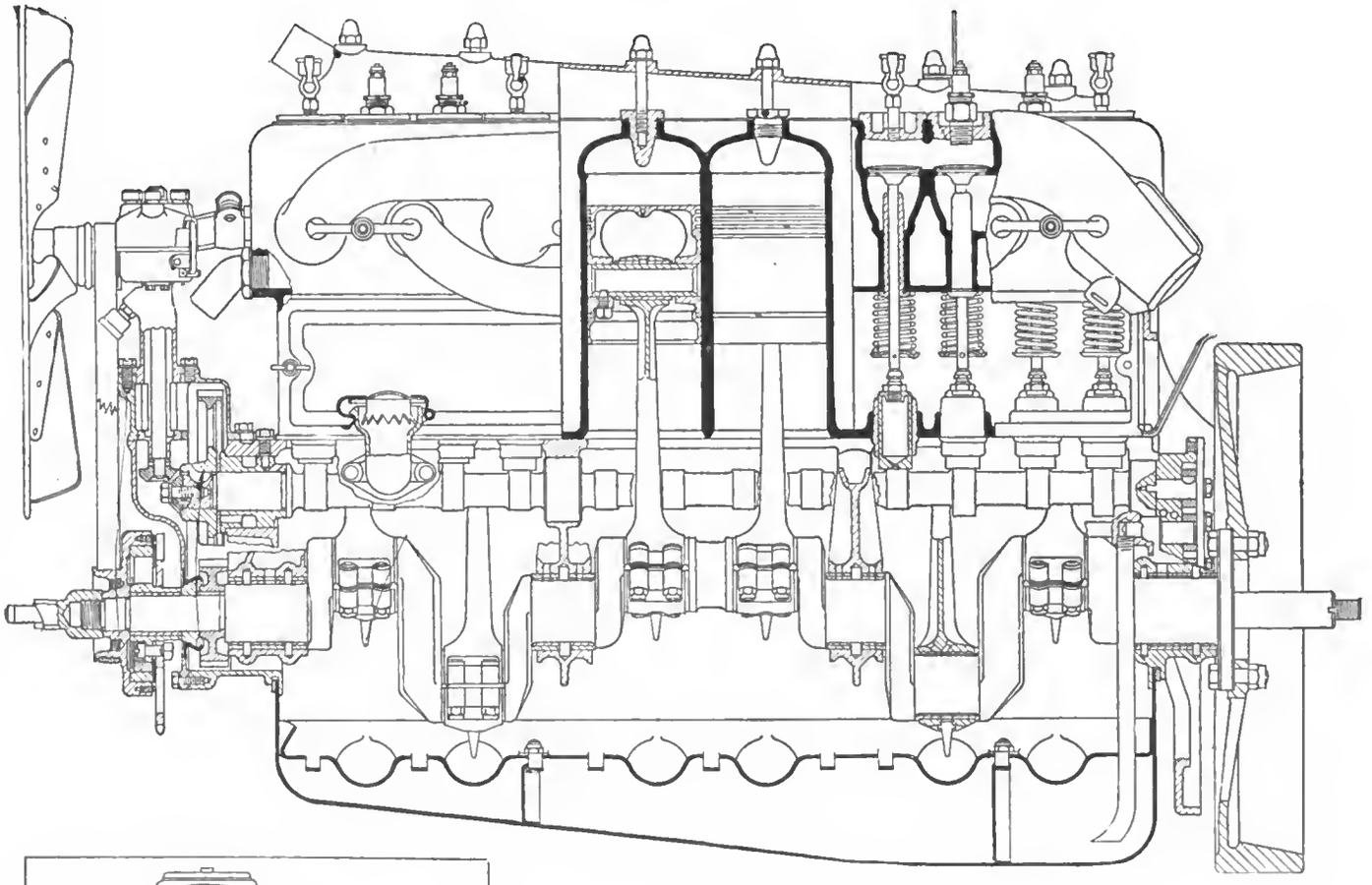
From a manufacturing standpoint, the outstanding feature of the Studebaker line is its standardization. The four and six are exactly similar in design throughout, both engines having their cylinders cast in a single block of similar dimensions, 3⅞ by 5 in., and with all parts similar from one end of the chassis to the other; excepting where structural dimensions differ on account of the difference in the power plants.

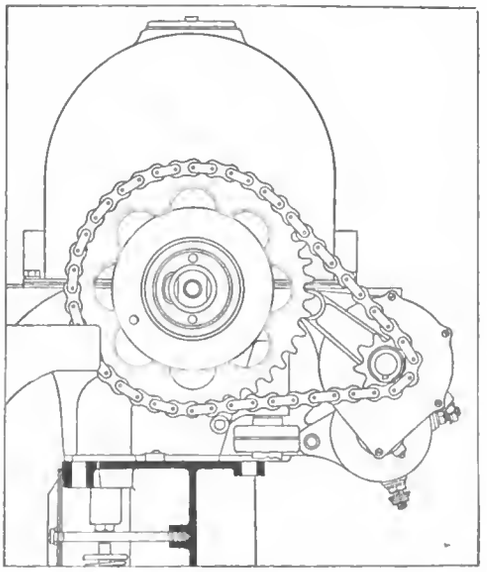
For 1916 Studebaker cars were redesigned and a considerable number of alterations were made in the power plants. For 1917, the engines which were introduced have been continued practically without a single change. The other Studebaker characteristics have also been continued this year and the rear axle gearset, cone clutch, and Wagner electric units are all found in the latest models. In the cars of 1916 the cowl gasoline tank was used for a time, but this was changed over so that on the 1917 models there is a vacuum feed from the rear tank.

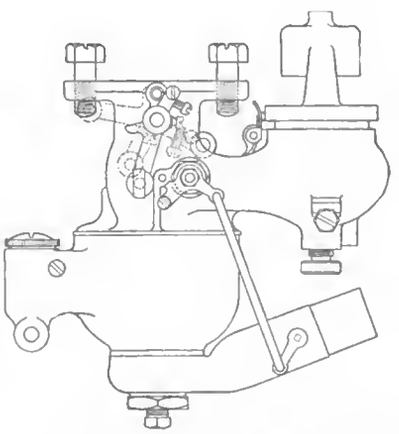
Both the intake and exhaust manifolds are on the left with the carbureter carried on a horizontal flange at the bottom of the intake header. A particular feature of the intake manifold is in the smoothness of the interior surface and the elimination of sharp bends. The hot air stove is attached to the exhaust manifold at the rear of the engine and is carried direct to the air intake of the carbureter by a flexible tube.

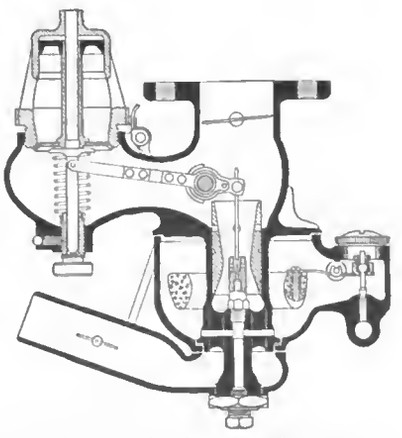
Connecting Rods Taper

Cylinders follow conventional design as illustrated in the sectional drawings, and a noteworthy feature of the connecting-rods is the taper from top to bottom in order to give a constant strength column between the wristpin and

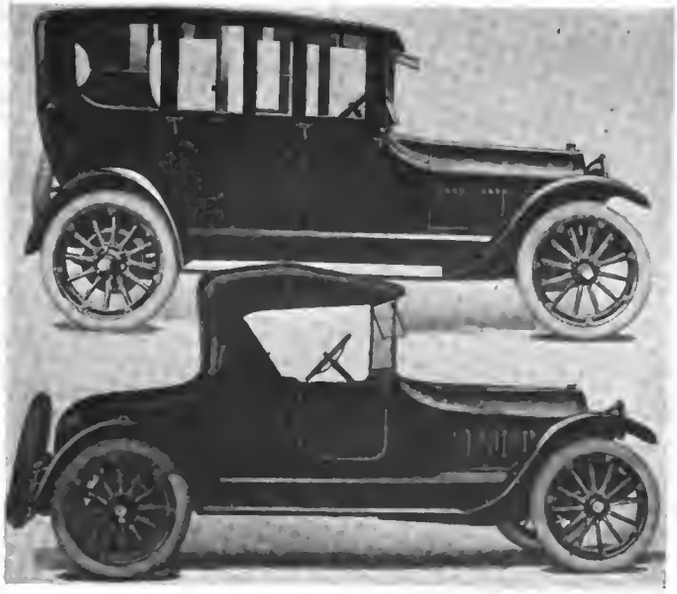








The principal change in the Studebaker engine is reduction of reciprocating weight. Observe the large water spaces round the valves The small views show the roller chain drive for the starter and the carbureter with fuel and air adjustments



Above—Convertible design or Every-Weather type which fits over the standard touring body. Below—Side view of the roadster body with full equipment

Upper—Studebaker six-cylinder, four passenger coupé. Lower —Landau roadster which makes a convenient car for physicians and professional men

the crank pin bearing. The center lines of the connecting-rods are slightly offset, as will be noted from the longitudinal section. In the six-cylinder engine the crankshaft is carried on four main bearings, and in the four there are three main bearings. The entire assembly of piston, rod and crankshaft is featured by high strength factors secured by liberal dimensions. The wristpin is secured in the piston boss by a set screw and the bearing bronze for the upper rod bearings secured in the upper end of the rod. At the lower end of the rod there are four alloy steel bolts provided with shims between the cap and bearing for adjustment.

No alteration has been made in the valve action. The camshaft is driven by helical gears directly from the crankshaft and the tappets are the same constant-diameter units adopted last year. These cylindrical pieces, being of the same diameter at the bottom as they are at the top, can be drawn from the crankcase by simply lifting the valve and the spring out of the way.

Lubrication is by a circulating splash system with a gear pump. The oil is driven from the crankcase reservoir through a lead running the entire length of the crank case with a duct to each of the main bearings. The oil is forced through this and the pressure under which it is being fed is registered upon a gage mounted on the dash. The oil passing through the entire length of the main lead flows to the timing gears and acts as their lubricant. The overflow from the main bearings enters the splash troughs where it is picked up by the scoops at the bottom of the connecting-rods.

Electrically, the Studebaker car is Wagner equipped. The starting and lighting system is a two-unit outfit with the motor and generator both mounted on the right. The generator is mounted vertically and driven from the helical gears in mesh with the crankshaft gear. The starting motor engages the crankshaft through a chain drive and is provided with an over-running clutch which releases the starter when the engine is running.

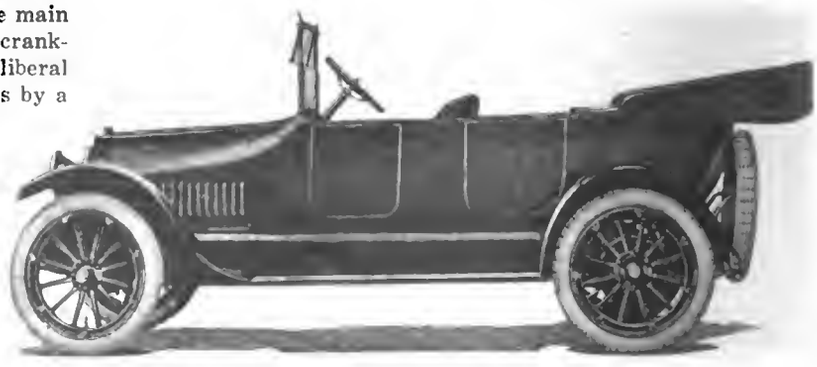
The torque exerted on the crankshaft is over 200 ft. lb., the energy being supplied by a three-cell, 6-volt, 100-amp.-hr. Willard battery mounted under the front seat. For ignition there is a Remy coil and distributer. The headlights can be focussed on any spot desired, and these, together with the dimming device, speedometer and tail lights are controlled by dash switches.

Single Wire System Used

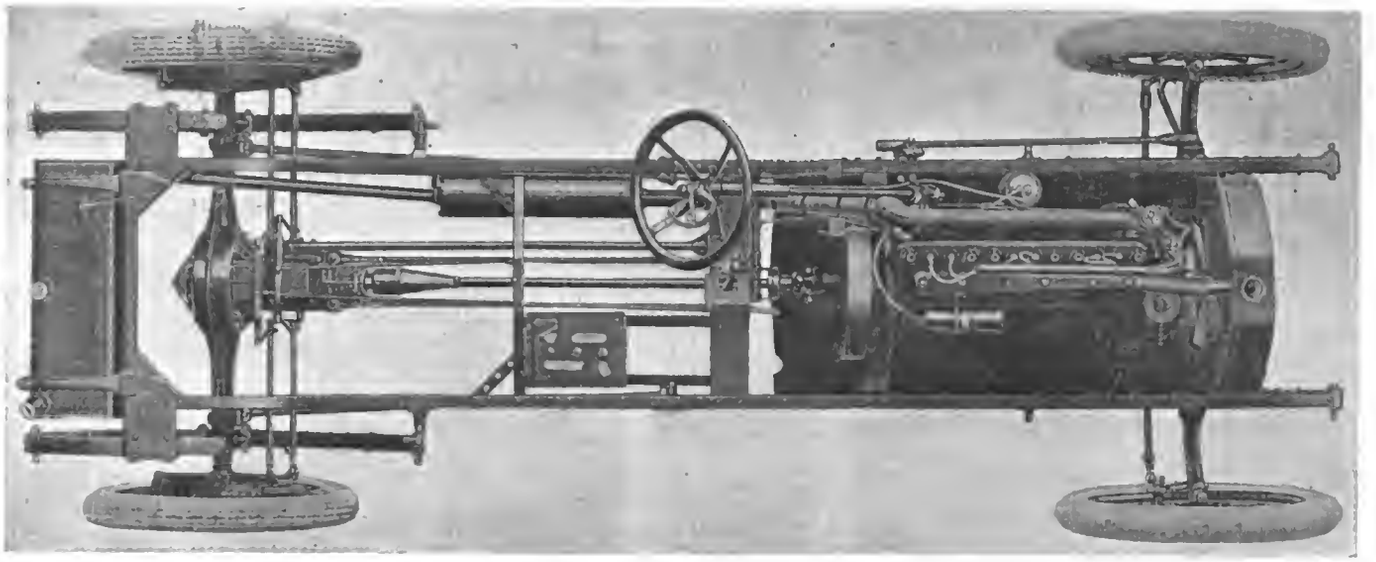
Particular attention has been given to the wiring which is a single system, grounded-return, with the wires carried in flexible metal conduits. The feature introduced last year of placing a junction box on the rear right side of the engine, where it is very accessible, is continued. All the wires go to this box and there are practically none on the body except to the control apparatus on the cowl. Four screws hold the cover plate on the junction box, giving access to any of the connections for the entire system. When the body is removed from the chassis there is no need to make a number of disconnections and furthermore the connections should not work loose, as they are all very rigid. The entire system operates at 6 volts.

The clutch has a pressed cone, the facing being mounted on easy-engaging springs and the throw-out device connected to a ball bearing collar. The drive is direct from the rear clutch member to the gearset at the rear through a 1 5/16 in. alloy steel propeller shaft fitted with a universal at each end. The gearset is bolted by means of a flange to the pressed steel housing of the rear axle and carries on its left side a torsion rod which connects to the main cross member of the frame just behind the forward end of the propeller shaft.

There are also two radius rods which are attached to the side members of the frame with flexible connections to allow for rear spring action, while preserving the alignment of the rear axle. A gear reduction at the axle of 4 to 1 on the



Studebaker series 18 seven-passenger touring car

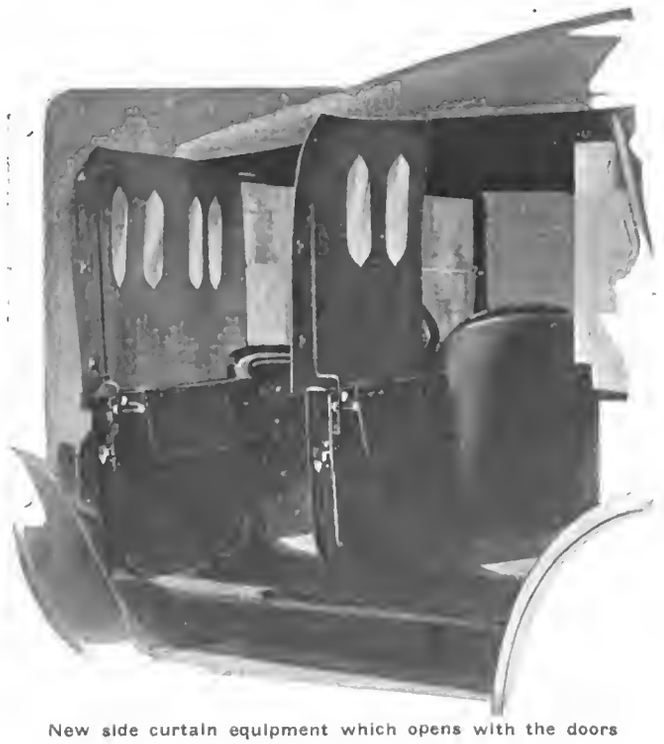


Plan view of the series 18 Studebaker six-cylinder chassis, showing layout of driving and torque members

four and 3.7 to 1 on the six is employed. The three-quarter elliptic spring suspension adopted last year has been continued, the springs being underslung beneath the axle. On both cars they are 51 in. in length with 38-in. front springs.

Wheelbases Differ

On account of the greater engine length there would naturally be a longer wheelbase on the six than on the four. There is a 10-in. difference in this respect, the four having 102 in. and the six 112 in. The tire equipment is 34 by 4 straight side on both cars. Non-skid safety treads are furnished in the rear, while each car is provided with a tire carrier at the rear of the body, together with an extra demountable rim. The wheels are artillery type covered by heavy pressed steel crowned fenders with clear running boards covered with corrugated rolled aluminum. The brakes operate on a 15-in. drum, the service brake having a 2-in. face width and being a contracting type. The hand brake is expanding and has a 1¾-in. face width. The steering gear is an irreversible, full worm-and-wheel type.



New side curtain equipment which opens with the doors

The body line is complete on both the four- and six-cylinder chassis, the cars now listed including the following:

Four-cylinder models:	
Chassis alone	$850
Roadster	930
Touring Car	940
Every-Weather Car (Convertible)	1,140
Landau Roadster	1,150
Six-cylinder models:	
Chassis alone	1,090
Roadster	1,170
Touring Car	1,180
Landau Roadster	1,350
Every-Weather Car (Convertible)	1,380
Touring Sedan	1,700
Coupé	1,750
Limousine	2,600

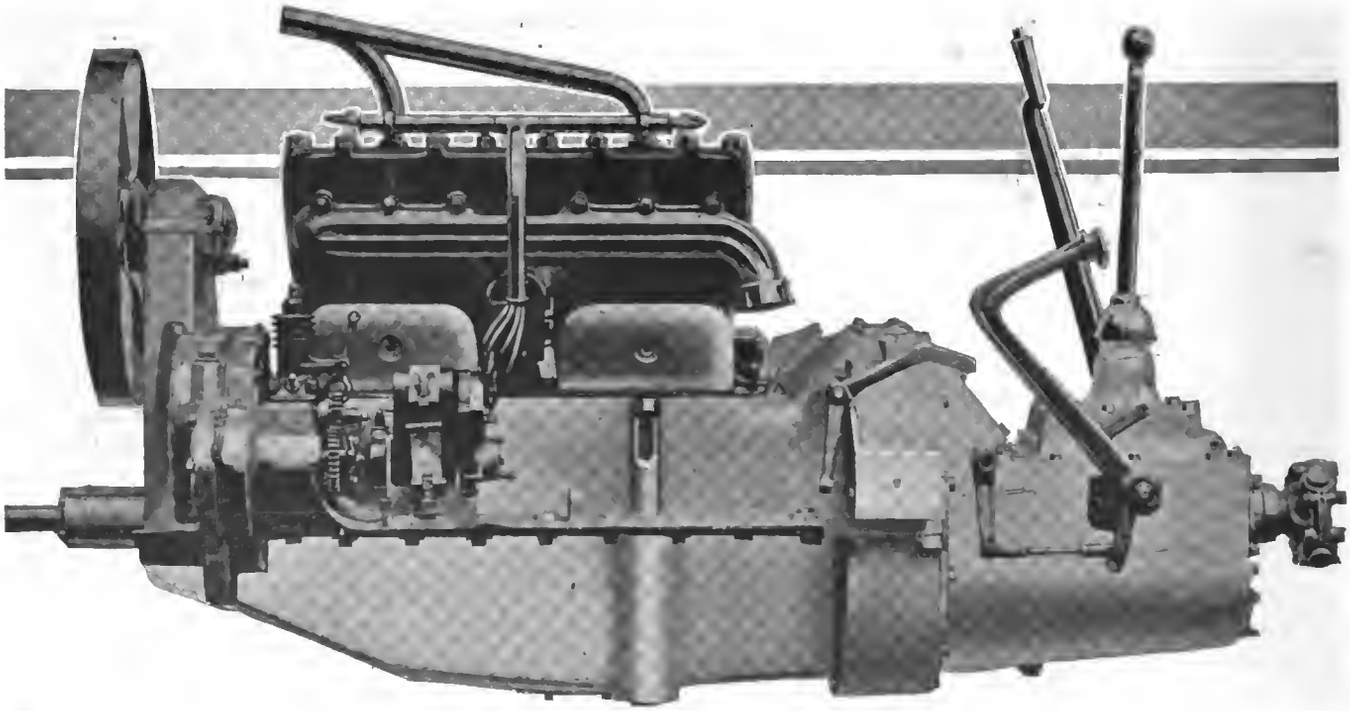
Complete equipment is included in the purchase price, which in all cases is f. o. b. Detroit. The upholstery in the touring and roadster models is straight-grained leather, while the sedan, limousine and coupé can be finished in many different shades and patterns with bedford cord and cloth upholstering. The side seats and back are finished in the same quality and workmanship as the cushions. In the sedan, limousine and coupé the carpet matches the upholstering. The front seats are divided and shaped to fit the back.

Windshield Is Adjustable

One of the features of the equipment is the windshield, which is a special adjustable type designed to fit snugly to the body. There is an overlapping portion of the upper glass which shuts out rain and snow. The steering wheel is 18 in. in diameter, and some of the additional equipment includes the leather covered instrument board, Stewart-Warner magnetic speedometer, battery indicator, oil pressure gage, carbureter control, gasoline gage on rear tank, Yale switch lock, Sparton horn and complete set of tools.

Pocket Book on Gearing

MANY useful tables and much data relating to gearing is contained in a little booklet issued by the Van Dorn & Dutton Co., gear specialists of Cleveland, Ohio, which they will be pleased to send to any engineer who will write them for a copy. Circular pitch, diametral pitch and metric pitches are all dealt with and there are long tables of conversion from diametral to circular giving the thickness of tooth, depth of cut, etc.: Formulas for strength of teeth and general information concerning bevel and spiral gearing are included.



Exhaust side of the new sixteen-valve, four-cylinder unit power plant which is a feature of the 1917 White. Note power tire pump mounting and magneto drive as well as inclosed fan drive

White Four Has Sixteen Valves

Two Wheelbase Lengths Provided on Otherwise Identical Chassis—Valves Are Set at an Angle

(*Continued from page* 949)

and in the experimental laboratory regarding the necessity for having the highest possible volumetric efficiency have been applied. As pointed out in the recent engine review in THE AUTOMOBILE, throughout the entire industry the motor engineers have realized that the way to success along the lines of thermal and mechanical engine efficiency is by securing the closest possible approach to 100 per cent filling on the intake stroke. The White company sums up the situation in the words, "valve efficiency is more important than the number of cylinders," and has used the sixteen-valve design to attain this end.

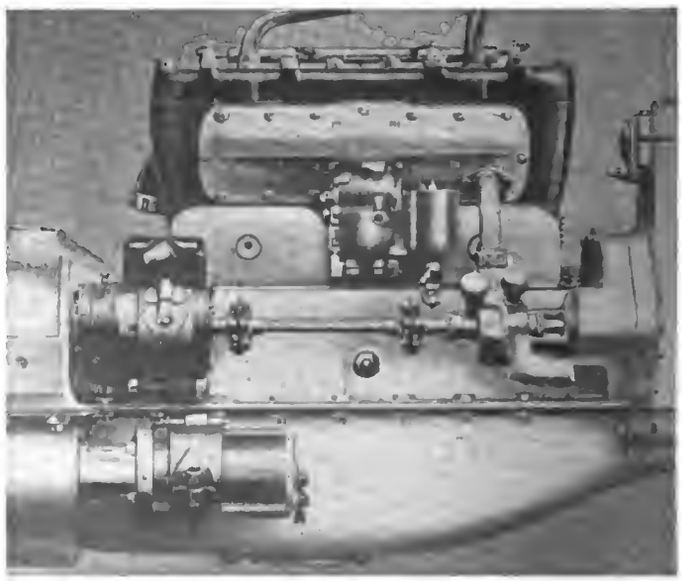
The White company advances nine reasons for the choice of the sixteen valve four. These are:

1—Greater volumetric efficiency.
2—Smaller valves for the same area.
3—Longer duration of maximum gas flow.
4—Cleaner scavenging.
5—Reduction of carbon deposit.
6—Reduction in number of times tuning is necessary.
7—Easiest course of gas flow.
8—Elimination of dead gas pockets.
9—Minimum area of combustion chamber wall.

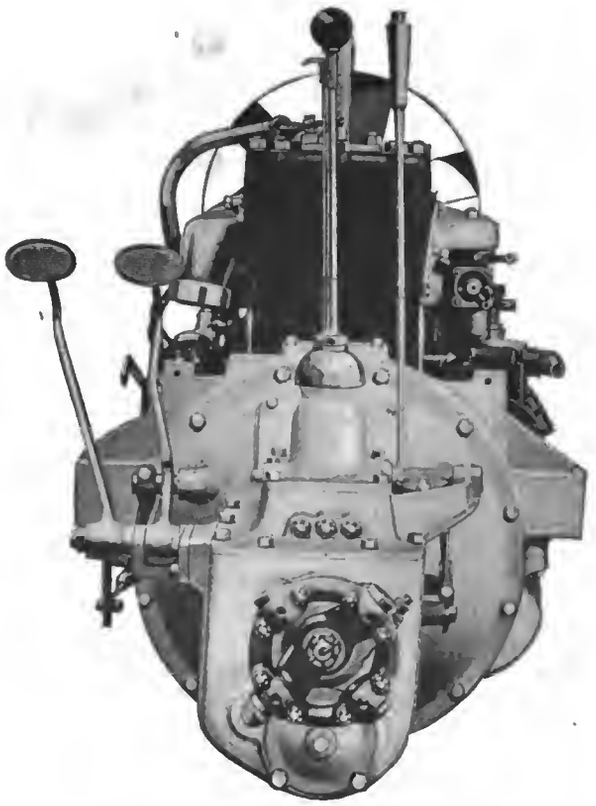
The chassis is made in two wheelbase lengths of 137½ in. for the touring, limousine and landaulet and 124½ in. for the runabout, sedan and coupé. With the exception of the wheelbases the two chassis are identical.

The Unit Power Plant

Combined as a single member, the engine, clutch and gearset form a unit power plant with three-point suspension. The 4¼ by 5¾-in. T-head cylinders are cast in a single block with the valves located at the four-corners of the square about the cylinder circle in the plan view. The cylinders are cast with an open arch between the second and third or middle two cylinders, for lightness this also serving as a factor in preheating the carbureter air. The head casting is entirely separate and contains no valve plugs, an unusual fact in conjunction with a T-head engine. The spark plugs



Intake side of the new White engine, showing mounting of carbureter and electrical units



Rear end view of the White sixteen-valve unit power plant, showing forward universal and control member mounting

are screwed directly through the head and fall in the diametric center of the cylinder, thus giving a symmetrical area for flame propagation and freedom from gas pockets. When the head casting is removed by taking out about fourteen studs, the spark plugs come off with it.

Removing the head exposes the valves and the combustion chambers, rendering the former free for grinding and the latter for cleaning. It takes 15 min. to remove the head and about 5 min. to take off all the side cover plates for the valves, to get at the springs and adjusting nuts.

The piston and rod assemblies are what would normally be expected in a high-speed engine of these dimensions. The pistons are aluminum alloy with three rings and other reciprocating weights have been kept low. The rods are drop-forged I-beams, and the crankshaft is carried on three main bearings which are lined with die-cast babbitt. The shaft is put into running balance by a series of counterweights.

There are two independent camshafts each carrying eight cams. These are driven by helical gears off the crankshaft, the timing gears being located in an independent case at the forward end of the crankcase. Stiffness is a feature of the camshaft to take the torsional stress of the eight valve springs, and the shaft is supported in five bushed bearings.

Valves Are Set at an Angle

A feature of the valves is that they are set on an angle to the vertical center plane. The principal reason for this being that it reduces the size of the combustion space and allows ample water space round the valves. Lubrication is by the full pressure system without splash. The pump is a gear design which leads the oil under a varying pressure commensurate with the speed of the engine to the main bearings. The shaft is hollow and the crank cheeks are also drilled, leading the oil directly to the lower rod bearings under pressure. The pistons and the cylinders are taken care of by the spray from the cranks and the oil then returns through a double bottom strainer to the aluminum crankcase reservoir in the bottom of the crankcase. All the bearings are carried in the upper half of the crankcase, so that when the pan is dropped the main and lower rod bearings are accessible for adjustment. By dropping the pan and removing the lower rod bearing caps the piston and connecting-rod assemblies can be withdrawn through the top of the cylinder, thus eliminating the necessity for removing the cylinder block.

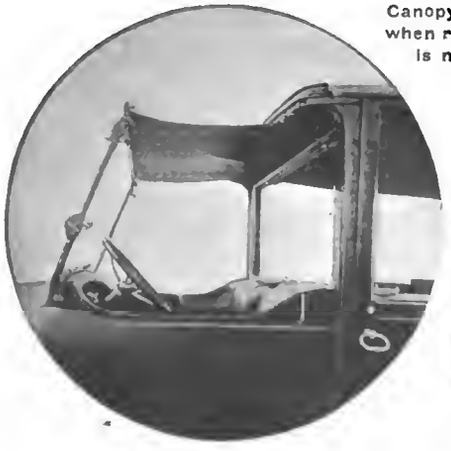
There is a level gage on the side of the crankcase, operated by a float which keeps the driver informed as to the oil supply. The condition of the feed is determined by the pressure gage. Former White cars have carried the oil supply in a dash reservoir. In keeping with the accessible design of the engine there is a removable plate through which the strainer can be taken from the crankcase and cleaned, and there is also a hand hole which allows of access to the inside of the case.

Vacuum feed is used for the gasoline system, the tank being mounted at the rear. The carbureter is a White barrel type of throttle bolted to a new design of intake. There is no header between the carbureter and the intake manifold to which it is attachd by a horizontal flange, the hot air passes through the arch in the center of the cylinder casting with a new type of adjustable stove attached to the exhaust pipe.

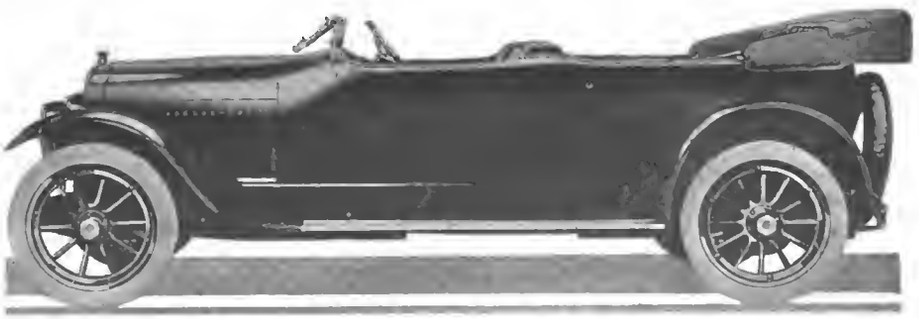
Provision for Heavy Fuel

As considerable attention is being paid to the heavier grades of fuel, the stove is of interest. There is a shutter valve on this, the air thus admitted being much cooler than that which enters the slot directly in the stove. The more the shutter is opened the greater the supply of cool air admitted, and the adjustment naturally depends on the atmospheric temperature. An accessible feature on this adaptation of the White carbureter is that both nozzles can be removed as a unit for cleaning by taking out two exterior bolts. The only adjustment on the carbureter is a knurled nut which governs the proportions of the mixture.

Pump circulation is used for the cooling water, with the pump on the generator shaft. The fan is a built-up alu-



Canopy for use when roof extension is not carried



White 1917 seven-passenger touring car which is fitted with the new sixteen-valve four-cylinder unit power plant. It sells for $4,600

minum unit with six blades and is driven by silent chain, the latter being inclosed. Adjustment of the fan drive is secured by placing the fan sprocket on an eccentric unit which is turned by a rack and pinion housed in the chain case. There is a nut connected with the pinion outside the case and when this is turned the adjustment is made by altering the center distance between the fan sprockets.

Two-Unit Electric System

For lighting and starting the Leece-Neville two-unit system is used and for ignition there is a single high-tension magneto. The generator is bolted to the crankcase at the right rear end, between the pump and generator, which are on the same shaft, there are two flexible couplings. The junction box is directly on the top of the generator.

Bendix gear connection is used between the electric starting motor and the flywheel ring gear. Current is supplied by a 12-volt, 75-amp. Willard or Exide storage battery, this voltage being used throughout all the circuits, and the two-wire system is employed.

A single plate, fabric-faced clutch running in oil is used. This delivers the power to a White four-speed gearbox which is over-geared on fourth. The shift is redesigned and, for the first time, the White company is using the cane type. The shifter is mounted on the cover of the gearbox following usual unit power plant practice. The gearset is carried on ball bearings and there is a removable plate at the bottom of the box through which the layshaft may be withdrawn, saving an hour at least on a repair job at this point.

Hotchkiss Drive Used

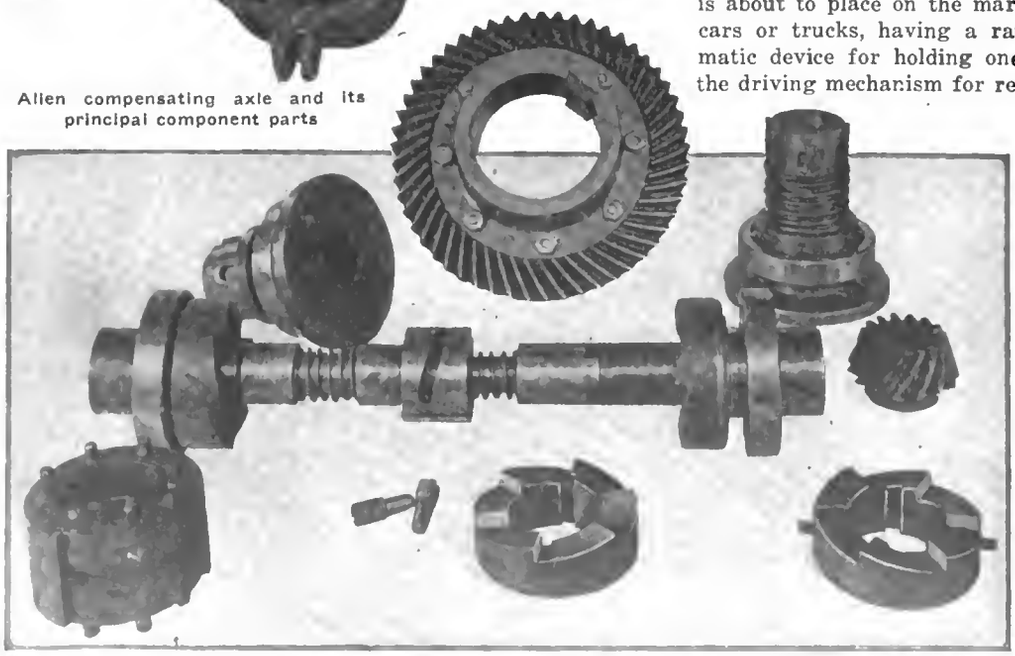
Two universals and a telescopic joint are used in the drive to the semi-floating rear axle and the hollow shaft is of chrome nickel tube. Both torque and drive are taken through the 60-in. semi-elliptic springs which are underslung beneath the rear axle. The drive connection is at the front end of the spring. There is a kick-up in the rear of the pressed steel channel frame. The brakes are on the rear wheels and the tire size is 37 by 5-in. all around with Goodyear and Goodrich cord tires optional. The extra tires are carried in the rear on forged brackets bolted to the frame and an extra rim is furnished as regular equipment. Steering is by worm and sector.

All the bodies mounted on the sixteen-valve four-cylinder chassis are new. The touring car is a center cowl divided front seat design with sloping windshield. A handy point is the mounting of all the switches and the carbureter control on the steering column. The color finish is optional within limits and there is a new design of one-person top which the White company calls the Mono-top. Full equipment including a power-driven tire pump is included in the purchase price, which for the touring car is $4,600.

Clutch Drives in Allen Axle

Differential Replaced by Ratchet Clutches —Drive on Inner Wheel on Turns

Allen compensating axle and its principal component parts



IF it were not for the necessity for providing a reverse gear, a very good automobile axle could be made by simply driving the two road wheels through ratchet clutches, so that the outer wheel on a turn would over-run the inner wheel, the latter doing all the driving. Such an axle, however, would not permit of reversing, and the engine would not be driven by the car in coasting, making it impossible to take advantage of the engine friction to provide braking effect.

The Allen Compensating Axle Mfg. Co., Philadelphia, Pa., is about to place on the market a new design for passenger cars or trucks, having a ratchet drive and a simple automatic device for holding one of the rear wheels rigidly to the driving mechanism for reversing or when the axle drives the engine.

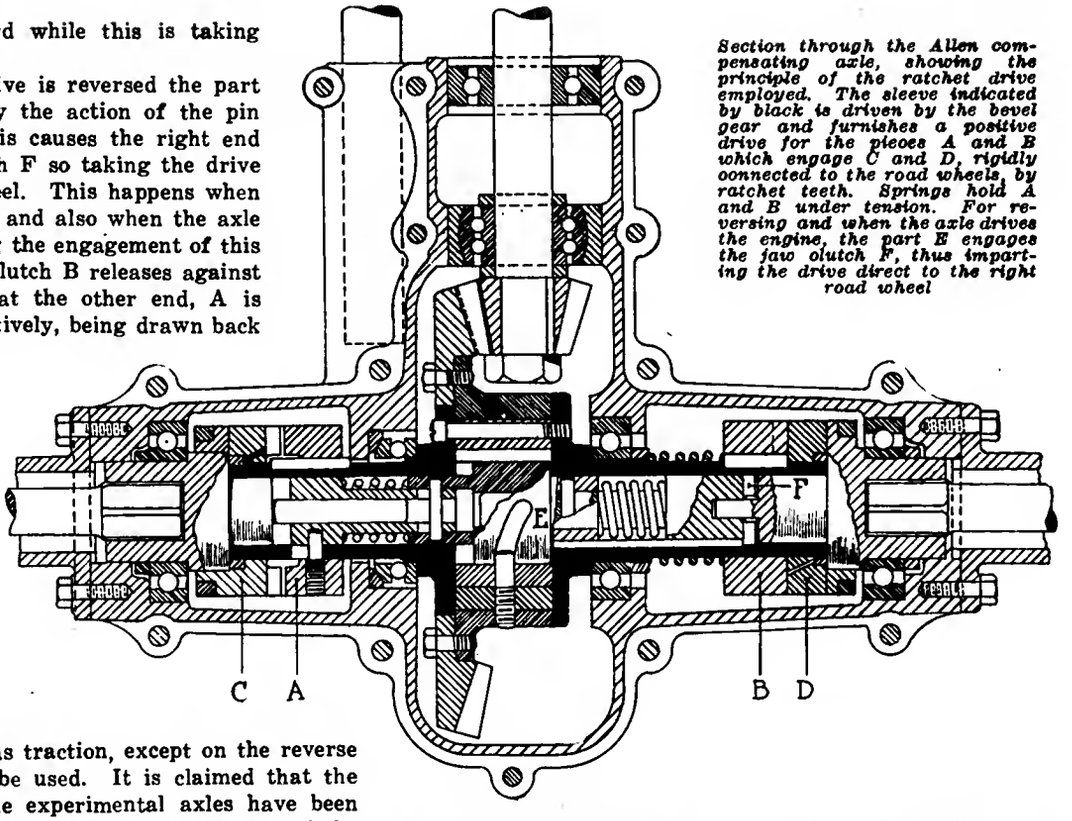
In the sectional view the sleeve shown in black is driven by the bevel gear and drives positively the two pieces A and B having ratchet teeth engaging the parts C and D which are connected rigidly to the road wheels. The springs which hold A and B up to their work are seen inside the black sleeve on the left and outside on the right. In forward driving the springs keep the ratchets engaged, but when a turn is made the outer road wheel over-runs the clutch on that side releasing against its spring. It is stated that the click of

the ratchet cannot be heard while this is taking place.

When the direction of drive is reversed the part E is moved to the right by the action of the pin and helical slot shown. This causes the right end of E to engage a jaw clutch F so taking the drive direct to the right road wheel. This happens when the reverse gear is engaged and also when the axle over-runs the engine. During the engagement of this reverse clutch the forward clutch B releases against its spring, but the clutch at the other end, A is held out of engagement positively, being drawn back by the movement of E as can easily be seen by following the details of the drawing.

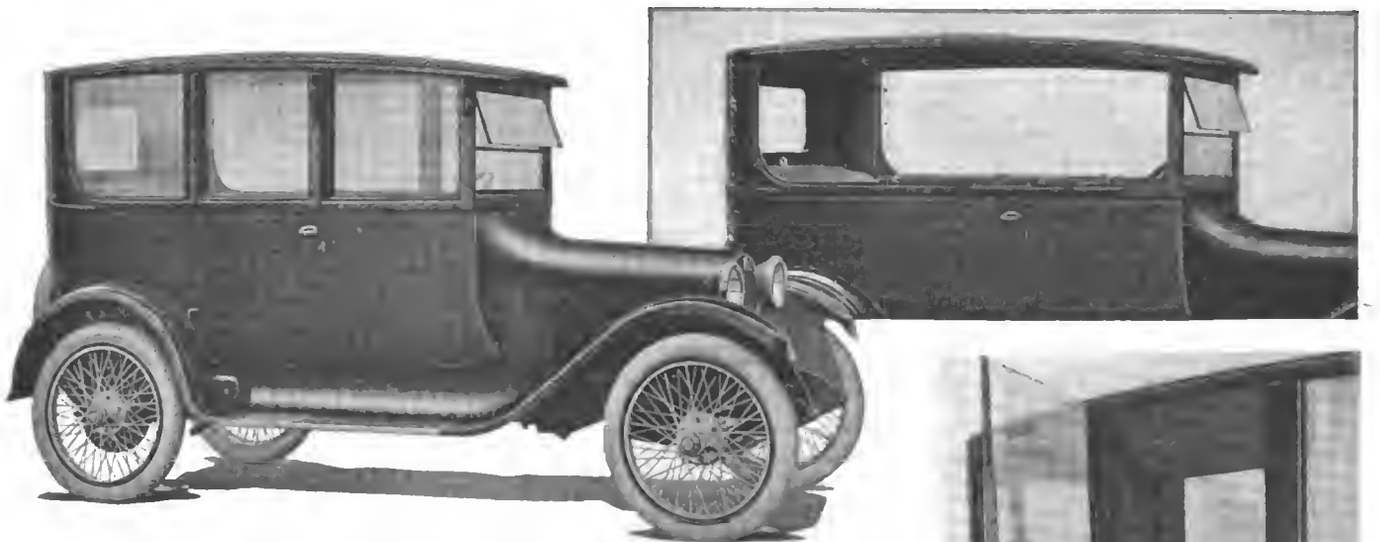
As soon as forward drive recommences the movement of the pin in the helical slot releases the reverse clutch and allows the main clutches to operate as before.

With this axle it is not possible to spin a wheel that loses traction, so there is always driving power for the wheel that has traction, except on the reverse where only one wheel can be used. It is claimed that the extensive tests to which the experimental axles have been put on heavy touring cars show that the elimination of the usual differential reduces the tendency to skid on applying brakes almost to vanishing point, since locking one brake cannot put a reverse drive on the other. It is planned to produce the Allen axle as a replacement part for several of the popular cars and also as a manufacturing proposition.



Section through the Allen compensating axle, showing the principle of the ratchet drive employed. The sleeve indicated by black is driven by the bevel gear and furnishes a positive drive for the pieces A and B which engage C and D, rigidly connected to the road wheels, by ratchet teeth. Springs hold A and B under tension. For reversing and when the axle drives the engine, the part E engages the jaw clutch F, thus imparting the drive direct to the right road wheel

Elegance in New Dodge Convertible Sedan



DESIGNED for use in either Summer or Winter, the new convertible sedan brought out by Dodge Bros., Detroit, is marked by conservative lines in which the influence of the latest American and European body styles is evident. The color scheme of the interior is gray with a bluish tint, a striped effect being carried out in the upholstery, curtains and flexible robe cords, with carpet, front compartment floor and running board coverings also gray. Cushions are of the Turkish type, upholstered in gray and trimmed with narrow lace. All fittings are nickel fitted and there is flush dome light. The front seats are divided.

The rear side windows may be removed and concealed in a narrow compartment in the back of the rear cushion. The other windows lower out of sight and the pillars may be carried under the rear seat. The sedan sells for $1,185, f.o.b. Detroit.

Four-Cylinder Best Tractor Engine

Tests of a Number of Engines Show Great Variations in Performance—Valve Timing Varies Greatly

By A. A. Potter and W. A. Buck

THE following gives the gist of an interesting account of investigations into the efficiency of tractor engines, and is extracted from a paper presented at the December meeting of the A. S. M. E. While many other engineers may not agree with the authors' conclusions, they have compiled their data carefully and the tables give information that cannot fail to be of value to tractor-engine manufacturers.

Authors' Conclusions

From the results of this investigation the authors have derived the following general conclusions:

The four-cylinder motor is better adapted for belt work on account of the greater number of impulses per revolution.

The single-cylinder motor and the two-cylinder motor operate better than the four-cylinder motor with fuels heavier than gasoline.

Carbureter Requirements

Carbureters now used are satisfactory for gasoline, but a carbureter jacketed with heat from exhaust gases should be employed when operating with kerosene or with the heavier fuels.

The ordinary automobile motor is too light for traction-engine work. The traction-engine motor should operate at lower piston speeds than the automobile motor. Motors operating at piston speeds of 700 to 900 ft. per minute are giving satisfaction.

Vertical Engines Preferable

The vertical types of motors are preferable on account of longer life and greater accessibility.

The valve-in-the-head type of motor has the more efficient combustion space and is to be preferred to the T-head or L-head types.

The combination of the forced feed and splash oiling system gives good results.

Jump Spark Ignition

The jump-spark system, on account of its mechanical simplicity, is the best system of ignition for traction engines of more than one cylinder.

The fuel-economy range is from about 1.30 lb. per brake horsepower per hour at one-fourth load to about 0.7 lb. per hour at full load. The fuel consumption in pounds per brake horsepower per hour is very nearly the same for both gasoline and kerosene.

Thermal Efficiencies

The thermal efficiencies at full load vary from 14.88 to 19.8 per cent for gasoline fuel, and from 13.7 to 15.97 per cent for kerosene.

The results of the tests relating to fuel consumption and thermal efficiency are given in Table 2. The lower fuel economy of the tests recorded for engine A as compared with tests on engine B (the same engine) was due to the difference in the spark advance. During the operation of engine A a greater spark advance was used, and more cooling water had to be injected into the cylinder with the fuel to prevent preignition. Water injection had to be used also during the tests of several engines with gasoline fuel (engines D, E and F).

Table 2. Fuel Consumption and Thermal Efficiency of the Traction-Engine Motors Tested

Engine	Per Cent of Full Load	Fuel per Hour per Shaft, Hp., Lb.	Thermal Efficiency, per Cent
	57.8	0.963	13.43
	99.8	0.808	15.88
	70.8	1.032	12.53
A	38.2	1.683	7.67
(60 B.H.P.)	111.3	0.928	13.93
(Kerosene)	98.8	0.874	14.77
	70.4	0.996	12.97
	41.5	1.188	10.88
	23.0	2.154	6.01
	18.1	1.780	7.26
	48.9	1.480	8.74
	17.5	1.750	7.39
	33.5	1.460	8.86
	51.1	1.100	11.76
	51.9	1.230	10.52
B	84.8	0.780	16.58
(60 B.H.P.)	66.4	0.990	13.07
(Kerosene)	65.9	0.760	17.00
	84.6	1.090	12.87
	97.8	0.810	15.97
	104.3	0.980	13.19
	127.8	0.940	13.76
	28.1	1.227	10.53
	65.1	0.793	16.34
	66.4	0.874	14.82
C	100.6	0.731	17.73
(65 B.H.P.)	102.1	0.767	16.89
(Gasoline)	112.7	1.010	12.83
	27.5	1.382	9.38
	68.1	1.008	10.06
	67.8	1.010	12.95
C	101.8	0.910	14.36
(65 B.H.P.)	36.0	1.582	8.26
(Kerosene)	101.3	1.328	9.83
	102.9	1.292	11.63
	102.9	1.274	10.24
D	90.0	0.997	13.43
(50 B.H.P.)	94.4	0.899	14.88
(Gasoline)	74.8	0.820	16.33
	52.6	0.883	15.17
	23.0	1.413	10.10
	23.6	1.204	11.87
E	47.1	0.670	21.32
(50 B.H.P.)	48.8	0.720	19.80
(Gasoline)	73.2	0.710	20.10
	74.0	0.710	20.10
	90.6	0.740	19.41
	8.7	3.210	3.85
	32.7	1.140	10.34
	32.7	1.120	12.36
	43 6	1.130	11.22
	43.2	0.950	13 02
F	43.9	0.980	12 54
(40 B.H.P.)	64.7	0.808	15.28
(Gasoline)	66.2	0.750	16.47
	88.0	0.730	16.94
	86.0	0.890	13.90
	82.4	0.780	15.25
	83.7	0.770	16 06
	84.0	0.770	16.06
	105.3	0.643	19.80
	127.0	1.047	12.10
	107.0	0.736	17.30
	98.5	0.706	18.00
G	81.6	0.779	16.30
(35 B.H.P.)	50.3	1.030	12.40
(Gasoline)	24.0	1.690	7.50
	80.6	1.045	12.20
	98.8	0.685	18.60
	81.8	0.808	15.80
	82.0	1.025	12.40
	23.6	1.791	7.10
	113.0	0.800	15.97
	131.2	1.019	12.54
	92.1	1.042	12.27
	58.1	1.161	11.02
H	28.7	2.097	6.10
(25 B.H.P.)	110.7	0.794	16.08
(Kerosene)	121.7	0.794	16.08
	91.4	0.951	13.45
	57.9	1.230	10.40
	27.2	2.099	6.09
	132.8	0.989	12.93
	91.9	0.930	13.73
	78.8	0.950	13.70
	80.4	0.810	16.10
	86.8	0.930	13.90
	39.9	1.050	12.40
J	24.4	1.640	7.90
(25 B.H.P.)	72.4	0.760	17.20
(Gasoline)	73.2	0.680	19.20
	96.0	1.040	12.50
	93.5	1.060	12.20
	95.9	1.030	12.60
	98.9	0.730	17.80
	70.1	0.740	17.50
	69.1	0.700	18.80
J	49.4	0.860	15.10
	49.5	0.930	14.00
	37.2	1.540	8.40
	127.7	1.003	12.69
	66.4	1.178	10 80
	92.9	0.976	13.03
	34.1	1.638	7.77
K	51.9	1.380	9.22
(20 B.H.P.)	75.8	1.071	11.87
(Gasoline)	98.5	0.905	14.06
	36.9	1.948	6.37
	54.6	1.385	9.18
	75.7	1.043	12.20
	110.3	0.818	15.44
	73.4	0.865	9.71
	45.8	1.447	9.12
	99 8	1.330	9.92
	23.3	1.778	7.42
	48.8	1.108	11.92
	72.1	1.020	12.93
	103.3	1.248	10.57
	23.2	1.865	7.07
L	70.8	1.303	10.13
(16 B.H.P.)	98.2	1.003	13.17
(Kerosene)	104.4	0.936	14.10
	71.5	1.279	10.32
	70.4	1.185	11.28
	44.8	1.187	11.22
	22.7	1.929	6.84
	71.1	1.103	11.97
	101.3	1.007	13.11
	93.0	1.043	12.64
	45.3	1.103	11.97
	22.9	1.702	7.76
	79.5	0.884	14.20
	30.5	1.508	8.30
	84.2	0.913	13.20
	18.9	1.753	7.20
	56.8	1.153	10.90
M	87.2	1.103	11.40
(20 B.H.P.)	60.1	1.020	12.30
(Gasoline)	104.1	0.811	15.40
	104.3	0.803	15.60
	60.5	1.103	11.40
	79.2	0.908	13.80
	77.8	1.051	11.90
	41.2	1.428	8.80

Table 1. Particulars of the Traction-Engine Motors Tested and the Fuels Used

Engine	Type (all 4-stroke cycle)	Ignition System	Lubrication System	Carburetor	Cooling System	Governor	Fuel: Gasoline or Kerosene	Fuel: Specific Gravity	Fuel: Heating Value, B.t.u. per Lb.	Rating, B.h.p.	Bore, In.	Stroke, In.	Rev. per Min.
A	hor., twin, 2-cyl.[1]	high-tension[7]	mech. op. sight-feed oilers	.....	pump	throttling[2]	K	0.809	19,700	60	....	....	.....
B	(same motor as A,	but tested when ne	w)	.....	.....	.....	K	0.800	19,680	0	....	....	.....
C	vert., L-head, 4-cyl.[1]	high-tension[3]	splash and mech. op. sight feed	Bennett	pump	throttling[2]	G	0.739	19,670	65	7¼	9	500
							K	0.786	19,500				
D	vert., T-head, 4-cyl.[1]	high-tension[3]	sight-feed pump	Bennett	pump	diaphragm[4]	G	0.741	19,000	50	6	7	650
E	hor., opposed, 4-cyl.[1]	high-tension[3]	st.-feed pump splash	Kingston	thermo-syphon	throttling[2]	G	0.735	17,880	50	6½	7	500
F	hor., opposed, 2-cyl.[1]	dual	mech. st.-feed oiler	Rayfield	thermo-syphon	throttling[2]	G	0.730	20,600	40	8	9	350
G	vert., L-head, 4-cyl.[1]	high-tension[3]	pump splash	Bennett	pump	throttling[2]	G	0.737	20,000	35	5	7	700
H	hor., L-head, 4-cyl.[1]	high-tension[3]	mech. st.-feed oiler	.....	pump	throttling[2]	K	0.789	19,900	25	5¼	8	575
J	hor., opposed, 2-cyl.[1]	high-tension[3]	pump splash	Kingston	thermo-syphon	throttling[2]	G	0.747	19,550	25	6½	7	570
K	vert., L-head, 4-cyl.[1]	high-tension[3]	pump splash	Bennett	pump	throttling[2]	G	0.737	20,000	20	4¼	5¾	800
L	hor., single-cyl.[1,6]	low-tension[6]	sight-feed oiler	.....	hopper	throttling[2]	K	0.805	19,280	16	8	12	400
M	hor. L-hd., 2-cyl., opp.[1]	Kingston dual high-tension	mech. st.-feed oiler	Kingston	pump	throttling[2]	G	0.738	20,290	20	5¼	7	650–720

[1]With mechanically operated inlet and exhaust valves.
[2]High-speed throttling type of governor that regulates the quantity of mixture.
[3]With K-W impulse starter magneto.
[4]Diaphragm type, using pressure of circulating water to control the speed.
[5]Valve in the head.
[6]Make-and-break system using an Accurate oscillating magneto.
[7]High frequency belt driven K-W magneto with trembler coil.

In the case of several engines the valve setting had to be changed before satisfactory operating conditions could be secured. In one case the preliminary tests indicated that the carbureter was too small for the engine. In order to facilitate comparison of various types the motors of the tests were grouped as follows:

Group I—Motors which develop at full load 15 to 26 hp. on brake. The tests recorded for motors H, J, K, L and M are included in this group.

Group II—Motors which develop 26 to 51 b.hp. In this group belong the motors recorded in the tables as D, E, F and G.

Group III—Motors which develop more than 51 b.hp. The tests recorded for motors A, B and C represent this group.

Average Fuel Economy

The average fuel economy for the various groups appears in the table at the right.

From the data on Group I and Group III Table 3 has been computed. Computations could not be made for Group II, as the engines in this class were not operated on kerosene. Table 3 shows the advantages of the kerosene-burning engine. Considering Group I, 10.07 gal. of kerosene will deliver as much power as 10 gal. of gasoline. With kerosene at 10 cents per gallon and gasoline at 20 cents, the cost with gasoline fuel will be 1.99 times that with kerosene fuel for the same power developed. Considering Group III, 12.32 gal. of kerosene will deliver as much power as 10 gal. of gasoline. This gives a ratio of 1.62 to 1 with prices of fuel at 10 cents per gallon for kerosene and 20 cents for gasoline. The advantages of the kerosene engine are offset to a greater or less degree, depending upon the operator, by the added trouble in handling. The life of the motor will also be somewhat shortened when using kerosene fuel. To this should be added the lower reliability with the heavier fuel. In some work done by traction engines reliability is the main factor.

Valve Timing

A study of the valve timing of the different motors in these tests shows no uniformity, except that the majority of the motors are so timed that the inlet valve does not open until after the exhaust valve is closed. The timing given in Table 4 is offered as a result of the authors' study and experience with traction engines.

TABLE SHOWING AVERAGE FUEL ECONOMY FOR THREE MOTOR GROUPS

Per Cent of Full Load	Fuel Consumption, Lb. per B.H.P. per Hour				
Group	Gasoline 1	Kerosene I	Gasoline II	Gasoline III	Kerosene III
25	1.853	1.990	1.416	1.47	1.827
50	1.147	1.265	0.893	0.93	1.190
75	0.940	1.044	0.767	0.78	1.013
100	0.855	0.935	0.720	0.73	0.977

TABLE 3—COST OF TRACTION-ENGINE POWER WITH GASOLINE AND KEROSENE

Per Cent Load	Cost per Horsepower-Hour in Cents with 60° Baumé Gasoline at Prices per Gallons (in Cents) of					45° Baumé Kerosene at Prices per Gallon (in Cents) of			
	9	12	15	18	21	5	7	9	11
25	2.72	3.62	4.53	5.43	6.34	1.49	2.10	2.70	3.30
50	1.68	2.24	2.80	3.36	3.93	0.95	1.33	1.71	2.09
75	1.38	1.83	2.30	2.75	3.22	0.78	1.10	1.41	1.71
100	1.25	1.67	2.09	2.51	2.93	0.70	0.98	1.26	1.54
Group III									
25	2.16	2.88	3.59	4.31	5.03	1.37	1.92	2.47	3.02
50	1.37	1.82	2.27	2.78	3.18	0.89	1.25	1.61	1.97
75	1.14	1.53	1.90	2.29	2.67	0.76	1.06	1.37	1.67
100	1.07	1.43	1.78	2.14	2.50	0.73	1.03	1.32	1.61

TABLE 4—VALVE TIMING FOR MOTORS OF TRACTION ENGINES

Speed of Motor, r.p.m.	Exhaust Valve: Opens before outer center	Exhaust Valve: Closes after inner center	Inlet Valve: Opens after inner center	Inlet Valve: Closes after outer center
200	20° to 25°	0° to 3°	0° to 3°	15° to 20°
300	22° to 27°	0° to 5°	2° to 5°	15° to 20°
400	27° to 32°	2° to 5°	2° to 7°	15° to 20°
500	30° to 35°	4° to 8°	5° to 10°	18° to 23°
600	35° to 40°	4° to 8°	8° to 12°	18° to 23°
700	40° to 45°	6° to 10°	10° to 12°	20° to 25°
800	45° to 50°	6° to 10°	10° to 12°	20° to 25°

Should Study Car Balance

Roadworthiness Equivalent of Seaworthiness and Different from Roadability—Proper Distribution of Weight on Front and Rear Axles Vital

By "Mercury"

WHEN a naval architect undertakes the design of a vessel, he must know accurately the weight and position of every bit of material which will enter into the construction. The sum of the weights must be exactly the displacement on which he has figured, to bring the ship to the water line he has laid down; they must be equally disposed on each side of the center line, so that she will float on an even keel; they must be properly distributed fore and aft, so that she may ride easily on the waves. Too much weight in the bow or the stern will make her steer wildly or plunge heavily into the seas; a lateral concentration of the weight will cause her to roll violently; while if her center of gravity is too high, she may be in danger of being rolled over by a beam sea, a menace to the lives of her crew and the safety of her cargo. In every part, the exact distribution of the weight must conform to the rules of science or the dictates of judgment and experience.

Weight Distribution

So this question of weight distribution has become as much a part of the work of those who design the carriers of the sea, as the determination of form, power and strength. In the design of the carriers of the land, it has received considerably less attention, although there seems to be little doubt that, as the distribution of weight in a ship affects the seaworthiness of the vessel, so the distribution of weight in an automobile affects its "roadworthiness." Perhaps some of this lack of attention may be explained by the fact that while water is a yielding medium which quickly makes apparent any defects in the distribution of the weights, the automobile rests on a solid base, and defects of this nature are not so readily discoverable. Perhaps also, "roadworthiness" is such an indefinable thing that it is difficult to formulate any rules in regard to it.

On the other hand, seaworthiness is also an indefinable thing, but although its attainment was for centuries, and still is, largely a matter for judgment and experience, nevertheless, many logical thories and some exact rules have been produced that have well-nigh revolutionized the art of ship design. While we can hardly expect theories and rules to be propounded within a few years, which in a similar case have required centuries for their production, nevertheless so many and such active minds have in recent years been concentrated upon automobile design and so much energy and wealth have been devoted to the attainment of perfection in automobiles, that it seems remarkable that more serious attention has not been given to this particular subject of the distribution of weight.

Old Models Often Superior

Many of our latest and most up-to-date designs suffer from this lack of attention, which is made only more apparent by their high degree of refinement in other directions. The ability to attain a high speed is a very useless accomplishment if that speed can only be attained on a road like a billiard table. Many a fine modern car that runs with the silence of an electric motor and that will show a fine turn of speed on the testing track, is put to shame on the road by some lumbering old Simplex or Fiat that rolls past, into the ditch and out again, with hardly a tremor, maintaining over all kinds of road surfaces a speed which the other would not dare to attempt. A plain board seat on a well balanced car may be more comfortable than the most luxurious upholstery on a car that bounces all over the road.

This is not entirely a matter of springs, as many people seem to think. One car that I have in mind, although very well sprung, is often at a disadvantage simply on account of the excessive weight of its rear axle. Another very popular car is a positive menace to its occupants and to other road users because of the high position of its center of gravity, and I have personally witnessed serious accidents which were attributable solely to this defect. Again, many chassis are entirely satisfactory when fitted with heavy touring or limousine bodies, but buck like bronchos when equipped as runabouts, while some touring cars that are quite comfortable with their full complement of passengers are very uncomfortable with only the front seats occupied.

Among the many advantages of the multi-cylinder V-sbaped engines, their compactness has often been cited, but it is also a fact that the great weight of the engine concentrated so far forward in the chassis has caused, in some cases, cars fitted with this type of engine to steer very wildly at high speed. Instances could be multiplied where "roadability" has been obtained at the expense of "roadworthiness." It is said that before the last British Tourist Trophy race, a competitor who had a very light car with a very heavy engine, arranged the engine to be movable, and by successive trials found the position of the engine in the chassis which would allow his car to maintain its best speed under the very varying conditions of the roads in the Isle of Man.

General Rules Possible

These instances simply point to the importance of this subject. While, of course, the wide variations in detail design make impossible an absolute standardization of the weight and position of each unit which enters into the construction, nevertheless it would appear that some general rules could be laid down for the position of the center of gravity, of the whole car, for the proportions which the weights of the various units should bear to one another and to the weight of the car as a whole and for the positions of these weights with respect to the center of gravity, to obtain the best balance and most satisfactory performance. Such an apparently elemental question as the proportion of the total weight which it is advisable to carry on the rear wheels is far from answered in the minds of most of us, and yet experience can readily supply a figure, which if not an inflexible rule, represents at least a satisfactory solution.

Years ago, the designer of the famous Lanchester cars, to whom we owe the introduction of the worm-drive and the wire wheel on modern cars, aroused considerable controversy by his original views on the proper distribution of weight, but since that time so little has been added to his investigations, that I think it would be extremely interesting, as well as instructive to many of us, to have the opinions both of designers and of users on this subject.

The Rostrum

Has 1905 Overhead Valve Peerless

EDITOR THE AUTOMOBILE:—I have an old four-cylinder overhead valve Peerless, No. 915, type 11. Can you tell me about what year it was made?

2—What is the gear ratio in fourth?

'—What is the horsepower rating and the r.p.m. of the engine?

4—What is the displacement of the pistons? E. A. F.

Philadelphia, Pa.

—This car was produced during the season of 1905.

2—The total gear reduction on fourth speed, which is direct drive, is 4 2/7. The maximum gear speed would, of course, be very difficult to determine on a car as old as this without some knowledge of its present condition.

3—Approximately 34 hp. figured at 1000 ft. piston speed, or roughly 1100 r.p.m.

4—The piston displacement is about 369 cu. in.

Removing Tar from Car Bodies

Editor THE AUTOMOBILE:—Supplementing my previous communication with reference to removing tar from automobile bodies, as it is a fact because tars are readily soluble in raw linseed oil, it is only necessary to apply the oil thoroughly in order to dissolve the pitch, and any convenient method of applying the oil that will not scratch the painted surface will be found satisfactory.

Would suggest, however, that the painted surface first be washed so as to remove all grit, then after same is dried apply the linseed oil with a soft rag, gently removing the spots of tar or pitch, and they will dissolve and come away from the painted surface without damage to same. Then after the pitch has been thoroughly dissolved, so that the painted surface appears to be free from same, due to the combination with the oil, then apply the ordinary wash of soap and water to remove the oil. This practice will be found more satisfactory than any other method I have ever known and is very easy to apply. H. A. M.

Philadelphia, Pa.

Cannot Change Steamer to Gas Car

Editor THE AUTOMOBILE:—I have a model 0.0 White steamer which has been run about 7000 miles. Would it be advisable to change it into a gasoline car if a suitable engine could be bought? D. O. W.

Marshfield, Ore.

—It is not practical to change your steamer into a gasoline car. Many persons have tried to do so in spite of advice that it cannot be done with any degree of efficiency. You would need a new radiator, engine, clutch, transmission and rear axle, to say nothing of necessary changes in the frame. The axle is high geared and not the right type for a gasoline car.

Timing for Model 17 Buick

Editor THE AUTOMOBILE:—Kindly give valve timing for the model 17 Buick.

Marysville, Ohio. M. M. CAR CO.

—The valves for the model 17 Buick will be correctly timed when the exhaust valve closes when piston is 1/16 in. past its upper dead center position and inlet valve opens when piston is 3/32 in. past its upper dead center. These measurements should be taken with a clearance of 0.010 in. between ends of valve stems and rocker arms when both valves are fully closed.

Wiring Diagram of 1910 Pierce 48

Editor THE AUTOMOBILE:—Kindly give wiring diagram of a 1910 Pierce 48 connecting up the coil with the battery and commutator, the original outfit of the Pierce-Arrow being used. I have been starting on the magneto and would like to have the battery to start on for the winter. H. C.

Brooklyn, N. Y.

—Wiring diagram of 1910 Pierce 48 is illustrated in Fig. 1.

Avoid Stopping on Main Highway

Editor 'THE AUTOMOBILE:—A remarkable demonstration of the wisdom of adopting and constantly living up to the principle of Safety First was given an automobilist of East Orange, N. J., recently. By exercising a little forethought he no doubt saved his wife's life and placed her in a position to safeguard his. On the side of a new and quite slippery road near Millburn, N. J., this gentleman was busy placing chains on his automobile when the thought occurred to him

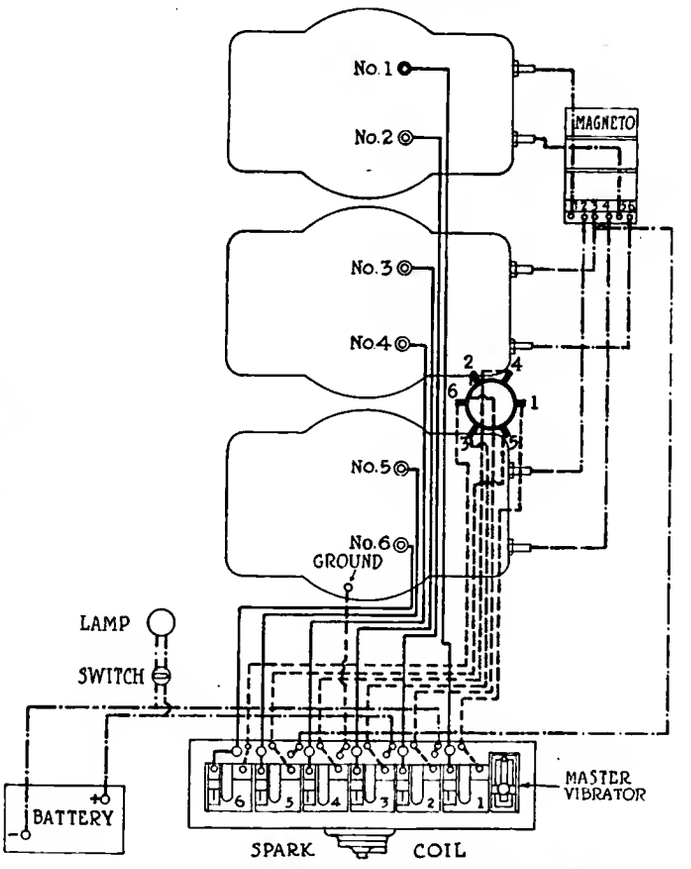


Fig. 1—Wiring diagram of 1910 Pierce-Arrow 48

that his wife, who was standing beside him, was in a dangerous position in the event of a car skidding into his.

Almost immediately after acting on his advice and stepping to the side of the car, a warning cry from her gave him sufficient time to step out of the way and avoid being struck by a large touring car which was skidding sideways and struck the rear end of his car with great force. The impact drove his car ahead, it afterward taking a course at right angles over an embankment down into a field.

This experience teaches automobilists that it is a very wise precaution and in obedience to the principle of Safety First to drive into a side street or roadway when conditions on main thoroughfares are dangerous and there stop for any needed purpose.

The fact that a part of your car is likely to stand in the way of passing cars making it necessary for the drivers to turn to one side, or possibly put on brakes, to allow traffic from opposite direction to pass—in either case inviting a skid—makes the above rule a wise one to follow.

East Orange, N. J. H. J. B.

How Delco Ignition System Operates

Editor THE AUTOMOBILE:—The Delco ignition on the 1916 Cadillac has been a puzzle to me for a long time. I have read instruction book as well as other books on it and still do not get it. Please tell me how the current travels from the battery to the plugs. Do the two breaker points break a primary circuit or does one break the primary and the other a secondary? Does the current come from the battery continuously even at high speeds or from the generator?

Brooklyn, N. Y. H. A. G.

—Current comes from the battery to each of the breakers. One breaker cares for one set of four cylinders and the other for the other set. No current is passing except when the one or other of the contacts is closed. When either pair of contact points come together the battery current passes through the primary winding of an induction coil. As soon as the points separate again the effect of stopping the flow of current suddenly like this is to cause a very high voltage current to be generated in the secondary winding of the induction coil. This high voltage current goes to the high tension distributer and this sends the discharge to the proper spark plug.

In an induction coil there is no connection between the primary and secondary coils. The former is a short coil of fairly thick wire, and outside this a great length of fine wire is wound. When current flowing through the inner coil is stopped a "surge" of high tension current is generated in the thin wire coil and the voltages are roughly in proportion to the lengths of wire in the respective coils.

At low speeds and at high speeds current is supplied by the generator, but it passes through the battery first. The battery is like a tank of water kept full all the time by a pump, the generator being the pump.

1910 Herreshoff Multiple-Disk Clutch

Editor THE AUTOMOBILE:—Will you kindly advise the number of disks in the multiple-disk clutch of the Herreshoff unit power plant in the 1910 or 1911 runabout? Also, please give the best timing for the engine. WM. M. L.

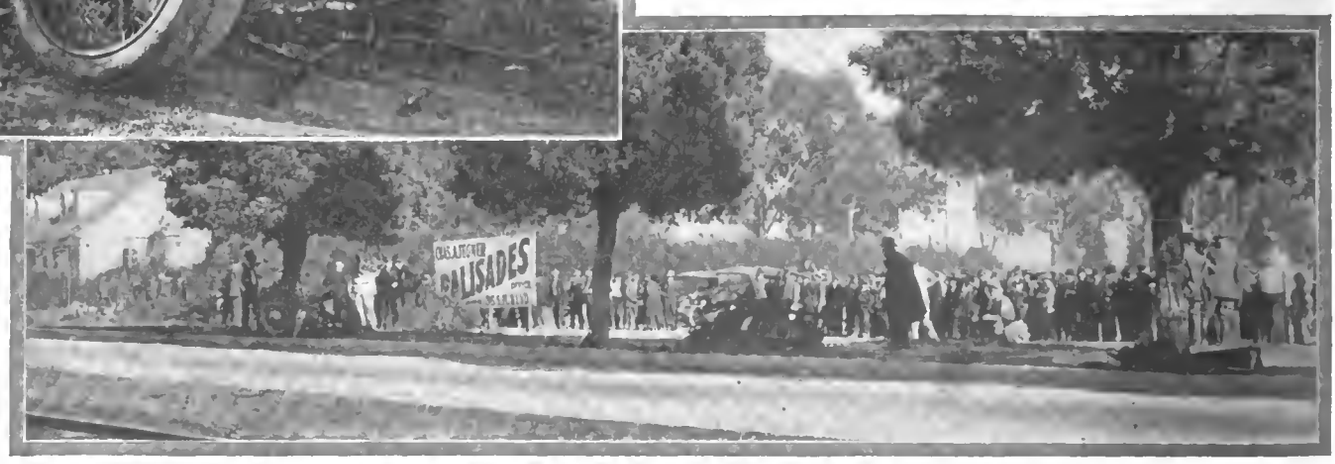
Paterson, N. J.

—There are fifteen driven and fifteen driving disks in the clutch of the Herreshoff 1910 and 1911 runabout. We are unable to furnish the timing of the motor.

A 2000-Hp. Crash at 100 M.P.H.

THE accompanying illustrations of Jackson's car wrecked in the thirteenth lap of the Grand Prize road race held at Santa Monica, Cal., Nov. 18, demonstrate the enormous amount of energy stored up in the rapidly moving car as well as the danger of modern high-speed racing cars traveling on ordinary streets and roadways. This machine was moving at 100 m.p.h. and probably weighed at least 3000 lb. It would then possess a kinetic energy of 1,007,390 ft.-lb. If this was dissipated in 1 sec. as the car struck the tree, work would be done at the rate of nearly 2000 hp. The force of the blow when the car hit the tree is equivalent to a blow from a weight of 1 ton falling freely for 500 ft.

The car hurdled the concrete curb, smashed two trees, one of which fell on a moving picture operator, killing him, and demolished a refreshment stand, killing the woman occupant and a spectator standing nearby. The car finished by wrapping itself around a third tree, cutting Jackson's body in two and hurling his mechanic, John Ghianda, 40 ft., seriously injuring him. Wreckage broke a woman spectator's arm and injured a man.



ACCESSORIES

Perry Lock Steering Wheel

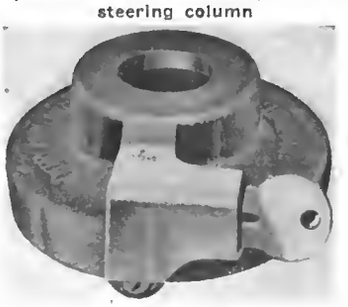
BESIDES in a complete steering wheel for any car, Perry locks are supplied to be mounted under the steering wheel on Ford cars. As shown in the illustration, the complete steering wheel is a very neat construction, the locking mechanism, consisting of a hexagon and a hub which is rigidly keyed to the steering post, being integral with the spider hub. When the car is locked, a key being used, the steering wheel has no connection with the steering column and is free to spin like a top, but when the wheel is in the driving position it is securely engaged. Different keys are supplied for every lock.

The device for Fords consists of a collar containing a locking device on the same principle as that used in the complete wheel, the steering wheel being locked out of engagement with the column. When in driving position the wheel is held as rigidly as if the lock were not used. In installing the lock no change is necessary except the replacement of the gear housing directly under the steering wheel. This can be done by anyone in 15 min.

With either of these devices the car cannot be towed or driven away as the front wheels are out of control. Price of complete wheel is $15. Ford lock sells for $5, installed.—Perry Auto Lock Co., 1238 Michigan Avenue, Chicago.

Perry lock steering wheel

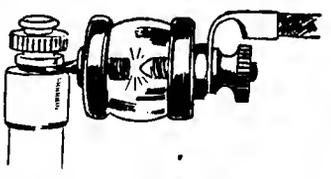
Perry lock for Ford cars in place on the steering column



Perry lock for Ford steering wheel

Marvel Spark Intensifier

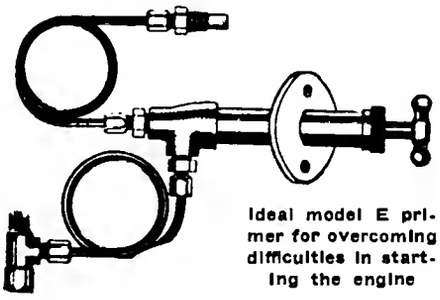
As shown in the accompanying illustration, this device embodies the principle that forcing the current to leap a gap before reaching the spark plug intensifies the spark which occurs between the points of the plug. A glass case incloses the two electrodes and the width of the gap may be readily adjusted by a small nut outside the case. Adjustment of the points is facilitated by having the spark gap in the intensifier visible through the glass. One intensifier should be fitted to each plug. The devices are neatly finished and simple to attach. Price 75 cents each.—Marvel Mfg. Co., 1020 Washington Boulevard, Oak Park, Ill.



Marvel Spark Intensifier attached to plug

Ideal Pressure Primer

The Ideal model E primer illustrated herewith is designed to overcome difficulties in starting an engine in cold weather, thus saving battery current. The primer, which is attached to the dash, is connected with the feed line and the proper amount of gasoline is injected into the manifold of the engine just before cranking. The stem is threaded and when the primer is not in use a few turns of the handle will close the valve, making it impossible for the device to leak, even under pressure. The manufacturer states that this primer can be used from one season to another without attention, due to the use of two materials on the plunger to avoid the trouble frequently experienced by the leather drying out. Special furnishings for any car are provided and directions included with each primer, the price complete with tubing and all connections being $5.—Ideal Brass Works, Tenth Street and Canal, Indianapolis.



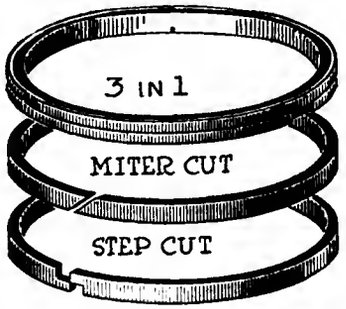
Ideal model E primer for overcoming difficulties in starting the engine

Fillometer for Fords

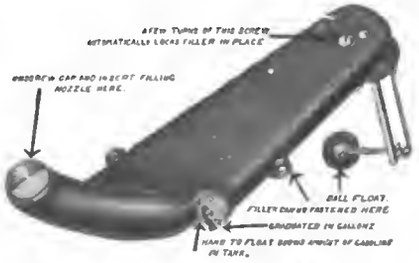
This device permits filling the gasoline tank of Ford cars without disturbing the occupants of the front seat. It consists of a metal casing that screws over the filler cap of the tank and fits flat under the seat cushion with its nozzle projecting past the edge of the seat. A gage is included that shows the amount of gasoline in the tank at all times.—Apex Electric Mfg. Co., 410 West Fifty-ninth Street, Chicago.

Stevens Non-Set Piston Rings

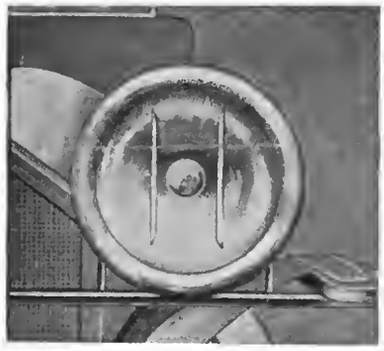
In these individually cast rings the natural skin of the casting is left in the finished ring. By the method of machining and polishing it is claimed that the resulting ring is extremely resilient and long-lived, making a gas- and oil-tight piston. Three styles of Non-Set rings are made—the miter-cut, the step-cut and the three-in-one. The latter is a compound ring made up of two narrow concentric rings lying on an inner ring in a manner that prevents any direct line for the gases to escape. Price,

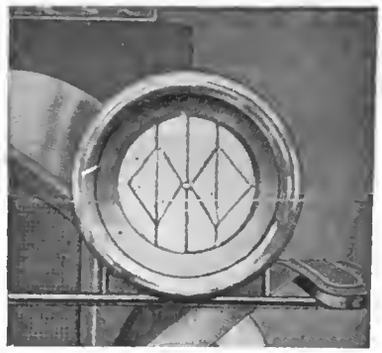


Stevens Non-Set individually-cast piston rings in the three styles made



Fillometer for filling Ford gasoline tank





Left—Hughes electric engine warmer for use in unheated garages. Above —Nodaz headlight dimmer, closed at left and open at right. The shutters employed in this device are operated by a push-button

miter-cut and step-cut, 25 to 40 cents each; three-in-one, $1 to $1.50, according to size and quantity.—Stevens & Co., 375 Broadway, New York.

Hughes Electric Engine Warmer

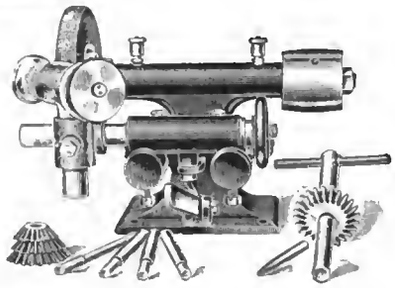
Engine and radiator are kept warm while in unheated garages by means of an electric heater operated from the lighting circuit. The heating element is inclosed in a metal case about the size of a dry battery, placed beneath the hood, and the hood and radiator covered with a blanket. The cost is said to be less than 1 cent per hour and the outfit well insulated and safe. Price, $4.—Hughes Electric Heating Co., 211 West Schiller Street, Chicago, Ill.

Walden Double Offset Wrenches

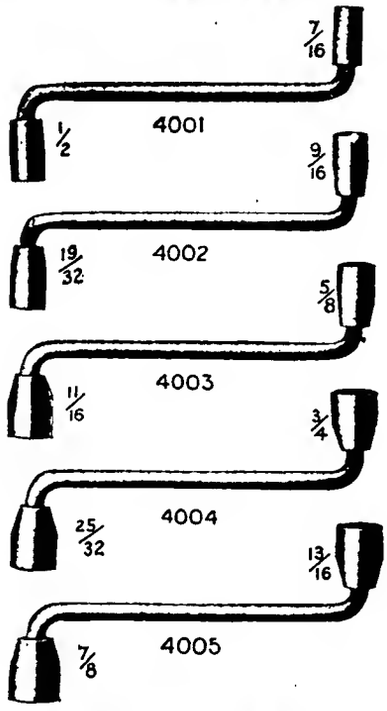
The sockets of these wrenches are placed at the end of a long handle that is bent in the form of a Z. These sockets are made of a solid steel bar, machine turned and broached to size. The handles are made of steel rod and have a length of 9 in. Price, No. 200 set, five wrenches, $2.—Walden Mfg. Co., Worcester, Mass.

Nodaz Headlight Dimmers

An electrically-operated translucent yellow shutter made in sections and installed in the headlight provides a dimming feature. When closed these shutters appear as narrow strips, permitting the searchlight beam of light to shine unrestricted. Pressure on a push-button near the driver's hand opens the shutters, causing the beams of light to pass through the translucent yellow material. Though giving a good driving light and a strong light at both sides of the road, glare is prevented, it is said. This company also makes a small rheostat for dimming headlights. Price, $10. —Ward Leonard Electric Co., Bronxville, N. Y.



Nasco valve grinder designed to secure any desired bevel



No. 200 set of Walden double socket offset wrenches

Nasco Valve Grinder

For grinding poppet-type valves to any desired bevel. A spindle, driven from an overhead shaft, carries a grinding wheel. The valve is carried in a swiveled chuck rotated by a small round belt, or, if desired, by hand. It is claimed to grind any valve to a perfect seat in 1 or 2 min., and not to require a skilled mechanic to operate it. Valve-seat reamer for refinishing the valve seats is also included in the set. Price, complete, $30.—National Auto Specialty Co., Tama, Iowa.

Bailey Muffled Heater

This heater is operated by the exhaust gases and is designed for either open or closed cars. The heater consists of a valve placed in the exhaust line between the engine and muffler. From here the gas passes through flexible tubing to a muffled seamless tube. The radiator lies flush with the floor and has an ornamented grilled nickel-plated surface. Price, $12 complete.—Riverside Machine Works, 228 Croton Avenue, New Castle, Pa.

No-Leak-O Piston Rings

The No-Leak-O piston ring is made of one piece. A groove is cut in the ring at right angles with the face and sloping downward for oil sealing. It is the oil sealing feature which is claimed to make the device proof against leaking. On the downward stroke of the piston the square edge of the ring will gather the surplus oil from the cylinder wall and pull it toward the oil pit. On the up-stroke the oil is distributed again on the cylinder wall from the sloping face of the groove. List prices range from 50 cents to $1.30, depending on the diameter.—Automobile Accessories Co., Baltimore, Md.

Bailey combined heater and muffler. It is easily and quickly applied

Industrial Miscellany

Factory

House Wire Wheel Co., Buffalo, N. Y., recently formed, is making arrangements for the erection of a plant for the manufacture of wire wheels for automobiles on a site recently acquired.

E. H. Sprague Mfg. Co., Omaha, Neb., has been formed to manufacture automobile accessories. It has taken over the plant of the Standard Foundry Co., that city.

Adams-Bagnall Electric Co., Cleveland, is completing an addition to its factory including a complete porcelain-enamel plant. Porcelain-enameled reflectors are largely used for industrial lighting.

Saxon Mfg. Co., Toledo, is planning to build a factory to manufacture automobile accessories.

Willard Storage Battery Co., Cleveland, has taken out a permit for interior improvements on its plant in this city. It will also build an $85,000 two-story plant, 135 by 222, at 280 East 131st Street.

Michigan Hearse & Motor Co., Grand Rapids, Mich., is building an addition to its plant. The addition is to be 100 by 60 ft. and will be devoted to the construction of bodies.

Specialty Mfg. Co., Minerva, Ohio, has been formed to manufacture automobile accessories. It will begin operations at once by the manufacture of an automobile light adjuster or tipper to be used in the place of a dimmer. Manufacturing will be concentrated in the Central Garage for the present.

Orrville Rubber Co., Orrville, Ohio, has started manufacturing tires and tubes.

Alpha Rubber Mfg. Corp. will locate in Genoa, Ill., to manufacture automobile tires and tubes. Up to this time the corporation has been selling a product manufactured expressly for it. Seventy-five employees will be worked in the new plant. J. A. Berger is president and general manager; Carl Schneider is vice-president.

Guarantee Tire & Rubber Co., Indianapolis, has been incorporated with a capitalization of $70,000 to deal in tires. The new company supersedes the Guarantee Tire Co. The officers are: G. F. Kreitlein, president; C. W. Minesinger, vice-president and treasurer, and Walter W. Kuhn, secretary. The company has taken over a five-story building at 214-216 McCrea Street for storage purposes.

Metallic Rubber Co., Columbus, Ohio, a subsidiary of the United States Rubber Co., did not open for operation Dec. 1, as was planned, because of delay in securing deliveries of machinery. The concern has taken over the former plant of the Midgley Manufacturing Co., on Dublin Avenue.

International India Rubber Co., South Bend, will begin the manufacture of automobile tires early next year. The first unit of the plant is nearing completion. The tread patterns for the tires to be manufactured by the company have just been patented.

Personal

Walter Woods and J. A. Clark are executives in the Van Cortlandt Vehicle Corp., New York Peerless representatives. Mr. Woods is vice-president and Mr. Clark is sales manager. Mr. Woods was formerly connected with the Peerless factory branch in New York. Mr. Clark managed the sale of the Peerless cars in New York for many years.

W. E. Heye, formerly with the Sharpleigh Hardware Co. of St. Louis, has been appointed traveling representative of the Gibson Co., Indianapolis, state Overland distributer and accessory dealer. He will have headquarters in South Bend, Ind.

Charles Campbell has been appointed manager of the used-car department recently installed by the Missouri-Haynes Co., Kansas City. He was formerly with the Moriarty Motor Co.

H. P. Nelson has been elected treasurer and sales manager of Robert Lurie & Co., New York, Metz representatives.

The Automobile Calendar

ASSOCIATIONS

Dec. 2-9—Electricians' Country-wide Celebration.
Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.
Jan. 9-11—New York City, Society of Automobile Engineers' Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.
Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.
Nov. 16—New York City, S. A. E. Meeting.
Nov. 23—Philadelphia, Pa., S. A. E. Meeting.
Dec. 7—Baltimore, Md., Safety First Convention of Safety First Federation of America.

CONTESTS

1917

April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 14 — Des Moines, Iowa, Speedway Race, Championship.
July 4—Tacoma, Wash., Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15 — Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race, Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13—Chicago Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Dec. 2-9 — Springfield, Mass., Show, Auditorium, H. W. Stacey, Mgr.
Dec. 7, 8, 9 — Rockford, Ill., Rockford Automobile Trade Assn., Shrine Temple.
Dec. 9-16—Akron, Ohio, Show for Passenger Care Only, Market Street Gardens, Akron Automobile Dealers' Show Assn.
Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel, I. R. Gates, Mgr.
Dec. 30-Jan. 6—Cleveland Automobile Accessory Show, Dreamland Auditorium.
Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.
Jan. 6-11—Milwaukee Auditorium, Milwaukee Automobile Dealers.
Jan. 6-13 — New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 12-20—Philadelphia, Show, Philadelphia Automobile Trade Aesn.
Jan. 9-10 — Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.
Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.
Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 22-27—Manchester, N. H., Academy.
Jan. 22-27—Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jsn. 23-27 — Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 5-9—Boston, 8th National Good Roads Show, Mechanics' Bldg.
Feb. 5-10—Bangor, Me., Bangor Automobile Assn., Auditorium.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 12 - 17 — Louisville, Ky., Show, First Regiment Armory, Louisville Automobile Dealers' Assn.
Feb. 14-17—Peoria, Ill., Coliseum, Automobile and Accessory Dealers' Asen.
Feb. 18 - 25 — St. Louis, Mo., Show, Automobile Manufacturers' and Dealers' Assn.
Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.
Feb. 19 - 24 — Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.
Feb. 19-24—Bridgeport, Conn., Show, Armory, Coast Artillery Corps.
Feb. 19-24—St. Louis, Overland Bldg., St. Louis Auto. Dealers' Assn.
Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.
Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.
March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co. Armory of the University of Ill.
March 3 - 10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 14-17—Davenport, Iowa, Show, Coliseum Bldg., Tri-City Automobile Trade.
March 18-23—Cedar Rapids, Ia., Cedar Rapide Automobile Trades Assn.

Henry McLaughlin has been appointed factory manager of the Detroit plant of the Lewis Motor Corp. He was formerly superintendent for Golden-Belknap & Swartz.

E. H. Gertz will manage the Mount Vernon and New Rochelle branches of the Hudson Motor Car Co., New York. He assumed his new duties Dec. 1.

F. E. Dennison has joined the sales department of the Hartford, Conn., branch of the Packard Motor Car Co. of New York and will manage the used-car department.

H. S. Jackson of New York has gone to Portland, Me., to manage the Gilson Automobile Co., Mitchell agent.

J. A. Lamkin, formerly of Boston, Mass., has gone to Portland, Me., as sales manager for the D. E. McCann's Sons Co., agent for the Smith Form-A-Truck.

W. M. Williams has opened a general advertising office at 132 South Salina Street, Syracuse, N. Y. Mr. Williams during the past year was a member of the advertising department of the Willys-Overland Co., Toledo, and previously was the advertising manager of the Franklin Automobile Co. for 2 years.

Dealer

De Lion Tire & Rubber Co., New York, has moved to 1922 Broadway.

Saxon Motor Co., New York, has moved to 1744 Broadway. The old store at 251 West Fifty-seventh street will be retained for display purposes.

A. J. Picard, metropolitan distributor for U S L batteries and national distributor for the Genemotor, has purchased the interest of E. S. Morrison in A. J. Picard & Co. Mr. Picard has incorporated his business and will continue under the old name of A. J. Picard & Co. A five-story building is being erected at 9 West 61st Street, which will be ready for occupancy on or about March 1, 1917.

Everard & Oberting Co., Columbus, Ohio, will distribute Macon cars in central Ohio territory. Sales offices are at 140 West Blake Avenue.

E. B. Fidler, Marion, Ohio, has purchased the garage and sales agency of Hoyes & Moyer for a consideration of $50,000. The concern will have the Buick agency. It is located on East Center Street.

Crow-Elkhart Sales Co., Milwaukee, Wis., has been organized to take the Wisconsin and Upper Michigan distribution of the Crow-Elkhart line.

Frank Hanrahan has become state representative in Iowa for the Champion Ignition Co., Flint, Mich.

Auto Tire and Rubber Co., Seattle, Wash., has taken the agency in Western Washington for the Johnson shock absorber.

Mack & Saurer Truck Co. of Missouri, St. Louis, has been organized to handle the trucks named. Negotiations are under way for salesrooms and service station quarters. These trucks were sold by George C. Brinkman Motor Car Co., which recently closed up its affairs.

Kunkle Wagon Works, Baltimore, has taken the agency for the Interstate cars.

Homewood Motor Co., Baltimore, will handle the Abbott-Detroit.

Walbeck Tire & Rubber Co., Louisville, Ky., agent for the Racine tire, has moved into its new building at 305 East Broadway.

Metcalf-Ericson Motors Co., Louisville, Ky., agent for the Empire and Regal, has been appointed state distributor for the Stearns-Knight.

Stahl Automobile Co., Kenosha, Wis., has become a Buick dealer as successor to the agency held for several years by F. A. Rice.

Hallstead Messersmith Co., 310 Michigan Avenue, Buffalo, N. Y., has taken on the King line for Buffalo and vicinity.

S. E. Barnwell, who handles the King line in Louisville, Ky., has moved into new quarters at 813 Third Avenue.

W. C. Wampler Co., King distributor for Dayton, Ohio, has opened up new showrooms and service station at 132 North St. Clair Street.

Times Square Auto Supply Co. has established a western distributing store in Dallas, Texas.

Bearings Service Co., Detroit, has established headquarters at Dallas, Texas, for the Southwest. This is the selling company for the Hyatt Roller Bearing Co., the Timken Roller Bearing Co. and the New Departure Ball Bearing Co. Headquarters are in the new Masonic Building, Main and Pearl Streets.

The Southern Auto & Electric Co., Little Rock, Ark., will handle the Liberty car for the state.

J. V. Le Blanc, Jr., New Orleans, will become distributer of the Jordan. Mr. Le Blanc is a sugar grower at Thibodaux, La., where he sold cars at retail, and recently removed to this city

Val Rolle Wagon & Automobile Co., New Orleans, has entered the field as builders of commercial bodies for Ford chassis.

Burke-Court Motor Co., Memphis, Tenn., has been named distributer for Chevrolet.

Dixie Motor Sales Co., Memphis, Tenn., has succeeded the Franklin Motor Sales Co. and will handle Franklin, Crow-Elkhart and Cole 8 and Gramm-Bernstein trucks.

Shartenburg & Robinson, a New Haven, Conn., department store, has taken on the agency for the Jordan car and a model has been placed on exhibition on the main floor of the store.

Todd Rubber Co. has established a branch in Bridgeport, Conn., and in addition to handling Kelly-Springfield tires will stock accessories. C. E. Minnerly is manager. The concern has branches in New Haven, Ansonia, Danbury, Hartford, New London and Waterbury in addition.

McQuay-Norris Mfg. Co., St. Louis, has made a number of changes in its representatives. L. H. Dally has succeeded H. G. Paro as Chicago manager and the Chicago office has been moved to 1140 S. Michigan Boulevard. Dally has been chief of the McQuay-Norris field force of engineers up to the present. H. W. Sweeney has succeeded J. W. McKeen as manager of the Pittsburgh branch office. R. W. Long has been transferred from the field force of engineers to be manager of the Denver branch. He succeeds H. W. Sweeney.

New Orleans branch of the Goodyear Tire & Rubber Co. is installed in new quarters at 818-20 Howard Avenue.

A. Meyers' Sons Co., Richmond, Va., for many years prominent in the wagon and carriage trade, has been appointed Ford agent. This firm also operates an accessory store at 325 West Broad Street.

Sterrett & Fleming, Washington and Baltimore, has opened a branch in Richmond to show Detroit electric cars and Philadelphia grid batteries.

Arkansas Reo Co., Little Rock, Ark., has been named state agent for the Scripps-Booth.

Patterson Harness Co., Little Rock, Ark., has obtained the state agency for the American tires.

Auto Tire Co., Hartford, Conn., has taken on the Faure tire.

John Millen & Son, Ltd., Montreal, Que., has been appointed distributer for the Boyce Moto-Meter.

P. C. Meredith, Des Moines, state distributor for Bull tractors, has taken the agency for the Dort, and will also distribute the Hercules truck. The new firm is called the Meredith Motor Car Co.

R. W. Llewellyn has been appointed manager of the Columbus, Ohio, branch of the Kelly-Springfield Tire Co.

O'Rourke-Muller Motor Co., New Orleans, has secured the agency for the Elcar and the Ames Ford attachments. A salesroom and service station will be opened at 824 Barronne Street. Temporary offices are at 853 Carondelet Street.

George A. Loque, Jr., New Orleans, distributer of the Hal cars, has opened a salesroom at 640 Barronne Street.

Goodyear Rubber & Tire Co., St. Louis branch, has moved into its new quarters at 3010 and 3012 Locust Street.

National Motor Co., Denver, National, Elgin and Wescott distributer for Colorado and Wyoming, with headquarters at 1616 Broadway, has dropped the Wescott and is now handling only the other two lines.

Northwest Mercantile Co., Kremmling, Col., has secured the Dodge and Velie agency for Grand, Summit and Eagle counties.

Wm. Thorney Auto Co., Denver, Apperson and Regal distributer for Colorado and Wyoming, with headquarters at 1315 Broadway, has gone out of the selling business and expects to start a garage as soon as a suitable location can be secured.

Estabrook-McGraw Tire Co., Denver, is a new tire-distributing agency for Colorado and extensive adjacent territory in the Rocky Mountain region for McGraw tires, with headquarters at 1646 Broadway. The new firm is headed by G. H. Estabrook, Hollier and Briscoe distributer and proprietor of the Estarado Garage.

The King Motors Co. has leased the premises at 2813 Locust Street, St. Louis, Mo., vacated by the Brinkman Motor Car Co., for a factory branch. William Schreiber, who has been connected with Paige, Premier and other distributing agencies here, will be manager. A service station carrying a complete set of parts will be opened in charge of a factory expert.

Nichoalds Co., Detroit, for many years dealer in automobile parts and accessories, has entered extensively into the jobbing business.

Kaehler Motor Car Co., Richmond, Va., has started a fall competition in sales by offering a free trip to the New York automobile show to the employe making the best showing between Nov. 1 and the date of the show.

Featuring Carburetion

The Automobile

Vol. XXXV
No. 24

NEW YORK, DECEMBER 14, 1916

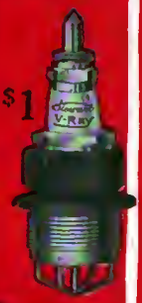
Ten cents a copy
Three dollars a year

Editorial Contents, Page 3

Advertisers' Index—Next to last page

Stewart Products

Stewart Speedometer
$25



$1
Stewart V-Ray Spark-Plug

No Profitless Days with Stewart Products

Dealers sell Stewart Products every day, every week, every month in the year.

Each season is a Stewart Products season. That is one reason why Stewart Products are such a fast-selling and profitable line for dealers.

Stewart Products have a big sale in Winter, Spring, Summer and Fall—they are needed and used all the year 'round.

There is the Stewart Tire Pump, needed in the Summer, but an absolute necessity in Winter. When ice and snow cover the ground—when it is bitterly cold—there is no task so unpleasant as to get out and hand-pump a tire. A Stewart Tire Pump will do the work quickly while the motorist sits in the car, out of the cold. It's easy to imagine the comfort and convenience a Stewart Tire Pump gives.

The same is true of all Stewart Products—each one is a Winter necessity.

"It will pay you to see that every car is equipped Stewart."

STEWART-WARNER SPEEDOMETER CORPORATION
CHICAGO, U. S. A.

$6
Stewart Motor Driven Warning Signals

$50
Warner Auto-Meter

Stewart PRODUCTS
PRESTIGE QUALITY SERVICE SATISFACTION
USA

Stewart Vacuum System
$10

$12
Stewart Tire Pump

$3.50
Stewart Hand Operated Warning Signal

$10
Stewart Speedometer for Fords

The Automobile

Vol. XXXV New York—Thursday, December 14, 1916—Chicago No. 24

Ajax to Purchase Racine Co.

Will Ratify Deal on Dec. 26—Ajax Increases Capital to $10,000,000

New York, Dec. 12—The Ajax Rubber Co., Inc., of tbis city and witb a factory in Trenton, N. J., has arranged for the purchase of tbe Racine Rubber Co., Racine, Wis., and bas called a meeting of its stockbolders for Tuesday, Dec. 26, at wbich the purchase of the Racine Co. will be ratified. It is understood that tbis purchase will not cbange tbe present status of tbe Racine Co., wbicb manufactures Racine and Horsesboe brand tires. The purcbase of the Racine company is in exchange for sbares of tbe captital stock of the Ajax organization.

New Capitalization

As a part of this purchase the Ajax company bas increased its capital stock from $5,000,000 to $10,000,000. Up to tbe present tbere bas been 100,000 shares of capital stock with a par value of $50, but under the new arrangement there will be 200,000 shares at the same par value. Tbe entire stock is common and there are no bonds. As a result of tbe deal and the rumors of it Ajax stock rose on the New York Stock Exchange from $70 to $90 in the past 10 days. Tbe company bas been paying 10 per cent dividends.

Rapid Development

During the past year Ajax has developed very rapidly, increasing its daily output from 2000 casings to 5000. There bas been a similar increase in the manufacture of tubes. During the year a new factory building, 550 by 350 ft. and tbree stories in height, has been occupied. In addition other warehouses have been built. During the year the number of dealers handling Ajax tires has been increased from 4000 to 6000. In addition seven new branch houses bave been opened, bringing the total to 23.

The Racine Rubber Co. has sold its output to approximately fifty to sixty jobbing accounts in contrast with the Ajax distribution through 6000 dealers. In tbis respect the lines complement each other and the present policy of distributing tbe Racine product through jobbers will be continued. The volume of business of the two concerns is approximately tbe same.

—

Cadillac Prices $160 Higher

Detroit, Dec. 11—The Cadillac Motor Car Co. will raise prices on all models $160, effective midnight Dec. 14. All cars shipped after tbat time will be charged at the new prices witb the following exceptions subject to prior sale. It will furnish at present prices cars of each body style to customers' signed unfilled contracts in tbe possession of the dealers on Dec. 14.

—

Increase Mack Truck Prices

New York, Dec. 8—The International Motor Co., this city, will advance its list prices on the Mack truck Jan. 1, as follows: 1-ton, $2,000 to $2,150; 1½-ton, $2,350 to $2,500; 2-ton, $2,700 to $2,800; 3½-ton, $3,400 to $3,650; 5½-ton, $4,000 to $4,250, and 7½-ton, $4,500 to $4,600.

—

Austin Increases Prices

Grand Rapids, Mich., Dec. 11—Tbe Austin Automobile Co., has increased the prices on its different 1917 models as follows: The two and four-passenger roadster from $3,150 to $3,750; the five- and six-passenger touring car from $3,400 to $3,750, and the seven-passenger touring car from $3,400 to $3,750; the coupé from $3,950 to $4,550; tbe sedan from $4,350 to $4,950, and the limousine from $4,650 to $5,250.

Analyzes After-War Conditions

Report of Federal Trade Commission Manifests Confidence for Future

Washington, Dec. 12—What will trade conditions be after the war is one subject handled in the long-looked-for recommendations from the Federal Trade Commission which deal with problems that will confront the United States, especially exporters, when bostility ceases. This report is a comprehensive review covering years of foreign trade conditions.

With regard to meeting European trade, the three important considerations involved are:

First—The presence of concerted action among the foreign competitors of American exporters.

Second—The probable effect of similar action by American manufacturers in foreign trade, including its possible disadvantages to domestic consumers and smaller competitors.

Third—The effect of the present laws of this country upon such co-operation on the part of American manufacturers.

Co-operation Advantageous

"The commission believes," says the report, "that the advantages to be gained by effective co-operation in foreign markets need not entail any sacrifice of the firmly established policy of this country in regard to the maintenance of fair competitive conditions and the prohibition of monopolistic control within the United States. At the same time, co-operation for export trade will enable the exporting manufacturer to realize an increased return for his products along with decreased costs through larger scale production, and the country

(*Continued on page* 1000)

Newby Resigns from National

Had Directed Company's Affairs for 16 Years—Dickson Succeeds Him

INDIANAPOLIS, Dec. 10—Arthur C. Newby, founder and for 16 years president of the National Motor Car and Vehicle Corp., has relinquished the presidency of the company to his chief assistant and general manager, G. M. Dickson. Mr. Newby has not been in the best of health lately and his retirement has been expected. He continues, however, to be the largest individual National stockholder.

A pioneer in the automobile field, having been with the National Electric Car Co., back in 1888, and 2 years later forming the National Gasoline Engine company, he has naturally been an enthusiast in the industry's activities. He was a leader in the early days of racing, being a staunch advocate of stock car racing. His cars were usually among the leaders, if not winning.

Recent connection made with the substantial new interests in the affairs of the National company, were the means of greatly increasing the size and production of the factory. With the company on the enlarged basis Mr. Newby proposed that Mr. Dickson be made president.

Mr. Dickson is not a newcomer to the automobile field, being associated with Mr. Newby at the National plant for 15 years.

With the change of titles the new officers are the same individuals who have assisted in the management of the factory for the past 10 years. They are: G. M. Dickson, president and general manager; W. Guy Wall, vice-president and chief engineer; and M. E. Elstum, secretary and treasurer.

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Precision Die Casting Merges Two Companies

SYRACUSE, N. Y., Dec. 9—The entire business of the Van Wagner Die Casting Corp., formerly the E. B. Van Wagner Mfg. Co., and the Precision Die Casting Co. has been purchased from Charles Van Wagner and the two companies will be merged into the Precision Die Casting Co., with a capital of $315,000.

Alterations and extensions to the factories have already been undertaken and more capital provided to take care of increased business.

The officers and directors of the new company include: President, T. G. Meachem, vice-president and general manager of the New Process Gear Corp.; vice-president, J. W. Knapp, treasurer of the Van Wagner Die Carting Corp.; treasurer, H. S. Tenney, secretary of the Syracuse Trust Co., and secretary, E. J. Quintal, of the accounting firm of Farrell, Sehl & Quintal. The above officers and the following include the directors: A. P. Bellinger, of the Solvay Process Co.; G. W. Bowen, of the G. W. Bowen Mfg. Co., Auburn, N. Y., and W. A. Ball, of the Semet Solvay Co.

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Gauvreau Joins Buick

DETROIT, Dec. 9—Victor Gauvreau has resigned as chief engineer of the Frontenac Motor Co. to join the Buick Motor Co., Flint, Mich.

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Weed Chain Maker Plans Capital Increase of $6,000,000

NEW YORK, Dec. 13—Stockholders of the American Chain Co., maker of the Weed chains, have been notified that a meeting will be held on Dec. 22 for the purpose of voting on an increase of capital from $4,000,000 to $10,000,000 by increasing the preferred from 20,000 shares, par $100, to 50,000 shares, par $100, and by increasing the common from 20,000 shares, par $100, to 50,000 shares, par $100. Each share of additional preferred will be entitled to the same preference and priority over the common as the preferred now issued and outstanding.

—

American Chain Takes Standard

YORK, Pa., Dec. 12.—The Standard Chain Co., operating nine large plants throughout the country, passed into the hands of the American Chain Co., with the sale of its interests to the latter and the resignation of J. C. Schmidt, York, Pa., the president of the Standard Chain Co. for the past 17 years, this week. The products of the Standard company include at least 1500 varieties, sizes, styles and types of chain, with automobile chain and automobile forgings.

Besides the two plants in York the company had been operating chain plants at Braddock, Allegheny county; rolling mill and Hayden chain plant at Columbus, O.; and one plant in each of the following cities: Carlisle, Pa., Mansfield and St. Mary's, Ohio, and Marion, Ind. The company employs approximately 1700 hands, of these 1000 being employed in the two York plants.

Arthur C. Newby, founder and president of the National company for the last 16 years

Bans Newspaper Publicity

P. O. Points Out It Violates Rule Against Advertising as News Matter

WASHINGTON, D. C., Dec. 12—Automobile publicity which has been carried in daily papers has come under the finger of the third assistant postmaster general, who has notified several daily papers that this publicity is in violation of the act of Aug. 24, 1912, which forbids the running of statements which are properly advertising matter and not news. Large daily papers in many cities have received letters from the third assistant postmaster general drawing attention specifically to items published which are properly advertising information. The department expects to report later on the result of its investigations. The article in question appearing in the daily papers cover a variety of subjects, some refer to the opening of new agencies, others to the photographs of new cars, others to comments on winning contests and others on various subjects. The presumption is that many daily papers have been accepting reading notices from concerns placing advertising, it being stated that the reading notice is a verbal part of the advertising agreement. This situation has come to the attention of the third assistant postmaster general with the results as stated.

There are various suggestions as to how the matter reached official circles in Washington. It has been stated that paper manufacturers displeased with the complaints of publishers have intimated that if the daily press cut out the free readers there would be room for plenty of news that is at present kept out. Those large daily papers which have strongly and consistently opposed this method of publicity are naturally gratified at the present investigation.

In a Friendly Spirit

Third Assistant Postmaster General, W. M. Dockery, discussing with a representative of THE AUTOMOBILE the movement, said he was taking this step in the friendliest possible spirit as toward the newspapers of the country, and he felt and believed it would be only necessary for him to call the attention of publishers to the law which forbids such a practice, to bring about a cessation of this form of activity.

"While it is hard to draw the line of demarcation between a newspaper article discussing certain facts in connection with the performance of a suggested make of an automobile, which article might not constitute an advertisement,

(*Continued on page* 1001)

To Facilitate Argentine Shipments

Mercantile Corp. Formed for Co-operative Trade in Non-Competing Lines

NEW YORK, Dec. 13—The Argentine Mercantile Corp., an organization for the purpose of co-operative trade in non-competing lines, has been started in this city for the purpose of making trade with Argentina easier to handle. Fifty to sixty different U. S. A. manufacturers in varied lines, none connected with the automobile industry, are reported to have met last week for preliminary organization work and will meet later this week to complete organization plans and elect officers.

The plan of this corporation consists in maintaining in the city of Buenos Aires a permanent exhibition of samples of all goods manufactured by those who are members of the corporation. This exhibit of samples will be in charge of salesmen and in addition there will be a force of salesmen traveling through the Argentine Republic in the interest of those belonging to the corporation.

To facilitate shipping of goods, exchange, collections, etc., the Argentine Mercantile Corp. contemplates maintaining a shipping department at the Bush Terminal, New York City, where 3700 sq. ft. of shipping space will be maintained and a clerical shipping force engaged. It will only be necessary for members to consign their merchandise to this office, after which all matters of crating, engaging accommodation, marine insurance, etc., will be handled by the corporation.

In the matter of payments, it is expected that members will be paid for their merchandise when delivered at the Bush Terminal and that the corporation will handle the entire work of collections in South America, banking accommodations, exchange, etc.

According to the present plans, which are very incomplete, each member of the corporation will place samples in the Buenos Aires exhibit, and that the rent for such exhibit building, overhead, and other charges will be paid for by the members according to the exhibit space they occupy. It is planned to place one salesman over each particular line of merchandise, such as agricultural machinery, or automobile accessories, or hardware lines, etc. Only one make of automobile or one make of motor truck would be handled.

The organization of the Argentine Mercantile Corp. has not progressed sufficiently to state what membership initiation fees, and annual dues will be charged. The corporation has been organized for the purpose of profit and dividends will be declared in some manner to those participating. It is expected that manufacturers will sell goods to the corporation at their export prices. It is planned to place the organization in the control of thirty-one directors, fifteen of whom have already been named.

The organization is being fostered by one William Hill Hunt. Mr. Hunt says he has spent some time during the past year in Argentina collecting information on those lines of goods which have sold best in the republic.

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Joy Leaves Packard — Dividend Increase

DETROIT, Dec. 14—H. B. Joy has resigned as chairman of the board of directors of the Packard Motor Car Co. because of other interests. At its meeting here yesterday the board of directors increased the dividend on the stock from 7 to 8 per cent yearly payable as 2 per cent quarterly. The next payment is January.

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Pfeffer and Brinegar Go to Cuba

DETROIT, Dec. 12—C. A. Pfeffer, who recently resigned as vice-president and assistant general manager of the Chalmers Motor Corp., and E. P. Brinegar, the man credited largely for the organization of the old E. R. Thomas Detroit Co., sailed from New York City last Saturday for a pleasure trip through Cuba.

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Holmes Building Own Car

SYRACUSE, N. Y., Dec. 12—Arthur Holmes, formerly sales manager of the H. H. Franklin Mfg. Co., this city, has started a company of his own in this city for the purpose of manufacturing automobiles.

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Chalmers to Retire from D. A. C. Presidency

DETROIT, Dec. 8—Hugh Chalmers has announced that he will retire permanently from the presidency of the Detroit Athletic Club, of which he has been the head for the past four terms. Coupled with his announcement Mr. Chalmers has presented the club with Herman Richir's painting "The Red Shawl," which he acquired following its exhibition in the Belgian section of the Panama-Pacific Exposition.

Mr. Chalmers has been the only president the club has had since moving to its downtown location.

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Ball & Ball Carbureter on Winton

CLEVELAND, OHIO, Dec. 6—The Winton Co. has adopted the Ball & Ball carbureter, made by the Penberthy Injector Co., as standard equipment.

To Raise Tire Prices 15 to 20%

Increase in Price of Materials and Cost of Manufacture Responsible

NEW YORK, Dec. 9—Leading tire manufacturers are planning to make a substantial advance in automobile tire prices next year. This increase, it is expected, will be between 15 and 20 per cent. Early this year prices were advanced an average of 12½ per cent.

The high cost of the materials used in the manufacture of tires has necessitated this increase. Fabric is now selling at an advance of about 125 per cent over the figure of a year ago. Although crude rubber is not now commanding exorbitant prices, other materials used in tire making are advancing skyward and there is a greater amount of fabric than of rubber in an automobile tire. On an average, the cost of the materials used in tires has risen at least 20 per cent.

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Lansdale Leaves Denby Truck

DETROIT, Dec. 11 —Henry Lansdale has resigned the vice-presidency of the Denby Motor Truck Co. Mr. Lansdale has been the vice-president and general manager for the company since 1915.

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Girl Heads Standard Parts

CLEVELAND, Dec. 8—Christian Girl is president of the Standard Motor Parts Co., the combination of the Standard Welding Co. and the Perfection Spring Co. The Perfection plant will now be known as the spring department and the Stanweld plant as the rim and tube department.

Other officers of the new concern are: F. W. Prentiss, first vice-president; E. W. Farr, second vice-president; T. E. Borton, treasurer. C. C. Bolton and Arnold S. Goss, together with the officers above, will constitute the board of directors. P. A. Connolly is secretary, but not a director.

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Jackson Goes to Europe

DETROIT, Dec. 11 —R. B. Jackson, factory manager for the Olds Motor Works, has gone to Europe to study automobile construction. He will visit London, Paris, Germany and Italy, and will attend the automobile show at Paris besides visiting all factories.

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Bethlehem Truck Ready in February

NEW YORK, Dec. 12—Two truck models of 1¼ and 2 tons' capacity will be marketed about February by the Bethlehem Motors Corp., Allentown, Pa. A new

plant to have a floorspace of 199,000 sq. ft. is being built. The concern has a capital of $6,000,000, made up of $1,000,000 preferred, paid in, and $5,000,000 common. The preferred is all held by the four men who head the concern.

Arthur T. Murray, formerly of the Brady-Murray Motors Corp., local Chandler dealer, heads the concern as president. Associated, besides Allentown and Bethlehem capitalists, with Mr. Murray is W. S. Stevenson, formerly sales manager of the old Mack Bros. Motor Truck Co., who will be sales manager. D. G. Dery, a silk manufacturer, is vice-president.

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Carburetion Subject of Ind. S. A. E. Meeting

INDIANAPOLIS, IND., Dec. 9—The December meeting of the Indiana Section of the Society of Automobile Engineers will be held Dec. 15 in the Assembly Hall of the Claypool Hotel.

The subject of the meeting will be "Carburetion and Manifolding," papers being read by F. C. Mock, chief engineer of the Stromberg Motor Devices Co., and by Professor Berry, professor of experimental engineering, Purdue University.

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582 S. A. E. Banquet Tickets Sold

NEW YORK, Dec. 7—Tickets for the annual banquet of the Society of Automobile Engineers on Jan. 11 at the Hotel Biltmore are being sold fast. To date 582 have been sold out of a total of 750. Every seat, numbering 762, has been taken for the special performance of Ziegfeld's Midnight Follies, which comes as a climax to the dinner.

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S. A. E. to Meet in Detroit

DETROIT, Dec. 11—The Engine and Transmission Division of the Society of Automobile Engineers, and of the Council of the S. A. E. will meet in Detroit on Dec. 14.

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Stetson Motor Car Co. Formed

DOVER, DEL., Dec. 7—The Stetson Motor Car Co., with a capital of $1,000,000, has been incorporated to manufacture automobiles and appliances. The incorporators are P. A. Zizelman, W. Hanford and C. W. Van Ranst, all of New York.

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Troy Trailer Sales Co. Formed

TROY, OHIO, Dec. 11—The Troy Trailer Sales Co. has been incorporated under the laws of Ohio by C. A. Geiger, C. N. Peters, G. R. Harris, R. C. Sykes and H. H. Tamplin. The Troy Wagon Works Co. will henceforth market its trailers under the name of the Troy Trailer Sales Co.

New Engine-Testing Method

Prof. Roesch, of Armour Institute, Describes His System Before Mid-West S.A.E.

CHICAGO, Dec. 9—A method of testing automobile engines and of charting the results of these tests in such a manner that a great deal more information becomes available than has been possible in present methods of testing has been developed by Prof. Daniel Roesch, associate professor of gas engineering Armour Institute of Technology. It is Prof. Roesch's contention that the present method shows the performance only under wide-open throttle conditions, a condition not often maintained in use, and that one engine showing superior merits to another under the usual test conditions might not be so good when tested under properly open-throttle conditions, at which most automobile engines are usually operated. His method involves, of course, tests made in the conventional way at various speeds with wide-open throttle and corresponding one at other throttle positions, thus giving power, gasoline consumption, heat losses, effect of spark advance, etc., under all conditions as driving. Prof. Roesch explained his method of conducting tests and outlined the results obtained and what was to be deduced from them in his paper presented at the quarterly meeting of the Mid-West section last night. This meeting was held at the Armour Institute of Technology, Chicago, and after the presentation of the paper and its discussion the speaker conducted the seventy-five engineers and motorists present to the testing laboratory of the institution and actually ran a partial test, according to his new method, on a twelve-cylinder Packard engine.

In the discussion G. A. Smith, of the Nash Motors Co., brought out the fact that the results of Roesch's tests showed the great advantage from economy standpoint of operating the engine at a certain definite speed and that it was one of the reasons for the better economy of European engines that more gear changing was done.

In reply to his question whether all the curves shown were the result of tests and whether all were made on the same carbureter setting, Mr. Roesch explained that the carbureter setting must he maintained constant.

Engineer Mock, of the Stromberg company, suggested that Roesch's method of testing could be used to co-ordinate curves of engine and car performance by using the deceleration test for car performance, and that he had witnessed car tests on the road which showed the practical value of Roesch's charts. He pointed out that chart No. 7 showed the economy of gearing the car low. He said he had witnessed an increase in economy of from 18 miles per gallon to 30 m.p.g. by gearing the car as a truck is geared and shifting as necessary. He felt the spark advance should be susceptible to control according to the throttle opening.

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Buffalo Section S. A. E. Formed

BUFFALO, Dec. 13—*Special to* THE AUTOMOBILE—The Buffalo section of the Society of Automobile Engineers was enthusiastically formed here to-night at the Buffalo Engineering Society meeting, 150 being in attendance. The governing committee of the new section is: Chairman, David Fergusson, chief engineer pleasure car department Pierce-Arrow Motor Car Corp.; vice-chairman, C. M. Manly, vice-president and chief engineer Manly Drive Co.; secretary, D. W. Sowers, president and engineer Sowers Mfg. Co.; treasurer, John Younger, chief engineer motor truck department Pierce-Arrow Motor Car Corp. and chairman of membership committee, H. T. Parrock, manager Lumen Bearing Co.

Russell Huff, president of the S. A. E., Coker Clarkson, secretary and general manager, and A. Ludlow Clayden, chairman of the standards committee, spoke on the general advantages of the society, President Huff stating that within 4 weeks the society will have a membership of 2600, the Detroit section now having over 650.

The paper by A. P. Brush on the four-cylinder engine, appearing on pages 1006 and 1007 of this issue, provoked considerable discussion, seeming to fall in with the views of those present.

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Re-organization of Ross

DETROIT, Dec. 12—It is reported that C. G. McCutcheon will resign his presidency of the Ross Automobile Co. to take effect Jan. 1, and that a number of New York capitalists will re-finance the concern to the extent of $500,000.

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Muir Heads Maxwell Advertising

DETROIT, Dec. 12—Gordon Muir has been appointed advertising manager of the Maxwell Motor Co., Inc. Mr. Muir has been with the Maxwell company for the past year.

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Weed Hal Advertising Manager

DETROIT, Dec. 11—J. C. Weed has been appointed advertising manager of the Hal Motor Car Co. of Cleveland.

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Lloyd Is Cassidy Advertising Manager

NEW YORK, Dec. 11—L. M. Lloyd has become advertising manager for the Edward A. Cassidy Co., this city. The Cassidy company handles the national sales of many automobile accessories.

Makers Arrange Banquet Program

White Toastmaster—Speakers Include Leland, Coffin and Clarkson

DETROIT, Dec. 12—A reception committee has arranged a program for the Manufacturers' Banquet to be given by the Society of Automobile Engineers on Dec. 14. The committee is composed of D. McCall White, chairman, and chief engineer of the Cadillac Motor Car Co.; B. G. Koether, general sales manager of the Hyatt Roller Bearing Co.; Russell Huff, chief engineer for Dodge Bros.; W. C. Rands, president of the Motor Products Corp.; K. W. Zimmerschied, chief metallurgist for the General Motors Co.; R. F. Dyer of the Aluminum Castings Co.; J. E. Diamond, engineer for the Aluminum Castings Co.; A. H. Doolittle, sales and advertising manager of the Zenith Carburetor Co.; W. B. Stout, manager the aircraft department of the Packard Motor Car Co.; A. I. Stevens of the N. Z. Graves Corp.; C. L. Nedoma of the Chalmers Motor Co.; L. V. Spencer of E. E. McCrone & Co.; L. B. Fijux, branch manager of the Bijur Motor Lighting Co.; H. A. Brown, sales engineer of the Hyatt Roller Bearing Co.; R. T. Middletown, branch manager for the Steel Products Co.; W. C. Keys, assistant engineer of the Cadillac Motor Car Co.; C. T. Myers, consulting engineer, and O. E. Hunt, chief engineer the carriage division of the Packard Motor Car Co.

The program will be started by a speech from Russell Huff, president of the Society, who will introduce D. McCall White, who will be toastmaster for the occasion. Other speakers will include Coker F. Clarkson, general manager of the S. A. E.; Job Hedges of New York; Captain L. E. Goodier, Jr., of the aviation service; H. M. Leland, president of the Cadillac Motor Car Co., and Howard Coffin, director of the Hudson Motor Co., besides a number of others who are expected to signify their assent shortly.

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Lozier Brothers Co. Announces New Cars and Officers

PHILADELPHIA, Dec. 11—The Lozier Brothers Co., recently formed with a $1,000,000 capital to build a four at $785 and a six at $1,595, announces its officers and directors as follows: H. A. Lozier, president; G. P. Grandfield, vice-president, former first assistant United States postmaster general; H. S. Evans, treasurer, manager of the International Time Recording Co., Philadelphia; P. E. Remington of New York; H. C. Shober, vice-president of the National Bank of Huron, S. D.; F. M. Byrne, Governor of South Dakota; Roswell Davis, president of the First National Bank, Freeport, L. I., N. Y.; Hugh Herndon, New York lawyer; Kern Dodge, consulting engineer, Philadelphia, and a director in the Link-Belt Co., Chicago, and James Levy, Chicago. The four-cylinder car will be featured with a 3⅜ by 5¼ valve-in-head engine, Stromberg carbureter, Remy distributer, thermo-syphon cooling, semi-elliptic springs, 32 by 3½-in. tires, and a 112-in. wheelbase. The six-cylinder model will have a 3½ by 5½ valve-in-head engine, Bosch magneto, 34 by 4½-in. tires, and a 127-in. wheelbase.

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General Engineering Directorate Completed

DETROIT, Dec. 8—At a meeting of the stockholders of the General Engineering Co., this week, the organization of the directorate was completed. The members of the board include Abner Doble, J. H. French, M. J. Hammers, C. L. Lewis, A. W. Russel and W. F. Trant. Officers elected were C. L. Lewis, president; Abner Doble, vice-president, and M. J. Hammers, secretary and treasurer.

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Bucyrus Rubber Elects Directors

BUCYRUS, OHIO, Dec. 7—The following directors were elected at the annual meeting of the Bucyrus Rubber Co., this city: W. A. Blicke, Jacob Coulter, P. H. Heater, Philip Browarsky, A. J. Richards, W. J. Schwenck, A. G. Stoltz, H. A. Paxton and George Donnenwirth.

The company is at present employing forty-five men with a daily output of eighty tires.

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$10,000,000 Parts Co. Plans Industrial Town in Los Angeles

LOS ANGELES, Dec. 13—A $10,000,000 parts concern, under the name of the Eisenhuth Motor Co., has been formed and has obtained an option on a 364-acre site at Los Angeles harbor. It proposes erecting a parts and assembly plant, a foundry and factory buildings to construct parts for all makes of automobiles and trucks. It will build everything that enters into automobiles except tires.

J. W. Eisenhuth, president of the company, is a capitalist, formerly of New York and Brooklyn. He states that the project is being financed by eastern capital. Eisenhuth's idea is to surround the factories with an industrial town where living conditions are ideal. He says construction will start next month.

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Monroe Buys Four-Story Factory

PONTIAC, MICH., Dec. 13—The Monroe Motor Co. has purchased the four-story factory formerly owned by the Auto Painting & Trimming Co. This acquisition increases the Monroe company's available floorspace by 100,000 sq. ft.

113,000 Overlands on Contract

Valued at $100,000,000—More Than 4600 Dealers Attend Convention

TOLEDO, Dec. 13—During Monday and Tuesday of this week 29,500 cars valued at $25,000,000 were signed for by Willys-Overland dealers in convention at the factory. This makes a total of 113,000 cars worth $100,000,000 taken by dealers since the opening of the convention, Dec. 4. Over 4600 delegates have arrived at the factory.

The convention will continue until Dec. 23, with fresh groups arriving every other day, and John N. Willys, president of the company, believes that the 3 weeks during which the dealers will be in Toledo will mark the sale of 200,000 cars, with a value of $200,000,000, which means that the company's entire output for 1917 will have been contracted for.

The company is doing everything in its power to make the convention a success from both an industrial and entertaining viewpoint.

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Willys-Overland Increases Wages

TOLEDO, Dec. 9—Wages of the employes of the Willys-Overland Co., will be increased to total $1,250,000 per year. The wages of companies allied with the Overland company have been increased $225,000 per year at the Electric Auto-Lite Co., $350,000 per year at the Morrow Mfg. Co., of Elmira and $100,000 per year at the Morrow Mfg. Co. at Elyria, Ohio. The rates of increase are:

All rates up to and including 30 cents per hr. will be increased 10 per cent.

All rates over 30 cents and including 40 cents per hr. will be increased 7½ per cent.

All rates over 40 cents per hr. will be increased 5 per cent.

All piece work rates will be increased 5 per cent.

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A. O. Smith Raises Wages 10%

MILWAUKEE, Dec. 13—The A. O. Smith Co., this city, has announced a 10 per cent increase in wages for all employees drawing less than $125 per month, effective Dec. 1. This affects approximately 1400 men.

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Heinze Concentrates on Ford Starters

SPRINGFIELD, OHIO, Dec. 12—The John O. Heinze Co., manufacturer of starting and lighting apparatus, is at present confining its entire efforts to the manufacture of Ford starters. The factory has a daily capacity of 100 outfits and

has 280 employees. The company is manufacturing all of the electrical apparatus entering into these, such as manufacturing its own armatures, doing its own winding, and manufacturing its fixtures and regulators. The company incorporated in July a year ago and started production in March of the present year. It was not until last October that the present rate of production was reached.

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Smith Truck Elects Directors

NEW YORK, Dec. 7—The Smith Motor Truck Corp. at its directors' meeting elected the following board of directors: A. D. Smith, E. I. Rosenfeld, A. G. Hanauer, J. M. Hoyt, C. B. Little and Louis Hennock.

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Clodio to Concentrate on Houdaille Shock Absorber

NEW YORK, Dec. 12—Paul V. Clodio, until recently senior partner of the firm of Clodio & Engs, metropolitan distributor for Kissel, has resigned from that firm to form the Houdaille Shock Absorber Co., Inc., at 1737 Broadway, New York. Associated with Mr. Clodio as incorporators are John N. Van Vranken and Edwin Rushmore.

The plan is to exploit more widely the Houdaille patents and Mr. Clodio has found it desirable to confine his efforts more closely to the shock absorber, the American rights to the manufacture of which he has controlled for years.

The Houdaille shock absorber is standard equipment on the Mercer cars for 1916 and 1917 and on the Peugeot, Panhard, Delaunay-Belleville and other prominent foreign cars.

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Star Prepares to Make Tires

AKRON, O., Dec. 11—The Star Rubber Co. is preparing a plant with 100,000 feet of floorspace for extensive manufacturing of tires. The Star company, organized in 1910, has manufactured to a large extent rubber goods for druggists and surgeons, and in 1916 started manufacturing tires in a small way. The company has been recapitalized at $500,000.

L. H. Firey is president and treasurer. He was for 15 years proprietor of the Coates House in Kansas City. R. R. Robinson, vice-president, is vice-president of the Robinson Clay Products Co., Akron. O. L. Weaver, secretary, was for 10 years with Goodyear, 2 years with Willys-Overland, and the last 4 years northeastern Ohio Pierce-Arrow dealer.

Other prominent stockholders include H. B. Manton, president of the Robinson Clay Products Co.; Francis Sieberling, connected with several Akron rubber companies; I. R. Manton, a director of the Robinson Clay Products Co.; J. P. Loomis, president of the Akron Coal Co., and George D. Bates, vice-president of the First-Second National Bank of Akron.

To Confer on Aeronautics

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M. & A. M. and N. A. C. C. Interested—Five New Accessory Members Elected

NEW YORK, Dec. 11—Realizing the important part that aeronautics are destined to play in the future and their close connection with the automobile accessory business, the forthcoming First Pan-American Aeronautic Exposition to be held in Grand Central Palace, New York, Feb. 8 to 15 inclusive, was discussed and acted upon by the executive committee of the M. & A. M. at its monthly meeting in New York, Dec. 8.

Following a talk by Howard E. Coffin, of the Hudson Motor Car Co., and chairman of the Pan-American Aeronautic Exposition, who thoroughly explained the objects of the aeronautical exhibition and aeronautics in general, it was voted to appoint a committee of three to confer with similar committees from the National Automobile Chamber of Commerce, the Aero Club of America, the Pan-American Aeronautic Federation and the American Society of Aeronautic Engineers, at which time the matter of officially approving the aeronautical show will be discussed. Those who will represent the M. & A. M. include President C. W. Stiger, C. E. Thompson, chairman of the show committee, and William M. Sweet, director.

During the past week the M. & A. M. has been elected to membership in the Chamber of Commerce of the United States of America and President C. W. Stiger was elected as national councillor and Vice-President C. E. Thompson as delegate to represent the accessory association in connection with the Chamber of Commerce.

William M. Sweet, chairman of the banquet committee of the M. & A. M., reported in connection with the forthcoming banquet to be held at the Waldorf-Astoria, Jan. 10, that the sale of tickets had greatly exceeded that of any previous year and that it was expected that the 1917 banquet would be the most successful in the history of the M. & A. M.

Five new members were elected, making a total membership of 263 manufacturers of motors, part and accessories.

The new members are: Automatic Carbureter Co., Chicago; Superior Lamp Mfg. Co., New York; Amalgamated Machinery Corporation, Chicago; Warner & Swasey Co., Cleveland, and the Metal Stamping Co., Long Island City.

Those present at the meeting were C. W. Stiger, president of the Stromberg Motor Devices Co., Chicago; C. E. Thompson, president of the Steel Products Co., Cleveland; E. H. Broadwell, vice-president of the Fisk Rubber Co., Chicopee Falls; Christian Girl, president of the Perfection Spring Co., Cleveland; W. O. Rutherford, general sales manager of the B. F. Goodrich Co., Akron; William M. Sweet, assistant to president of the United Motors Corp., New York; Sidney S. Meyers, counsel of the M. & A. M., and L. M. Bradley, manager.

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Kearns Is Lee Tire Manager

CONSHOHOCKEN, PA., Dec. 8—John Kearns has become general manager of the Lee Rubber & Tire Co. He was the organizer of the British Dunlop Co. of Australia. Mr. Kearns comes from the Fisk Rubber Co., Chicopee Falls, Mass., where he was vice-president.

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Jackson Is Briscoe Comptroller

JACKSON, MICH., Dec. 13—W. V. C. Jackson has been appointed comptroller of the Briscoe Motor Corp. Mr. Jackson was formerly general manager of the motor wheel division of the A. L. Smith Co.

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Kellum with Columbia Motors

DETROIT, Dec. 8—E. F. Kellum has been appointed as purchasing agent for the Columbia Motors Co. Mr. Kellum was formerly associated with the Weston-Mott Co., of Flint. G. J. Martin has been appointed auditor for the Columbia company. Mr. Martin was formerly deputy city comptroller of South Bend, Ind.

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Rahan To Make Ford Starters

DETROIT, MICH., Dec. 12—Electric starters will be made for Ford and other cars by the Rahan Co., which is incorporating Jan. 15 under the laws of Michigan for $100,000.

It is a 12-volt, two-unit system made in straight line form, the generator and motor shafts being co-axial. The patents under which the machine is being made are held by Frank B. Rae, and the principal one is No. 1,153,338 on a transmission mechanism. This is a missing tooth differential operated by a cone which at the apex end terminates in an offset ball connection to the driving shaft and at the base end carries upon its periphery a set of gear teeth, one less in number than the set with which it meshes on the driven side. The device as arranged on the standard unit gives a 30-1 reduction.

The starting motor is series wound and has an over-running ball clutch engagement. It gives 81.6 ft. lb. stalling torque, it is said, with a weight of 42 lb. It is largely made from stampings and die castings. It is regulated by magnetic control. The generator has a charging rate of from 7 to 15 amps., cutting in at 8 m.p.h. The outfit for Fords will sell for $50.

Tanks for U. S. Army

Will Have Two Revolving Turrets, Armored Machine Guns and Motorcycles

WASHINGTON, Dec. 11—Chief of Ordnance of the Army Crozier, in a report just made, declares that the United States Army soon will be equipped with caterpillar tractors similar to those in use in the British army, the so-called "tanks." The report of General Crozier says armored cars, with two revolving turrets, mounted with machine guns; armored machine guns, equipped motorcycles and individual armor for the men of the ranks, also are under consideration.

Along this line the quartermaster general of the army, in a report, shows that $2,175,000 was spent by the army on motor truck equipment alone after the expedition was ordered into Mexico in pursuit of Villa.

The quartermaster general, in testifying before the House military committee, said that the use of trucks for transportation purposes has more than tripled the mobility of troops. He added that had General Pershing only mule trams to use in moving his command he could not have traveled half the distance he did in Mexico.

Col. Chauncey Baker of the Quartermaster's Corps testified that a motor truck made from 60 to 120 miles a day against a possible maximum of eighteen for mule teams. A four-mule team, he added, would eat in 4 days all the fodder it could haul. It was shown by Colonel Baker that the army now has 2600 motor trucks of several satisfactory types, and that the machines show less than 20 per cent depreciation in efficiency, despite the severe tests imposed by the hard service they were put to.

Representative Julius Kahn told the committee he was told by Brig-Gen. Franklin J. Bell that it would be possible to put 50,000 men into Chihuahua City in 2 days by motor truck.

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Indorse 42-In. Head-lamp Law

NEW YORK, Dec. 8—A conference on the head-lamp situation was held at the S. A. E. office here to-day, among those present being A. Reeves, National Automobile Chamber of Commerce; A. G. Batchelder, A. A. A.; Elmer Thompson, Automobile Club of America; C. A. Stewart, Motor Dealers' Association; A. Ludlow Clayden, chairman S. A. E. standards committee, and Alden McMurtrie, consulting engineer, who has made many experiments with automobile lighting. It was agreed that the limitation of head-lamp rays to rise not more than 42 in. above the road at a distance of 75 ft. or more in front of the car was a solution of the difficulty which was desirable. It is easy to make lamps which will conform to and to adjust existing lamps to suit a regulation of this sort. What is required is a much more general spreading of the knowledge of how to focus and set head-lamps. It was remarked that of all instruction books issued by automobile manufacturers, very few indeed gave any instructions for focusing a lamp, although this is almost as important as adjusting a brake. Thus it seems that the chief work of the different bodies representing automobilism will be to educate users of cars, dealers, repairmen and manufacturers into the art of lamp adjustment. The work now being done by the S. A. E. committee in an experimental way will benefit the manufacturer most of all by indicating how to make lamps in the future that will require a minimum of adjustment.

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Win Temporary Injunction Against Ford

DETROIT, Dec. 9—A temporary injunction, restraining Henry Ford and the Ford Motor Co. from the erection of a $12,000,000 blast furnace plant was granted in behalf of John F. and Horace E. Dodge by the Wayne county circuit court in the decision rendered to-day in their suit against Henry Ford. The extensions to the Ford plant, now in process, are not affected by the decision. The judges recommended that the suit come to a hearing on its merits within 60 days.

The suit will come before the court again Dec. 13, when counsel for both sides will appear before Judg Wiest to arrange for carrying out the conclusions of the judges.

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Two Ghent Models for 1917

CHICAGO, Dec. 13—The Ghent Motor Co., Ottawa, Ill., will bring out a four at $750 and an eight at $1,050 in 1917. Both models are touring cars. The four will use an L-head 3¾ by 4¼-in. motor, developing 37 b.hp. Oiling is accomplished by force feed and splash system. It also uses the model R Schebler carbureter with hot air stove and the electrical system is the three-unit Gray & Davis. A 6-volt starting and lighting and manual control ignition system with a 90-amp. hr. storage battery and a motor-driven horn are used. Rear axle is floating and the drive is Hotchkiss. Springs are semi-elliptic, both front and rear. The wheels are Parker hydraulic pressed steel. The body has the center cowl with straight stream line from radiator back. The windshield is set at an angle of 25 deg.

With the exception of the rear axle, which is three-quarter floating, the specifications of the eight are practically the same as the four.

Military Tractor Train Tested

U. S. Government Makes Exhaustive Test in Texas of Caterpillar Type

MARFA, TEX., Dec. 7—The initial test run of the military tractor train recently received here from Peoria, Ill., for use in the Big Bend region of the upper Rio Grande border, has just been finished. The run was made over a rough stretch of country, and is said to have come up to the army requirements in every way. The test was conducted under the direction of Capt. H. A. Hegeman, quartermaster in charge of the motor truck shops at Fort Sam Houston.

The run was made between Marfa and Presidio, a distance of 63 miles, over a desert, rough region where water is scarce. The equipment consisted of a 75-hp. caterpillar tractor and four trailers, each equipped with caterpillar tread instead of wheels. Each trailer had a cargo-carrying capacity of 15 tons.

The trip was made at an average speed of about 2½ m.p.h. over a road that is a road in name only. The train was loaded to full capacity with supplies on its outgoing trip. Captain Hegeman will make a complete report on the trial trip to Col. H. L. Rogers, chief quartermaster of the Southern Department, with headquarters at Fort Sam Houston.

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Anderson Motor Co. Incorporates

ROCK HILL, S. C., Dec. 8—The Anderson Motor Co., this city, maker of the Anderson car, has incorporated with a capital of $1,500,000. The incorporators are J. B. Johnson, J. G. Anderson, T. L. Johnston, J. M. Cherry, Alex Long and J. W. O'Neal, all of this city, and J. A. Carr of Birmingham.

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United Takes Over Fairbanks Hammers

BOSTON, Dec. 9—The United Hammer Co., this city, has purchased the power hammer business of the E. & T. Fairbanks & Co., St. Johnsbury, Vt., which marketed them under the name of Dupont. In 1902 the business was taken over by E. & T. Fairbanks & Co., which has been manufacturing them since.

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Willis Is Hal Vice-President

DETROIT, Dec. 11—F. B. Willis, who recently resigned as sales manager for the Chalmers Motor Corp., has become the vice-president of the Hal Motor Co., of Cleveland. Mr. Willis will be in charge of the sales, service and advertising and in addition will be assistant to the president of the company.

South Is Buying More Cars

States There in Sound Financial Condition—Good Roads Promote Sales

ATLANTA, GA., Dec. 7—The South is buying more automobiles this year than in any time in its history. A comparison of automobiles shipped this year reveals an increase of nearly one-half over that of last year. The sounder financial condition of the Southern States is largely responsible for the increased shipments.

Twenty cent cotton has done much toward filling the coffers of the South. This condition holds with especial force for the planters in Georgia, Alabama, and Texas. But turpentine as much as cotton is cutting a figure in southern incomes. The discovery of the use of resins in the production of synthetic leathers and harder products like Bakelite has boomed the turpentine industry. Old stills that have been abandoned for years have reopened, and both owners and commission men find themselves buyers of automobiles.

In other parts of the South, diversified farming is demonstrating its profitableness. Grain crops and stock at new price levels are adding materially to farm revenues. This fact holds true particularly in Texas, where many of the smaller landholders in the last 2 years have become prospects for medium-priced automobiles.

Kokomo Rubber Refinanced

NEW YORK, Dec. 11—The Kokomo Rubber Co., Kokomo, Ind., organized in 1895 with a capital of $200,000, will soon incorporate under the laws of New York under the name of the Kokomo Tire Co. and will have a capital of 100,000 shares of stock of no par value. Fieldsteel & Co., this city, will underwrite 25,000 shares, 25,000 shares will be offered to stockholders and 50,000 will be held in the treasury.

This company, which has been manufacturing bicycle tires extensively, will develope its automobile tire business. It also manufactures automobile tubes. The officers will remain unchanged.

Annual earning, it is stated, will approximate $550,000. The old company has paid out $600,900 in cash dividends and $135,000 in stock dividends.

Decker Buys Universal Car Equipment

DETROIT, Dec. 11—The Decker Auto Top Co. has purchased the Universal Car Equipment Co., this city. The combination continues business as the Universal Car Equipment Co. The new combination is moving into a factory of its own with much larger manufacturing facilities.

Four Wheel Takes Over Utility

CLINTONVILLE, WIS., Dec. 11—The Four Wheel Tractor Co. has taken over the Utility Steel Tractor Co., Antigo, Wis., and will market the Utility tractor with improvements. David S. Stewart, who invented the Utility tractor, has opened an electric theatre in Appleton, Wis.

S. O. Raises Gasoline Prices

CHICAGO, Dec. 8—The Standard Oil Co. of Indiana has advanced the price of gasoline 1 cent a gallon to 16½ cents in all of its territory. In the Kansas City district Standard Oil and the independent companies have advanced prices 1 cent a gallon to 15.8 cents, tank-wagon basis.

Another increase of 1 cent a gal. in gasoline in 10 days has been made in Milwaukee, Wis., by the Standard Oil and independent companies. Current quotations are: 59-deg., 17.6 cents and 16.6 cents, filling station and tank wagon delivery respectively; 62-deg., 21 and 20 cents; 65-deg., 25.5 and 24.5 cents. Los Angeles prices have gone up 1 cent to 20 cents retail. The standard Oil and Union Oil companies are the leaders in the movement and so-called independent producers follow suit. The price of gasoline in Southern California has been raised 9 cents a gal. in the last 14 months.

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Change
Aluminum, lb.	.63	.63	.63	.63	.63	.63	...
Antimony, lb.	.14	.13	.13	.13	.13	.13	— .01
Beams and Channels, 100 lb.	3.37	3.87	...	3.42	3.42	3.42	+ .05
Bessemer Steel, ton	55.00	55.00	55.00	55.00	55.00	55.00	...
Copper, Elec., lb.	.35	.35	.35	.35	.35	.35	...
Copper, Lake, lb.	.35	.35	.35	.35	.35	.35	...
Cottonseed Oil, bbl	12.70	12.84	12.79	12.70	12.64	12.30	— .40
Fish Oil, Menhaden, Brown, gal.	.72	.72	.72	.72	.72	.72	...
Gasoline, Auto, bbl	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.30	1.30	1.30	1.30	1.30	1.30	...
Lead, 100 lb	7.75	7.75	7.85	7.90	7.90	8.00	+ .25
Linseed Oil, gal.	.93	.95	.95	.95	.94	.94	+ .01
Open-Hearth Steel, ton	55.00	55.00	55.00	55.00	55.00	55.00	...
Petroleum, bbl., Kan., crude	1.00	1.00	1.00	1.00	1.00	1.00	...
Petroleum, bbl., Pa., crude	2.75	2.75	2.75	2.75	2.75	2.75	...
Rapeseed Oil, refined, gal.	.98	.98	.98	.98	.98	.98	...
Rubber, Fine Up-River, Para, lb.	.79	.79	.79	.80	.80	.81	+ .02
Rubber, Ceylon, First Latex, lb.	.76½	.78	.84	.82	.84	.83	+ .06½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	44.50	44.00	43.75	43.50	43.50	43.25	—1.25
Tire Scrap, lb.	.06¼	.06¼	.06¼	.06¼	.06¼	.06¼	...

Rubber Prices Are Higher

Para Reaches 98 Cents a Lb. and Ceylon 81 Cents—Crude Oil Quoting High

NEW YORK, Dec. 12—Rubber prices featured this week's activities in the automobile materials market. Prices fluctuated and closed yesterday higher. Para rose 2 cents a lb. to 81 and Ceylon rose to 83 cents a lb., a net gain of 6½ cents. Shipments have not been regular of late with the consequent rise. Lead prices went up 25 cents a 100 lb. to $8.00. Linseed oil rose 1 cent to 94. Tin dropped $1.25 per 100 lb. to $43.25.

The advance in rubber is attributed to several causes. The chief one is said to be the great delay experienced in ocean transportation between the Far East and London. Formerly, under normal conditions, a shipment of rubber could be brought from London in 45 days. Under present conditions it is not unusual for a cargo to be in transit for 3 months. There has been great delay also between London and New York. Against a voyage of seven days, often twenty-five days have been required in recent months.

In spite of an increased production of plantation rubber, these conditions have enabled speculators in London, and to some extent in this city, to bid up prices without buying very much of the product. Stocks in London are not large, but consumers in this country are said to be fairly well supplied.

It is estimated that the yield of plantation rubber for 1916 will be 160,000 tons, against 107,000 tons in 1915.

Crude oil prices are at present the highest in twenty years. The new production is small in volume, and the cost of drilling the wells is quite heavy. Pennsylvania crude oil is quoting at $2.75 per barrel. The previous record price was in 1895, when it was quoted at $2.60 a barrel. Indications point to $3 a barrel shortly.

Continental Asks for Stock Issue

DETROIT, Dec. 11—Stockholders of the Continental Motors Co. will be asked by the board of directors to approve a plan by which $15,000,000 common stock and $3,500,000 preferred will be issued. Each common stockholder will receive three shares for each share now held and $5 cash.

It is stated by the company that the purpose of the plan is to provide sufficient working capital to meet the needs of the concern. In addition, $1,000,000 funded debt will be paid off. The outstanding preferred stock of the company will be retired or exchanged for

new preferred stock. There is $472,300 preferred outstanding.

In their letters to the stockholders the company directors state that they have refused offers for control of the capital stock of the company. The plan, they say, has been approved by stockholders having 80 per cent of the stock. The directors have placed their stock with the Security Trust Co., which will act as depository, and ask that other stockholders do likewise.

Under the plan, a new committee will be formed under the supervision of a committee composed of B. F. Tobin, R. W. Judson, H. J. Warner and A. H. Zimmerman. The new stock issue will be handled by William P. Bonright & Co. and Lee, Higginson & Co. It is stated that the common stock taken by the bankers will be held for investment and will not be offered to the public.

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Dividends Declared

Willys-Overland Co., regular quarterly of 1¾ per cent on preferred, payable Jan. 2 to stock of record Dec. 20.

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E. & J. to Pay Dividend

DETROIT, Dec. 12—The Edmunds & Jones Corp. will pay its third dividend on Dec. 20, amounting to 1¾ per cent on the preferred stock and $1 per share on the common stock, according to a statement by G. D. Edmunds, president.

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Pierce-Arrow Pfd. on 8% Basis

NEW YORK, Dec. 13—The Pierce-Arrow Motor Car Corp., Buffalo, has declared an initial dividend of 2 per cent, putting the stock on an 8 per cent per annum basis. This dividend will be payable Jan. 2 on stock held from Dec. 6 to Dec. 31, inclusive. Quarterly dividend payments will be made in January, April, July and October.

Securities Drop on Peace News

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Chevrolet Drops 20 Points—United Motors 2 Points Lower —Market Weak

NEW YORK, Dec. 13—News of Germany's peace proposals was the cause of the widest break in stocks in the last 2 years. Heavy selling on the part of professionals was followed by liquidating orders from the commission houses. This selling movement continued until noon, when more than 1,000,000 shares had changed hands. After the second wave of selling, both on the Stock Exchange and the Curb, had receded, motor issues were found to have suffered badly.

Chevrolet was the largest loser with a drop of 20 points, General Motors dropped 7 points, and United Motors dropped 2 points. Stutz went down to 63, National dropped 2 points to 36, and Springfield Body common had a similar drop to 85.

Before the German news had been published, that is, for the week ending Saturday, automobile stocks were fairly active and higher. Ajax Rubber featured the market with a gain of 16½ points on the strength of the deal with the Racine Rubber Co., which is planned to be taken over by it. Ajax Rubber is now quoting at 86½. Stewart-Warner stock will be listed on the Stock Exchange.

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Hayes Capital Now $1,500,000

DETROIT, Dec. 13—The Hayes Mfg. Co., body builder, this city, is increasing its capital to $1,500,000. The present capital consists of $500,000 in common, $135,000 preferred, and $60,000 in bonds. The company has a surplus of $440,000 for this year. A part of the increase in capital is a 75 per cent stock dividend, $625,000 worth of stock being issued in all. Earnings for the 5 months of the current year are $114,000.

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Harrison Radiator Granted Charter

ALBANY, N. Y., Dec. 8—The Harrison Radiator Corp., Lockport, N. Y., has been granted a charter to manufacture radiators, parts and accessories. It is capitalized with 20,000 shares, half of no par value. It will carry on business with $1,050,000. The directors are Beononi Lockwood, F. A. Gaynor and R. G. Coad. This company was recently taken over by the United Motors Corp.

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Phelps Capital to Be $400,000

COLUMBUS, OHIO, Dec. 9—The capital stock of the Phelps Mfg. Co. will be increased from $100,000 to $400,000 in the near future. The company is manufacturing wire wheels for automobiles.

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Paige-Detroit Issues $1,000,000 Preferred Stock

NEW YORK, Dec. 8—The Paige-Detroit Motor Car Co., Detroit, has issued, through Chandler & Co., this city, $1,000,000 of 7 per cent cumulative preferred stock, par value $10 a share. The amount authorized is $1,500,000. The Paige-Detroit company also has $2,000,000 of common, par value $10, of which $1,500,000 has been issued.

The preferred stock will be redeemed at par and accrued dividends at the rate of $100,000 annually, beginning with Jan. 1, 1918, and ending with Jan. 1, 1927.

For the 13 months ended Dec. 31, 1916, the net income available for dividends was $609,755; for the 10 months ended Oct. 31, 1916, $964,442. Ten months'

Automobile Securities Quotations on the New York Stock Exchange

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co.	86½	86½	+16½
J. I. Case T. M. Co. pfd	86¼	89½	— ¼
Chalmers Motor Co. com	135	..	..
Chalmers Motor Co. pfd	105	115	—5
*Chandler Motor Car Co	110	112	—1
Chevrolet Motor Co	170	180	+5
Fisher Body Corp.	38	41	..
Fisk Rubber Co. com	70	80	—10
Fisk Rubber Co. 1st pfd	100	110	—10
Fisk Rubber Co. 2d pfd	90	100	..
Firestone Tire & Rubber Co. com	150	152	—12
Firestone Tire & Rubber Co. pfd	106½	107½	— ½
*General Motors Co. com	650	800	..
*General Motors Co. pfd	113½	120	—6½
*B. F. Goodrich Co. com	68¼	68⅜	—1¼
*B. F. Goodrich Co. pfd	111	111⅜	..
Goodyear Tire & Rubber Co. com	293	296	..
Goodyear Tire & Rubber Co. pfd	109	109¾	+ ¼
Grant Motor Car Corp	7	9	—1
Hupp Motor Car Corp. com	3½	4½	— ¼
Hupp Motor Car Corp. pfd	80	100	..
International Motor Co. new com	14	18	..
International Motor Co. 1st pfd	60	80	+12
International Motor Co. 2d pfd	30	50	+7
Keystone Tire & Rubber	15¼	15½	— ¼
*Kelly-Springfield Tire Co. com	72¼	73	—2¾
*Kelly-Springfield Tire Co. 1st pfd	95	99½	..
*Lee Rubber & Tire Corp	31¼	32¼	—5¼
*Maxwell Motor Co. com	70⅜	71½	—2⅛
*Maxwell Motor Co. 1st pfd	79⅜	79½	—2⅛
*Maxwell Motor Co. 2d pfd	47	50	—2
Miller Rubber Co. com	253	258	—2
Miller Rubber Co. pfd	106	108	—2
Mitchell Motors	55½	55¾	..
Packard Motor Car Co. com	173	183	—5
Packard Motor Car Co. pfd	101	103	—3
Paige-Detroit Motor Car Co	41½	42½	—2½
Peerless Truck & Motor Corp	21	23	—1
Pierce-Arrow	55¾	55½	..
Portage Rubber Co.	174	..	—7
Regal Motor Car Co. pfd	20	30	..
Reo Motor Car Co	45¾	46¼	— ¼
Saxon Motor Car Corp	76	77	..
A. O. Smith Corp. com	41½	42	..
A. O. Smith Corp. pfd	96½	91	+1
Springfield Body Corp. com	95	105	+10
Springfield Body Corp. pfd	120	130	..
Standard Motor Construction Co	6¾	7	+ ¾
Stewart-Warner Speed. Corp. com	..	..	..
Stewart-Warner Speed. Corp. pfd	..	..	..
*Studebaker Corp. com	108½	110	—1½
*Studebaker Corp. pfd	..	..	..
Stutz Motor	63¼	63½	+ ¼
Swinehart Tire & Rubber Co.	..	88	..
United Motors Corp.	59½	59¾	—1
*U. S. Rubber Co. com	68¾	69	—3
*U. S. Rubber Co. pfd	113	113½	— ½
White Motor Co	53	54	— ¾
*Willys-Overland Co. com	38	38½	+1½
*Willys-Overland Co. pfd	99	99¾	+ ¼

*At close Dec. 11, 1916. Listed New York Stock Exchange.

operations show net earnings of more than thirteen times the annual preferred dividend requirements.

The company's output has increased from 267 cars in 1910 to 12,456 cars for the year 1916 up to Nov. 25.

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McCord $1,000,000 Stock Issue

DETROIT, Dec. 14—McCord Mfg. Co. has authorized an issue of $1,000,000 in 7 per cent cumulative preferred stock, of which $750,000 will be offered at once, and also 75,000 shares of common stock of no par value for immediate issue. The brokers handling the issue are John Burnham & Co. of New York, and E. E. McCrone & Co. of Detroit.

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To List Paige-Detroit on Curb

DETROIT, Dec. 8—Paige-Detroit stock will soon be listed on the New York curb, according to statements made by reliable Detroit sources.

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Rickenbacher Sails for Europe

NEW YORK, Dec. 12—Ed. Rickenbacher, racing driver, sails for Europe Saturday to visit England, France and Italy to purchase two racing cars for next year's campaign in this counrty. He goes as a representative of Wm. Weightman, Kenova, Va., who made his debut in racing by driving a Duesenberg in the Astor Cup Race and later won third place in the recent Vanderbilt Cup Race in a Duesenberg. Rickenbacher expects to take the matter up with the Sunbeam Co. and has been approached by that organization to drive for them next summer. He prefers however to purchase cars outright. It is expected that he will visit Fiat and one or two of the French makers.

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Boston to Have Salon

BOSTON, Dec. 9—Manager C. I. Campbell of the Boston automobile show today leased the ballroom of the Copley Plaza Hotel for the week of the Boston show in March to hold the automobile salon. While the Mechanics' Building exhibit is to open Saturday night, the salon will not open until Monday night. The exhibitors in the salon will be members of the Boston Automobile Dealers' Association. There will be a limit of not more than two cars for each dealer. Another restriction limits the exhibits to limousines, landaulets, coupes, sedans, etc., with the exemption that no open touring car whose price is less than $2,500 will be admitted.

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Two More Show Exhibitors

NEW YORK, Dec. 12—The Craftsman Motor Co., Chicago, will be an exhibitor at both national shows. The Superior Lamp Mfg. Co., New York, has just been given space at the New York show.

Safety First Advocates Education

Punishment of Traffic Violators Censured at 3-Day Session of Association

BALTIMORE, MD., Dec. 7—Education will do more toward reducing accidents than punishing violators of traffic rules. Such was the keynote of the annual convention of the Safety First Federation of America, which opened a three-day session here to-day. With the ever-increasing volume of automobiles on our streets comes a corresponding increase in the traffic chaos of busy thoroughfares and a consequent need for more ease of movement of vehicular traffic and the necessity for extreme care on the part of pedestrians and operators of automobiles and horse-drawn vehicles alike.

Perhaps the one great message that was brought to the convention came with Joseph Sabath, now superior judge of Cook County, Ill., and former head and originator of the speeders' Court in Chicago. Judge Sabath's experience in handling some 20,000 cases in the speeders' court has given him a knowledge of motor traffic such as is possessed by few, if any, other individuals. It is his opinion that the problem confronting a judge in his former position requires something more than a cold administration of the law, the exacting of fines and penalties, the adding of revenue to the city treasury, something that the administration of the law does not reach—the question of guarding human life. "The levying of fines and penalties is insignificant," said Judge Sabath, "compared with the real service a judge in such a court can render the community if he takes the problem seriously and devotes himself to a study of the question and urges such remedies as his experience shows him to be best for all concerned."

In his plea for education as a substitute of penalization, Judge Sabath declared that the man who is fined usually leaves the court room defiant. His penalty is paid and he owes nothing more to society. However, if the judge patiently and earnestly points out to him the seriousness of his offense, because of its danger to society, his better self responds and he becomes a champion of the work the court is doing.

Summing up, Judge Sabath said that no mercy should be shown an intoxicated driver of a car, for he is a real menace, and a prison sentence should be meted out to him. Among other things he advocated as being necessary for greater safety on our streets are the abolishment of glaring headlights, better regulation of motorcycles, licensing of every person driving a car and the establishment of a special court in each city to handle violations of the traffic rules and run along educational lines.

Several speakers at the convention advocated that all vehicles be brought to a full stop a certain number of feet—preferably ten—back of a street car that has stopped to take on or discharge passengers, unless there is a safety zone or the street is sufficiently wide to allow the vehicle to pass and give passengers 8 to 10 ft. of space between the car and the vehicle passing.

Education both of the pedestrian and the vehicle operator in the principles of Safety First was the prevailing thought expressed.

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Studebaker Six Has 122-in. Wheelbase

NEW YORK, Dec. 13—The wheelbase of the 1917 six-cylinder Studebaker is 122 in., and that of the four-cylinder model is 112 in. In the description of these cars published in THE AUTOMOBILE last week the four was incorrectly given as 102 in. and the six as 112.

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Harkness Resigns as Sheepshead President

NEW YORK, Dec. 12—Harry S. Harkness has resigned as president of the Sheepshead Bay Speedway Corp., to take effect at once. No reason is given for his resignation. The speedway made little money this year and Mr. Harkness and other heavy stockholders were obliged to put up much money to cover the heavy expenses.

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Analyzes After-War Conditions

(*Continued from page* 991)

will enjoy greater industrial stability resulting from a broader market."

Laws Must Change Slightly

The present laws, the report says, in many cases as they stand operate to prevent formation of co-operative organizations for export trade. Changes must be made, it says, to relieve the manufacturer of even doubt as to their application in foreign trade organization, but leaving them as at present to protect the domestic consumer against combinations to control prices.

Probably the most important part of the report is that which goes into detail touching the question of legislation under which the American exporter may be protected in his business, once peace is restored abroad.

Several months ago a preliminary report along this line was made by the Trade Commission, and following this action Representative A. Y. Webb, chairman of the House Judiciary Committee, introduced a bill covering the recom-

mendations made by the commission. Mr. Webb said to-day that he is prepared to push his bill at the present session of Congress.

The trade report suggests that unnecessary alarm is being felt by American exporters just at this time because of the fact that high costs of raw materials, increased taxes, probably higher wages, to say nothing of the capital and stocks of material necessary to repair the wastages of war, are expected to delay the full power of European competition until it regains its normal state. But laws to put the American exporter on a footing with his foreign rival by authorization of collective foreign selling agencies are recommended.

In studying the export situation the trade commission, it is declared, has tried to take the problem in its broad, historical aspect, considering the present war as a temporary interlude, the permanent influence of which it is difficult to estimate.

Competition Will Be Sharper

"It is frequently asserted," says the report, "the manufacturers and producers of the belligerent countries will take effective measures to regain their former trade. Such foreign manufacturers and producers may be expected to fully utilize their highly efficient organizations for the promotion and handling of trade beyond their borders, even foregoing profits or taking a very low profit till their costs again become normal and they have re-established their trade. Hence, competition from foreign industrial combinations, aided by foreign ship lines and foreign banks, and backed by foreign governments, may be even sharper than before the war."

Other Countries Considered

The report takes up competitive conditions in most of the countries of the world, devotes a chapter to competition in South America, gives competitive conditions in particular industries, and carries a mass of tables and statistical data concerning trade conditions everywhere.

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Detroit Show Space All Sold

DETROIT, Dec. 8—Every square foot of floor-space for the 1917 Detroit automobile show has been sold. More space is available at the Billy Sunday tabernacle where the coming show will be held, than was at the disposal of the Detroit Automobile Dealers' Assn. last year but demands have been so great that members have been held down on space and non-members have been forced to tak cut allowances in order to partially meet the demand. As it is, there will be many pleasure car dealers and accessory companies who will be unable to display their exhibits.

Battery Service Discussed

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Ind. Service Managers at Meeting—Advocate Co-operation by Garages and Owners

INDIANAPOLIS, IND., Dec. 10—Closer co-operation on the part of garage men and automobile owners with manufacturers as a means of eliminating many storage battery problems as they relate to starting and lighting systems was recommended at the regular monthly meeting of the Indiana Automobile Service Managers' Assn. held here last night. The meeting was attended by about seventy-five persons with members of the Indiana section of the Society of Automobile Engineers as guests.

"The Battery Service Problem" was the subject of a paper read by J. Whyte, service manager of the Prest-O-Lite Co. H. S. Bentley of Cleveland, manager of agents of the Willard Storage Battery Co., read a paper entitled "Proper Care of Batteries on Cars Held in Stock."

The chief topic of discussion among the service managers was the cold weather problems that result from the lack of care of storage batteries, and as a result of this discussion car manufacturers were asked to request their service men, agents, and owners to make the following recommendation for starting cars in cold weather:

> Throw the clutch out—do not keep it in neutral position—while trying to start engines in cold weather. By throwing out your clutch you relieve your starting battery of a heavy load, thereby increasing the efficiency of your starting system.

The service managers expressed the belief that not one motorist out of twenty-five knows of or practises this simple rule which would accomplish much in the elimination of battery and starting system troubles.

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Earle & Boggs Take Buda Motor

NEW YORK, Dec. 12—Earle & Boggs, 1790 Broadway, New York City, manufacturers' representatives carrying a general line of automobile materials, have been appointed representatives of the Buda Co. in the East.

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P. O. Bans Newspaper Publicity

(*Continued from page* 992)

and a similar article which might be an advertisement," said General Dockery. "Cases have been brought to our attention in which these alleged news items, undoubtedly written by the same fellow, have appeared in different publications. Therefore, in view of all the facts, while not saying the newspapers are violating the law, in view of complaints being made we are investigating.

"The construction of this law is very clear, and likewise the evident intention of Congress is very clear. Otherwise, Congress would not have gone so far as to make the violation of it a criminal offense, in addition to the denial of second-class mail privileges to the offenders. This particular feature is a part of the section of the law which calls for the publication, ever so often, of sworn statements as to ownership and circulation. As I said before, I hope the letters I am sending out, together with the possibility that I may have to call some of the offenders before me, will suffice. If not, I am then required by the law to have recourse to the courts, and the procedure would be to refer my complaints, together with the information obtained by me, to the United States District Attorneys in the territories where offenses seem to have been committed."

General Dockery then continued to discuss in an interesting manner his views as to the line of demarcation already referred to. He said, in this connection, that if a news notice and a display advertisement are run at the same time, and the two are apparently connected, the natural presumption would be that the news notice is in effect an advertisement, and if not so marked would be a violation of the law.

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Traffic Men Indorse N. A. C. C. Methods

DETROIT, Dec. 13—Twenty-five traffic managers of leading automobile companies met here yesterday and voted to approve the methods of the National Automobile Chamber of Commerce traffic department for relieving freight congestion.

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Madison Square Garden Sold

NEW YORK, Dec. 11—Madison Square Garden, the cradle of the automobile industry and the scene of exhibitions and spectacles of all descriptions for the last twenty-six years, has been put up on the block. Last week it was sold for $2,000,000 to the New York Life Insurance Co. Lovers of the staid old structure had visions of a modern building in its place, but the insurance company has since expressed its intention of selling it, so there is a slight chance that the building will continue to be for exhibition purposes.

In Madison Square Garden was held the first automobile show of this country. This was in 1900, and for thirteen consecutive years the place was the setting for the local national show. Each time since that rumors claimed the sale of the Garden. When the industry enlarged and more room was needed to harbor the show, a worthy successor to the historic old building was found in the Grand Central Palace.

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Carbureter Demands

THE attitudes of the purchasing agent and the engineer of an automobile factory are typical of the problems the carbureter maker of to-day has to solve. The purchasing agent looks upon the carbureter as a necessary piece of brass which must be bought to make the car complete, but which, like all other equipment, must be bought at the lowest possible figure.

On the other hand, there is the engineer, who knows he has a fine power plant, but must have the best possible carbureter in order to bring out the power of which it is capable. He wants 3 m.p.h. on high. He wants quick starting after a night in a zero-temperature garage. He demands acceleration from 3 to 30 m.p.h. in a city block, and all this at a reasonable economy figure and with a high peak on the power curve.

To meet these standpoints of the purchasing agent and of the engineer offers a problem that does not tempt the faint-hearted. In fact, more than one carbureter maker who believes that he has a good instrument will not even attempt to bid for factory business. Instead these manufacturers go after the retail trade, and more than one are successful.

To be a commercial success, however, the carbureter of to-day is like the rest of the car. It must not only be designed to do its work in the best possible manner, but it must be a commercial proposition which adapts itself to quantity production. It must not have to be hand-filed and lapped after entering the assembly room. It must come through so that the assembly is a matter of course and not a matter of expediency. Every carbureter, in other words, must go through alike and not be hand fitted in the assembly process.

City Exits

THE wider use of the automobile is restricted to-day due to several of our largest cities not having adequate exits and further not having adequate streets leading into the main business centers from residential sections. The first situation, that of insufficient exits, is serious. The automobile has largely changed the face of city life. The man of wealth no longer lives where he was 10 years ago. The street he then lived on is to-day a fashionable business street. His residence is now 15, 20 or 30 miles out. The railroad train is at his service but many prefer the automobile. The use of the automobile for such service will increase, but its increase will largely depend on the street facilities. If an hour or more will be needed to get out of the traffic zone as at present in some cities, then the automobile's use in this respect will be unfortunately restricted. What is needed is a wide street, preferably with double roadways and if possible no trolley crossings. This is impossible in some cities but it is not improbable that there will in the next 10 years be elevated roadways for motor travel leading out of our cities. The automobile is of sufficient importance to-day to demand such. In at least six or seven largest cities the elevated motor road is not only a possibility, but very much of a probability. New York, Chicago, Boston and other cities need such to-day. New York is perhaps the easiest city to get out of in America. On the other hand, Boston and Chicago are among the worst. Wider exits are questions that our makers should give attention to, and they are problems that can be handled better and cheaper to-day than 10 years hence.

A. C. Newby

THE withdrawal of A. C. Newby of the National company from the active management of the company is an opportune time for rendering unto Caesar that which is Caesar's, etc. Mr. Newby, while not one of the most conspicuous figures in the automobile field, has been a good representative of that conservative element in the industry which has served so as a stabilizing influence throughout the varying vicissitudes the industry has passed through. He was one of the pioneers in the field, first with the electric vehicle industry and then with the gasoline type of vehicle. Every manufacturer has admired that stalwart spirit of honesty which has been a part of every word and action of Mr. Newby. In the automobile contest field the same spirit had an inspiring influence and Newby was a force for good in automobile racing at a time when such an influence was highly essential.

Germany After the War

By Edward Allen Langdon*

¶ Germany has all told nearly 300,000 automobiles in use to-day.
¶ Germany is now using approximately 160,000 automobiles in the war—one-half on the Western front, one-fifth on Russian, and the remainder in the Near East.
¶ There will be a demand for 300,000 to 500,000 automobiles in Germany after the war closes.
¶ After the war it will be impossible to market automobiles in Germany unless there are good U. S. A. service stations there.
¶ Germany will buy automobiles as a unit and not as individuals after the war.
¶ Germany will offer a good market for U. S. A. accessories and parts.
¶ Adoption of metric system of measurement will gain headway after the war.

GERMANY, while carrying on a warfare admitted to be highly efficient by her very enemies, is already making extensive preparations for the time when peace shall have been restored. This holds good of every department of national life, industry, finance and trade, as well as agriculture and countless illustrations of this activity could be cited. Instead, the following remarks will be limited to the automobile situation, and particularly to those phases thereof which are of necessity of practical interest to American makers and exporters of automobiles.

160,000 Cars Used by Empire

While the official figures are impossible to obtain, thanks to the intense secrecy which surrounds all data of any direct or indirect military importance, the ideas of people inofficially in touch with the situation indicate that the State, *i.e.*, the Empire, is now using close to 160,000 automobiles. One-half of these are in service at the Western front, one-fifth along the Eastern front between Riga and Lemberg and the remainder along the Rumanian and Saloniki fronts.

Besides, there are now in Government service perhaps 50,000 machines far carrying officials and industrial products in Germany herself, and perhaps the same number is employed for private purposes. In all, there are in Germany between 250,000 and 300,000 motor vehicles, and as these are being used up the supply is being replenished; but there is hardly any increase of the total number, because the automobiles on hand are sufficient for German requirements, and also because the raw materials are more urgently needed in the making of munitions, which industry during the last few months has been pushed more energetically than ever before.

The automobiles, the number of which is practically constant, will however not be considered efficient when the war is over and money once more will have to be reckoned with. For this reason it is safe to predict that after the war two-thirds of the automobiles will be replaced by new ones, and it is understood that this will be done on the following plan. The Government will keep the machines commandeered during the war, to be rebuilt and used, either for public works, or to be sold practically at cost to small agricultural individuals or concerns, so as to facilitate farming. On the other hand, the former owners of these cars will receive a Government subsidy of from 45 to 65 per cent toward the purchase of new automobiles built in Germany along standard lines and approved in their specifications by the Imperial Government. Thus, there will be a sure demand in Germany, immediately after the war, for about 200,000 cars.

Horses Are Scarce

But this is not all. Before the war, horses were still extensively used in German cities as well as in the country. They are now very much decimated and it is doubtful whether raising horses will be favored by the Government, and it must be understood that Government control of all economic affairs is a thing growing in Germany by leaps and bounds. Horses have not only proved vastly inferior to motor equipment, but were also somewhat of a disappointment to the German stomach. Very likely all the energy formerly turned toward raising horses will, after the war, be devoted to cattle breeding, and the millions of working horses will have to be replaced somehow.

A 1,000,000-Car Market

If the war ends within a year, assuming developments somewhat similar to the past, Germany will have a population of 60,000,000 people when peace is made. The Empire will then be a highly industrial country and therefore require ample facilities for transporting passengers and merchandise. If the demand will be for one machine to every sixty of the

*EDITOR'S NOTE—Edward Allen Langdon has for many months been in different parts of Europe studying automobile conditions in those countries. Mr. Langdon is a critical student of conditions. He is making a comprehensive study of trade and all his utterances savor of conservatism.

population, the market will call for a million automobiles, of which Germany will be able to supply, with international conditions restored to normal, from 50 to 70 per cent. There still remains a market for from 300,000 to 500,000 automobiles of simple, strong construction, efficient in operation and moderately priced which could be supplied by American exporters.

Points to Be Considered

Following are the points to be considered by German buyers:

1—*Fuel Economy.*—Efficient operation will be as necessary after the war as it is now. Taxation will be high, there will probably be a general and fairly high tariff, and every cent will count.

2—*Durability.*—Automobiles will be driven by careful, well-taught drivers, of whom there are now hundreds of thousands, thanks to the army training. Nevertheless, each automobile will always be worked to its full capacity, and wherever seven-passenger touring cars or five-ton trucks are bought, they will be expected and called upon to prove their true character every minute of a working day.

3—*Diversity of Fuel.*—It is quite likely that industrial alcohol and benzol will be cheaper than gasoline after the war, as they were already before its outbreak. Other things being equal, motors adapted for such fuels will have a point in their favor over ordinary gasoline motors.

4—*Agricultural Field.*—Many thousand of cars will be required which are of the passenger type, lightly built, of 18 to 24 hp. and adaptable to driving agricultural implements, such as ploughs, hoes, spreaders, etc. These machines will have to be very simple and very strong in construction and it will be necessary to not only give clear demonstrations of their ability to do the work, but to submit doubtless proof of past performances.

5—*Passenger Cars.*—They should be completely equipped, with self starters and electric lighting, high-tension ignition and substantial tires.

6—*Trucks.*—Simplicity of design and strength will be the chief features looked for, but starting and other equipment will count, as many machines will be driven by women who have now assumed a definite position in Germany's industrial life. Electric trucks will find a specially good field in the industrial cities.

Service Absolutely Necessary

7—*Service.*—It will be almost impossible to market an automobile in Germany, unless there is a service station including a complete stock of repair parts within the Empire.

It is now almost certain that Germany will buy abroad, and perhaps also from importers in the Empire, as one corporation, with the double advantage of eliminating competition among bidders and also of enormously reducing overhead expense. This does not mean, however, that trading with Germany will not be profitable; only, it will be necessary for American business men to meet efficiency with efficiency. In other words, if Germany's automobile industry and the users of automobiles in Germany will face the world market as a solid financial unit, Americans will have to adopt the same policy, at least in dealing with Germany.

Co-operation Favored

The German Empire does not know the reactionary unscientific legislation against progressive concentration in business and rather favors than hampers it. Therefore, American automobile dealers in Germany can quite well work together, conducting a permanent automobile exhibit in Berlin, Frankfort-on-Main, Leipzig and one or two more of the most important centers, using corporate advertising and letting their salesmen work hand in hand, distributing the products of all the companies to best advantage.

As has been said, taxation and duty will be high in Germany after the war, and only very efficient management will be able to successfully combat these handicaps. Duty on chassis and cars will most likely be higher than on automobile parts, and here the opportunity for the parts manufacturer begins. Motors, axles, steering and transmission gears, which America can easily supply, and which would come up to Germany's demand both in regard to quality and quantity, should find a ready and highly profitable market in the German Empire.

The same holds true of certain classes of equipment, especially electric starting and lighting sets. There is less opportunity for makers of speedometers and particularly delicate instruments, as the class of labor required for such manufactures is specially cheap in Germany.

Look to U. S. A. Industry

To some people consideration of all these points may seem premature, but if Germany who is at war considers them of sufficient importance to give them at least initial attention, American manufacturers ought not to overlook their possibilities. In fact, when the magnitude of this field is considered and that the business to be done is bound to amount to hundreds of millions, it is not surprising that Germans engaged in the automobile business are expecting the American industry to take well-organized steps toward capturing the lion's share of this business.

If the U. S. A. automobile industry, as a body, should approach the German government, it would in all likelihood succeed in obtaining for the buyers of U. S. A. cars, if not the same, then at least part of the subsidy extended to purchasers of native cars conforming with Government specifications. Perhaps, if the Government should feel unwilling to take such a course, an agreement could be obtained for a short term, say 2 to 5 years.

Getting a Foothold

Even if the market for American cars should be made more difficult after such an introductory period, many users would thereafter stick to the American product if it gave them satisfaction. This point, of getting a foothold in Germany immediately after the war, is the more important, as interests across the Channel will hardly be sentimental enough to sidestep profitable business with Germany, and as the very machine tools now making munitions against the Empire will then be used for making other, and marketable, products.

Before the war, Germany was England's best customer; after the war, if she can do so without serious loss, she will prefer to buy from others than her former enemies wherever possible, without declaring any distinct trade war.

Subsidies Are Possible

This immediately brings to the light another point, which is only of indirect bearing on the automobile situation, namely, that subsidies for cars built along lines approved by the Government will, as has been mentioned, be continued vigorously. This, however, indicates nothing more or less than the preparation for a renewal of the conflict now going on. As a matter of fact, well-informed Germans even to-day admit that, while they are perfectly confident as to the result of the war, they do not expect it to bring a definite decision; but they do expect that when the struggle is renewed they will have more friends among the nations than before the present war. From this viewpoint, Germany will very likely be ready to make greater advances in its trade relations to America than in the past, and this will be specially true where products of military value, such as automobiles, are concerned.

Another point to be remembered in dealing with Germany is that unless the war will continue to the utter exhaustion of Europe, its end may find Germany dominant in the Near

East, directing the affairs, in a larger sense, of not only Austria-Hungary and Bulgaria, but of Turkey, the Balkans and very lik ly Italy, with a strong influence in Scandinavia thrown in. Therefore the relations of any power with Germany will materially weigh in determining its dealings with the countries belonging to the German sphere of influence, which sphere during the past 18 months has been constantly increased. From this viewpoint, too, German business will pay.

Present Conditions Temporary

There are quite a number of materials formerly imported into Germany but now not available, due to the blockade. For most if not all of these serviceable substitutes have been found and the Germans are as a matter of course very enthusiastic over all these discoveries. There is no doubt, however, that a great many of these substitutes though they made fine makeshifts will not prove commercial when peace returns; although it may be that with some additional experimenting and study they *may* develop into profitable propositions. The fact that an article found extensive use during the war has almost nothing to do with the possibility of producing it profitably, or even, for that matter, without a loss.

It must be remembered that the consideration for profit, at least from the State's point of view, is being completely thrown to the winds for the time of the war's duration. The Government pays liberally for everything, money circulates at a very lively rate and everybody makes plenty of it. But, as remarked, these conditions will almost instantaneously cease with the war. Hence, a great many effective substitutes unless profitable in competition with the original articles will disappear.

Rubber Most Important

The most important of these products, so far as the automobile industry is concerned, is rubber. The Germans claim that they are now using a lot of synthetic rubber, and from the fact that automobiles are equipped with the necessary tires, it would seem that their statement is correct. It is not so certain, however, that the production of the synthetic product will be able to continue after the war, in competition with natural rubber; and here, too, there may yet be a very great field for American manufacturers. The competition in the normal European market, so far as tires are concerned, includes a considerable supply of English and French made goods; for which reason the above remarks, referring to the need of Americans being awake to the very earliest trading opportunities offered by Germany after the end of the war, hold true in the tire field also.

Parts and Accessories in Demand

When the chance and probability of hundreds of thousands of American cars being sold in Germany, is considered, it follows that reserve parts and accessories, from springs to spark plugs, will find a ready market here, too, as long as these American cars are used and continue to come in. Accessory and parts makers and tire exporters, for that matter, also will do well to consider the same principles of economy and efficiency in German exporting as were laid down in the foregoing remarks for makers of automobiles.

Poland May Develop

The European war, reducing Europe to two spheres of interest and influence, as it is bound to, will also bring into prominence once more the world-wide adoption of the metric system. There is a considerable probability, according to the opinion not only of German but of neutral engineers as well, that England will very soon and completely adopt the general use of the decimal system for weights and measures. This will be one of the minor effects of the war, but will be of considerable bearing upon international trade in products made according to mathematically exact measurements.

Although officially independent of Germany, the new Kingdom of Poland, one-quarter as great as Germany and populated by almost 15,000,000 people, will present a noteworthy market resembling in many respects that of the Empire itself. Poland is a rich grain country, although the population up to now has been anything but prosperous, and very likely will now be developed not only to greater agricultural efficiency, but also into an industrial section of quite some importance. The country is level and the roads not as bad as 2 years ago. The Germans are already doing a good deal in modernizing conditions and soon after the war Poland ought to offer a good market.

In a way, this holds true of the Balkan States, too, which have once more been roused to more modern ideas and methods by the war. No matter what the political distribution after the war, the territories now known as Servia, Bulgaria, Rumania and Greece will be in the market for all sorts of modern appliances, including automobiles and kindred products.

Must Begin Now

As has been stated in the introductory paragraph, only the most striking features of the situation now developing in Germany are given attention here, and a great deal will be left to the ingenuity of American business men regarding the best way of getting the business to be obtained in the Empire and its Confederate States. Too much stress, however, cannot be laid on the point that conditions should be studied and plans outlined—as far as possible—now, without waiting for the end of the war. Capable people should be despatched to the Continent to look matters over and so far as can be done now, prepare for commercial relations to be taken up as soon as normal conditions are restored again. The earlier this is done, the more favorable will be the conditions American manufacturers will be able to obtain in dealing with the authorities handling these matters.

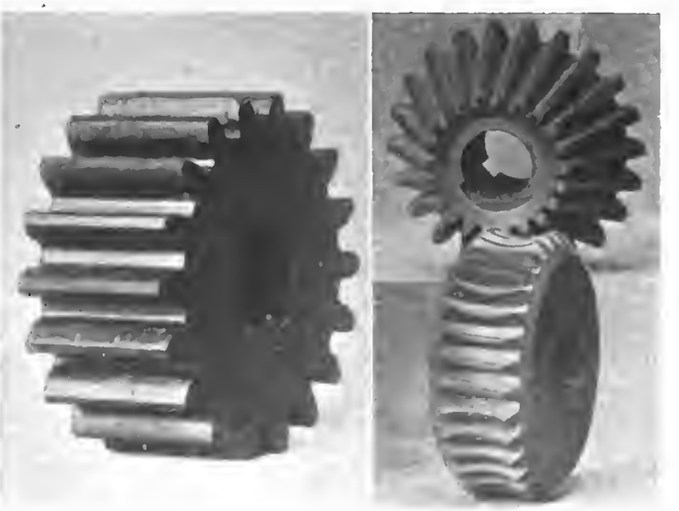
After the War

To sum it all up in so many words:

After the war, more than ever before, the devil is bound to take the hindmost; and the hindmost will be everybody who will fail to realize very early that the whole fabric of European economic life is being completely rewarped by the war.

—

Westinghouse Noiseless Bakelite Gears



Examples of gears made by the Westinghouse Electric & Mfg. Co. from Bakelite-Micarta-D. This material is claimed to be almost noiseless in operation and to be so strong that it can be used without metallic inserts for timing gears. It machines easily, takes a high polish and is not affected by oil

Four Is Ultimate Engine

Sixes, Eights and Twelves Have Special Uses but Four Is Automobile Engine of Greatest Value—Production Restricts Development

By A. P. Brush *

ISN'T the four-cylinder engine coming back? Will the four-cylinder engine ever come back? As a matter of fact, the four-cylinder engine isn't coming back and never will come back. Such a thing is impossible, for the very simple reason that it has never gone out.

Considered solely from the standpoint of numbers, the four-cylinder engine is, and has been for the last 10 years, the standard prime mover for self-propelled road vehicles and, in my judgment, will continue to be so long as the four-cycle internal-combustion engine holds its place as the most satisfactory prime mover for mobile use. Other engines of the four-cycle internal-combustion type, such as the six-, the eight- and the twelve-cylinder forms, are more or less special engines built for the purpose of securing results outside the range and capacity of the four.

Naturally the question will suggest itself, if the four-cylinder engine is susceptible of development and improvement, and if it is even numerically the most popular engine and has the greatest amount of capital invested in its production, is it not reasonable to suppose that its development has been carried further than that of any other mobile prime mover?

Multi-Cylinder Development

It is my opinion that the six-, the eight- and the twelve-cylinder have all been developed more nearly to their ultimate possibilities than has the four-cylinder engine, and it is also my opinion that the greatest obstruction to the development of the four-cylinder toward its ultimate possibilities has been and is its very popularity. *Volume of production makes for efficiency of production and stagnation of development.*

The production engineer has carried his work nearer to the ultimate with respect to the four-cylinder than with respect to the six, the eight or the twelve, but to secure this result the production engineer has been an obstructionist as regards the development engineer. With his face set firmly in the direction of efficiency in production, he has been, with equal fixedness, opposed to change, because change is the arch enemy of production efficiency.

Progress in design, so far as the large-quantity manufacturer of four-cylinder-engine cars is concerned, may be said to originate only in the minds of the sales department, finding its expression in their effusions, to the end that it may exist as an hallucination in the mind of the ultimate consumer.

Production vs. Engineering Progress

While the foregoing may sound like an arraignment of the large manufacturers of four-cylinder-engined cars, I for one do not consider it as such. The efficiency of production that has been achieved was only possible because of this artificial stagnation in engineering progress. My only purpose in bringing these conditions as regards the four-cylinder engine to your attention is that these conditions are, to my mind, justification for the statement that relatively more progress can be made in the design of the four-cylinder engine than in any of the other types.

A Commercial Angle

There is another very real obstruction to the development of the four-cylinder engine. It has come to be accepted as the engine for the extremely low-priced automobile. It is, of course, possible that these Kresges and Woolworths of the automobile industry are producing the only marketable type of light-weight car of limited passenger capacity. That is a commercial rather than an engineering question and, technically at least, outside our consideration at this time. For use in the so-called pleasure type of automobile the four-cylinder engine is pre-eminently the engine to be used in light-weight cars whose ultimate owners are their own chauffeurs and mechanics. Right here I want to venture the opinion that this class of user is entitled to, and a considerable proportion are willing to pay a reasonable addition for, better car performance and higher comfort value combined with the same or greater simplicity and compactness of mechanism.

Let us consider first the question of performance. Four of the leading manufacturers of four-cylinder cars claim for their engines maximum horsepower per cubic inch of piston displacement ranging from 0.142 to 0.206, with total piston displacements ranging from 170 cu. in. to 213 cu. in., and maximum total horsepowers ranging from 25 to 35.

During the past year a four-cylinder engine has been designed, tested, and its production in a light-weight car has been arranged for. The cylinder dimensions are 3¼ in. by 4½ in., giving a piston displacement of just under 150 cu. in. Its maximum power, as determined by exhaustive dynamometer tests, is just over 44, giving a horsepower per cubic inch value of 0.29. Comparing this with the best four-cylinder engines previously referred to, you will find an increase of over 40 per cent in power output per cubic inch of piston displacement and an increase of over 25 per cent in total horsepower available.

Performance the Question

Comparing maximum horsepower output does not tell the whole story. Good performance in an automobile means, in the engine, a high power output throughout a wide percentage range of speed. In this respect this little engine probably surpasses its popular predecessors to at least an equal degree. Owing to the absence of published power curves I cannot make a direct comparison in this respect. I can only tell you that it excelled the maximum power output per cubic inch of its predecessors throughout a range of over 2000 r.p.m.; that is, it developed over 0.2 h.p. per cubic inch from 400 r.p.m. to 2600 r.p.m. Because of its smaller cylinder diameter, and, further, because of the fact that it is of the two-bearing-crankshaft type, this engine occupies much less room in the car than any of the other engines used for comparison. This means, of course, either more passenger room and comfort for a given wheelbase or the same passenger room and comfort with less wheelbase. These comparisons,

*Paper read before Buffalo Engineering Society, Dec. 13.

I think, clearly demonstrate the possibility of increased performance values in the light-weight four-cylinder car.

Now, let us see what are the results in comfort value. The objectionable characteristics of a four-cylinder engine are vibration at high speed, due to the weight of the pistons and the angularity of the connecting-rods, and another class of vibration which may be described as torque vibration, due to the relatively heavy and infrequent torque impulses at very low speeds. Obviously these smaller cylinder dimensions mean a reduction in piston weight, with a consequent reduction in vibration tendencies at high speeds, and because of its greater speed range it is obviously possible and advisable to use a lower rear-axle gear ratio, which means, of course, greater frequency of impulse and therefore less torque vibrations at low speeds. This marked increase in performance and comfort value has been secured with no increase in the complication of the mechanism which the owner-user must understand and care for, and production efficiency is equal, with very little if any increase in engine cost.

Valves Are Adequate

To avoid making this paper too long I shall give you only the briefest possible résumé of the essential details which were the means employed to secure the results outlined. The little engine is of the overhead-valve type, and, by the omission of valve cages and some other minor details of arrangement, valves of adequate size were used. Having secured valves of adequate capacity, the next problem was to secure a carbureter and manifolding arrangement which would give somewhere near maximum power at high speed and not destroy the engine performance at low speed. This result was secured by means of what may be described as a low-velocity down-draft dry manifold.

The Lubrication Problem

The next difficulty encountered was the failure of conventional lubricating systems to function properly in an engine of large power output and extreme speed and power range. This difficulty was overcome by using an oiling system which automatically controls the temperature of the crankshaft and its bearings, which gives a positive delivery of oil to the crankshaft and crankpin bearings, and which is interconnected to the engine throttle so as to vary the oil pressure with variations in power output.

To secure compactness the center bearing of the crankshaft was omitted, distortion of the crankshaft at high speed being prevented by fully counterbalancing the shaft and also by the use of an extremely rigid shaft, the crankpin diameters being 2¼ in., with crank cheeks of equal rigidity. I have given you this brief outline of the results obtained in this engine and the essentials of design by which these results were obtained, not as an example of ultimate possibilities but simply as one example showing a substantial advance toward that ultimate.

Warming a Manifold for Using Heavy Fuel

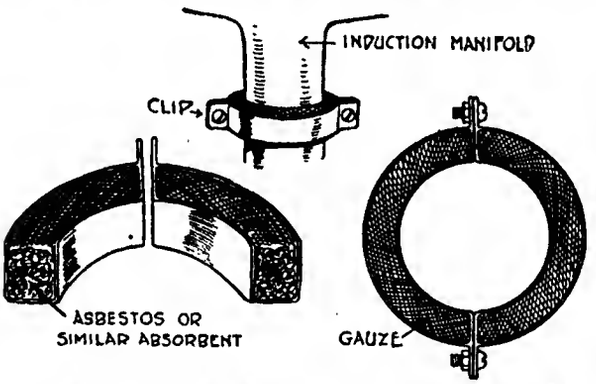
A SIMPLE method for warming up an induction manifold so as to enable an engine to be started on kerosene or something nearly as heavy without the use of gasoline, is described in a recent issue of *Motor Traction*, London, as the Wilkes method.

"The apparatus (which has been patented), as will be seen from the illustration, is an exceedingly simple and valuable asset. The small methylated alcohol stoves which are used in many households for the emergency warming of a small saucepan or kettle are well known, and it is this principle which has been adopted for warming up the induction pipe prior to starting.

"The arrangement consists of shallow metal circular or annular cups attached by suitable clips to the induction pipe immediately above the jet. The base of these circular cups is filled with asbestos wool or similar material, which is covered on the upper surface with fine wire gauze. Into these cups is poured the substitute or other suitable fuel, which impregnates the asbestos wool; this is ignited by means of a match or otherwise, producing a flame which burns for some time around the induction pipe, warming the latter sufficiently to obviate condensation, assisting the vaporizing of the liquid from the jet, and thereby rendering starting quite easy. In practice the time necessary on a standard Zenith carbureter for starting from dead cold has, we learn, been proved to be only 3 min.

"For purposes of running when once the engine is started, it is desirable to fit an exhaust-heated pipe immediately over the carbureter jet, so that vaporization of the fuel is assisted, such additional exhaust pipe being included in the patent specification.

"We understand the apparatus has been thoroughly tried and has proved most satisfactory in practice. When once the engine has been warmed up it will usually restart within a reasonable period by use of the handle only in the usual way."



Details of Wilkes method of starting on heavy fuel

Committees on Welfare Work at Reo Plant

THE Reo Motor Car Co., Lansing, Mich., is devoting many efforts toward welfare work for employees. A number of interesting and valuable methods devised to aid workers have been installed. The welfare work branches into a number of different departments and is done under supervision of department heads or by committees of men and foremen.

The safety committee comprises a chairman who gives his entire time to this work, and seven members each representing a division of the factory. Through this committee a constant oversight is maintained on the machines and safety appliances and the practices of the employees using them. Financial aid is given men, first through a fair wage, the minimum at the factory being 30 cents an hour. And a man in financial trouble receives additional help if the case is worthy by means of temporary loans or adjustment with the creditors.

A real estate commitee advises employees in the purchase of homes or the sale of real estate and is a great aid to foreigners unacquainted with conditions.

The company also maintains a first aid and hospital service, an industrial hall seating 1600, four bowling alleys, a library and dining rooms. They are at present erecting a clubhouse for employees which will probably be completed in December.

Pressure Lubrication Advantages

Theory of High Pressure Oil Feeding Borne Out by Experiment — Difficulty in Applying Very High Pressures to Automobile Engines — Importance of Cooling Effect of Oil on Bearings

By A. Ludlow Clayden

THE reason that splash lubrication is still more used than the pressure system is not entirely because the former is cheaper to manufacture. In an automobile engine the problem of keeping oil out of the cylinders has been more absorbing than the other problem of insuring enough for the bearings. With splash oiling it is easier to prevent overlubrication than with a pressure system, and splash oiling will, when well designed, give the bearings a supply sufficient to insure a reasonable life for the bushings.

On the other hand, bearings fed with oil under high pressure will outlast similar bearings fed by splash; they *can* be made almost everlasting. Engines have been built in which the crankshaft and connecting-rod bearings were able to keep their original tightness for 50,000 car miles. Give such an engine enough clean oil at regular intervals and you can almost forget that it has any bearings in it. Of course engine bearings in any good motor require renewal only at long intervals, so that they are not very costly to keep in repair, but everything that can be done to lengthen the period during which a car will run without mechanical attention is worth doing. Rear axles used to need tearing down and inspecting every 5000 miles or so. Now they will operate for years without any adjustment. It is but seldom now that a gear in the transmission has to be replaced, and ball and roller bearings have reached a pitch of perfection that enables them to outlast the gears. Even clutch facings now last an immense time, and the only part of the electrical equipment that needs much attention is the battery.

The day is in sight when an automobile will run for five years with no more attention than supply of lubricant and perhaps an annual wash out with kerosene before filling up with fresh oil. This is the reason why it is worth while to try to improve upon engine lubrication, which is already quite reasonably good.

From the viewpoint of the bearings in an engine we should design the lubrication without regard to the cylinders and, having cared for the bearings properly, we can then devise means for preventing cylinder flooding.

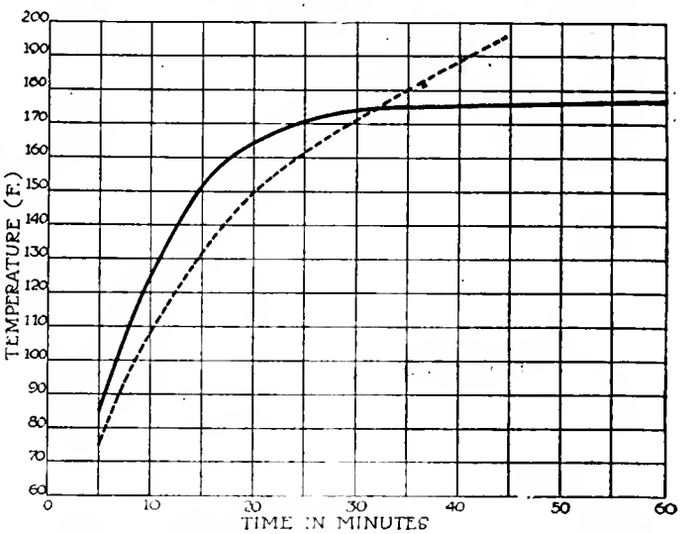
Theory of Pressure Oiling

The theory of lubrication has made a study for engineers of all nations for many years, and there are points which are still undecided. There are, however, a few simple rules which are accepted as fundamental.

1. Frictional resistance of a bearing decreases as the thickness of the oil film increases.
2. The loading for a given speed must not exceed a certain limit at which the oil film breaks down.
3. This limit is raised by making the bearing longer, because this increases the cooling effect of the oil.
4. The oil temperature varies throughout the bearing, being greatest where the oil film is thinnest.
5. Oil grooves placed wrongly may destroy the continuity of the film and so actually prevent proper lubrication whatever the oil supply.
6. A bearing with a reciprocating load is easier to lubricate than one with a constant load, as the relief of loading allows the entrance of oil (if it were not for this, splash lubrication for automobile engines would be impossible).

The value of pressure lubrication is mainly explained by item 1. We can regard the shaft and the bushing as being separated by a thin layer of jelly. When the load comes on, this jelly will be compressed on one side and allowed to expand on the other. Now, with a lubricated bearing the shaft and bushing ought not to touch. The frictional resistance is due to the force required to "shear" the oil film. The power required to do this decreases as the film grows thicker. Returning to the jelly illustration, it is obvious that the amount which the load would move the shaft relative to the bushing must depend upon the strength of the jelly. If the jelly is viscous it will resist displacement better than if it is thin. Actually, in a bearing, the effect of shearing the oil film is to heat the oil, thereby reducing its viscosity. If we can remove the oil as fast as it is heated, replacing the hot oil with cold lubricant, the viscosity can be maintained, and the shaft kept more nearly concentric with the bushing.

The function of pressure is to compel the continuous change of oil in the bearing. The cold oil being forced in drives the hot oil before it, giving it a chance to recover its viscosity before it returns to the bearing again. It is also beneficial in another way. Regarding the bearing as containing oil that can only escape at the ends, we see that the outlet consists of two narrow rings equivalent to a slit, twice the circumference of the bearing in length, and of a width equal to the clearance between the shaft and the bushing. No liquid will flow through a slit or other orifice in direct proportion to the pressure behind it, but in a proportion that decreases as the pressure rises. If a certain quantity flows



Effect of circumferential groove in bushing in reducing temperature. In this test the most efficient cooling, as shown by the full line curve, was obtained with a simple central groove to feed oil under the 40 lb. pressure. The other curve shows the greater rise of temperature when oil was fed to two longitudinal grooves close together and connected

out when there is a 5-lb. pressure behind, then less than double that amount will escape when the pressure is 10 lb. When the pressure on the oil supply is small the bearing is not kept completely full. With splash oiling, for example, the oil enters by suction of a sort. The oil in the bearing is squeezed out by the load on the shaft, and a partial vacuum is left in its place. This enables the atmospheric pressure on adjacent oil to drive it into the bearing, so displacing the vacuum.

Now with pressure-fed oil the bearing is kept permanently full, which means that the oil film is always as thick as possible; there are no variations in film thickness except those due to the oscillations of the load. Experiments made on bearings have shown that the friction decreased steadily as the oil pressure increased. In one particular experiment made on a steam engine giving 120 hp. at 450 r.p.m. it was proved that the friction horsepower was 3.33 with splash-fed oil and that this dropped to 2.13 with an oil pressure of 30 lb. per square inch, a steady fall in friction being noticed as the oil pressure was raised in small stages from nothing up to 30 lb. This is just one from a long series of similar experiments all showing the same thing, namely, that the power absorbed by friction in a bearing decreases as the oil pressure increases.

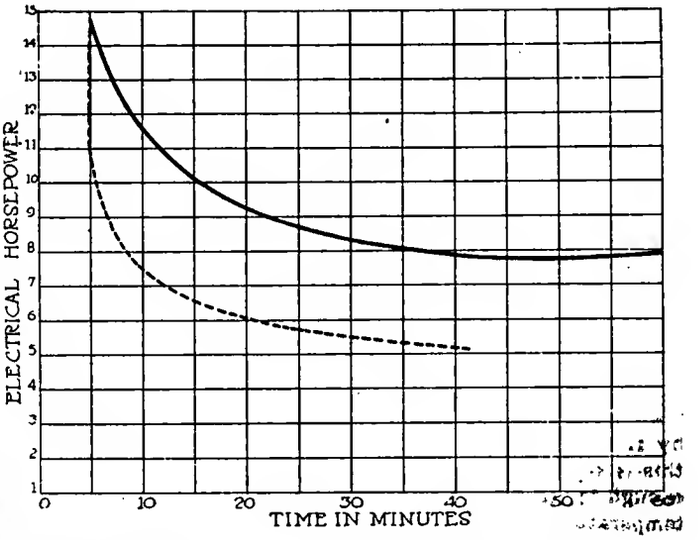
Precisely why this is remains a matter for argument, but some idea of the effect of high pressure oil may be obtained from the following analogy, which is not strictly a parallel case, though it serves to show the idea.

Suppose we regard the oil film round the shaft as a pneumatic tire and imagine that a series of rapidly varying loads are put on the shaft; then, obviously, the greater the pressure in the tire the less will the shaft move as the loads vary. If the tire is soft a big load may absolutely flatten it, driving out all air at one place; if the tire is hard this will not happen.

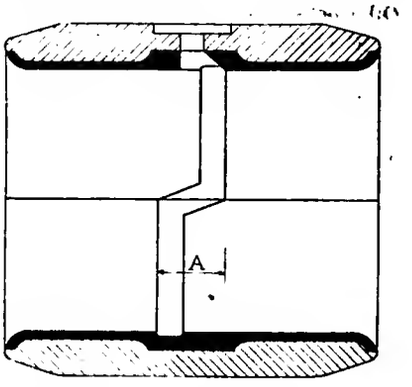
So with an oil film; one under high pressure will keep the shaft away from the bush while one under no pressure may be broken down by a sudden heavy load. An oil film in a bearing may be likened to the tire mentioned above, but with a constant leak in it, so that air is escaping all the time and has to be replaced.

Pumping Action of Bearing

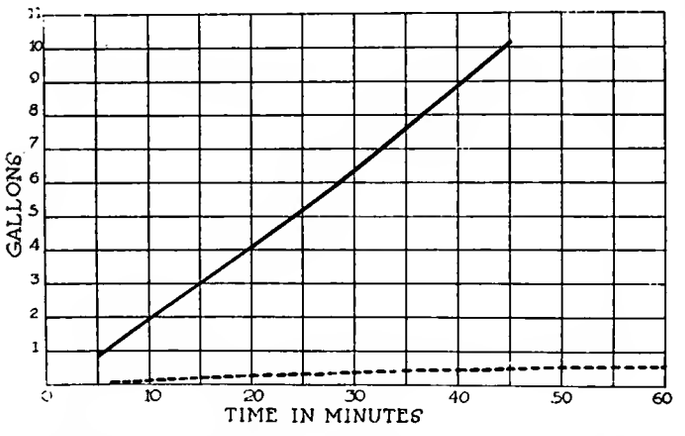
Luckily, a rotating shaft in a bushing is itself an oil pump. If it were not, lubrication by any other method than forced oil would be impossible. To use another rough analogy, suppose the shaft to have a series of blades on it and to be floating central with the bushing with the tips of the blades just clearing the bushing. Now put a load on the shaft so as to displace it relative to the bush, and we see that the space between the tip of the blade and the bush will be greatest on the side of no load and least on the side where the bush is supporting the shaft. Now imagine the shaft to be turning and the oil clinging to the surface of the bush. A blade descending toward the place of least resistance will be carrying a certain quantity of oil before it, and as the clearance decreases some of this oil has to escape. But the nearer the blade gets to the bottom the narrower will be the clearance through which such escape can occur; thus the pressure in the oil at the point of smallest clearance will be a maximum. In actual fact the point of smallest clearance is *not* directly opposite the point of loading, except when the shaft is not turning. The shaft carries the point of maximum oil pressure a little past the point opposite to the load, the exact location depending upon the speed of rotation.



Above — Curves from same pair of bearings showing the electrical horsepower taken to drive the shaft under load. After the state of equilibrium had been reached the bearing with the more copious lubrication required more power to drive it, but the bearing with the restricted supply was too hot to be safe to run further after 40 min.



Right—Groove for obtaining the best flow of oil in a bearing supplied with oil under pressure



These curves show the relative quantities of oil passed by the two systems of grooving the bushings. The bearings are the same as those used for the test of increase of temperature with time of running, showing that the lower temperature is due to the larger amount passed with the central, circumferential groove

There are several factors, the size of the shaft and length of bearing, the load, the speed of revolution and the viscosity of the oil. For any particular case, all things being settled except the load, we can find a maximum load which will just be supported without breaking through the oil film at the point of smallest clearance. Taking the same conditions but putting the oil *supply* under pressure, we gain an effect equivalent to an increase in the strength of the oil film, allowing a higher load to be carried before breakdown in the film takes place.

There have been many learned works on lubrication and many long series of experiments, but these all serve only to give an indication of what may be going on in an automobile engine bearing. Nearly all the experiments have been made with large bearings running under constant loads, and the load in an automobile engine bearing varies constantly. Variations in cylinder pressure, coupled with the inertia effects of the reciprocating parts, cause perpetual variations in the oil film conditions. It is thought by most investigators

that this is of great assistance in maintaining the film. Suppose a load placed suddenly on the shaft, as by the explosion, it must take some fraction of a second to squeeze out the oil. By the end of this period the load is smaller or has changed its direction, thus offering relief to the oil film an instant before its fracture occurs, and the same thing is repeated throughout the whole cycle. Were it not for this, lubrication of a piston pin by splash would be utterly impossible. Here again the effect of having the oil under pressure can be seen, for it takes longer to squeeze out compressed oil than oil under little or no inherent pressure.

Another thing that is but little understood is the cooling effect of oil and its influence upon friction and the wear of bearings. In the sort of steadily loaded bearing with which experiments have been made there appears to be a definite oil temperature at which friction is lowest, but in these cases the only heat that reaches the bearing is the heat produced by friction. This is not true of an automobile engine, for this is kept hot and the 180 deg. or so in the water jacket is enough to maintain the crankshaft bearings at a fairly high temperature without the heat of friction.

Oil Cooled Bearings

Working on the assumption that lubrication will be assisted if the crankshaft is provided with more than ordinary methods for getting rid of its heat, A. P. Brush has devised his ingenious system of lubrication which uses the crankshaft itself as the main oil distributing channel. In this layout oil is pumped to an end bearing of the crank and led right through to the other end, small side holes giving the supply to the various other bearings. The idea is to pass through the crankshaft a much larger volume of oil than could be passed through the bearings.

No doubt in a splash system of oiling the oil which covers every portion of the inside of the crankcase carries off a good deal of heat as it drains back to the sump, thus using for cooling purposes more oil than passes the bearings, but there is one thing that must not be overlooked in considering the use of the oil as a cooling medium as well as for lubrication, and this is the ability of the oil in the sump to part with its heat to the atmosphere. The sum total in effect of supplying a bearing with a small quantity of *cold* oil might easily be the same as that of giving it an equivalent quantity of warm oil, using more warm oil to help cool it in other ways. If we assume that the oil, by some means, has to carry away so much heat from the bearings, we must provide the sump with means for transferring just that same quantity to the atmosphere.

Oil Radiators

In this connection it may be remarked that C. Y. Knight is reported to have wished, when designing the first Daimler engine, to pump the oil through external radiating tubes; possibly a few tubes in the water radiator could have been isolated for this purpose, but the Daimler Co. objected for fear it might be said that this was *necessary* with the Knight engine. In some racing cars oil radiators have been used most successfully, and in the short races at Brooklands a very usual trick was to have a big hand pump full of cold oil which could be shot into the crankcase about 150 yards from the finish, the result being a sensational jump in speed lasting just long enough to get over the line. This was in the early days and did not apply to modern machines with lubrication systems suitable for continued high speed work.

Another detail of lubrication which has had practically no attention is the grooving of bearings for obtaining the best distribution of oil. The few experiments made and reported go to show that most oil grooves do more harm than good. The reason for this is that the oil film is broken by the groove. Why this is can be realized when we remember that a groove connects different parts of a bearing and that the oil film pressures are different at different places. If we link two spots together by a groove we cannot easily maintain different pressures at the two ends, since the groove acts like a passage external to the bearing.

In a splash system the oil groove ought to run lengthwise of the bearing so as to carry oil nearly the full length, and the groove should be located at the point of minimum oil pressure. Here it will not interfere with lubrication, since the pressure will be the same for the whole length. Diagonal grooves are disturbing to the equilibrium of the oil. But there is a difficulty here, this being that the point of minimum pressure on the circumference of the bearing is changing every instant as the direction of load changes. This means that a number of grooves linked together may be better than a single groove, despite their drawback.

Need Only Central Groove

With forced lubrication, however, grooves lengthwise of the bearing are seldom necessary, since automobile engine bearings are short for their diameter. Experiments made by R. K. Morcom, the head of the first manufacturing firm in Europe to build high speed steam engines in quantities, showed that the power absorbed by a bearing was reduced as the quantity of oil passing was increased. This probably is due to two things, to the cooling effect of the extra oil and to the fact that a big flow forced through means that the oil film is thicker and the danger of its breakdown less. The result of Morcom's researches showed that the best form of oil groove where lubrication is under pressure is a shallow groove right round the middle of the bushing with no longitudinal grooves. The theory of the effectiveness of this is that it forms a reservoir of oil under pressure, and thus insures a direct supply at whatever point on the circumference the minimum pressure due to the load may happen to be least at any instant. The plain circular groove, however, has one disadvantage, this being that it will, after a time, provoke the growth of a ring on the shaft. To overcome this Morcom staggered the upper and lower halves of the groove, this giving essentially the same effect as the plain groove so far as lubrication is concerned, but removing any danger of uneven wear on the shaft.

The results of Morcom's work were summed up in a paper read in England as long ago as 1910, and most of the curves shown here are taken from that paper. It is rather remarkable that nothing of the same character seems to have appeared since, for Morcom admitted that his research could be carried much further. For example, he stated that the flywheel end bearing in an automobile engine might need a lengthwise groove as well as the central ring, in order to permit enough oil to be passed through, but the exact location of such an additional groove and its proportional dimensions have, so far as the present writer is aware, never been studied completely. There is no data available on small bearings under alternating load with different groove proportions and fed with oil under different pressures, and there is an opportunity here for some engineer with a good laboratory to do some most valuable work.

Cylinder Oiling Separate Problem

Automobile engine lubrication has been complicated terribly as a problem by the need for using the same oiling system for the bearings and the cylinders. The effect of the smoke trouble and of carbonization has been to cause lubrication systems to be designed for the cylinders rather than for the bearings, and this has perhaps been a factor in restraining proper examination of the subject *from the bearing viewpoint.*

Ideally we should design our lubrication for the bearings and care for the cylinders afterwards, but the presence of too much oil in the cylinders seems so very difficult to prevent that engineers have perforce given most of their attention to what ought to be a subsidiary problem. Thus any investigations that may be made ought to be independent of

the cylinders, for what we want to know is the facts regarding bearing lubrication. Once having these we can proceed to devise means for caring for the pistons.

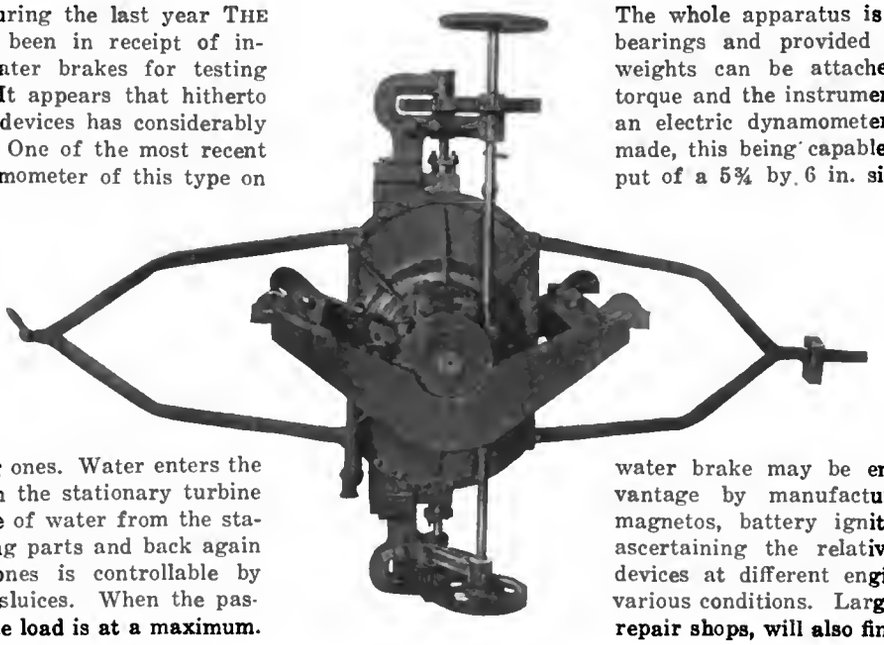
In discussion of an S. A. E. paper on a quite different subject, K. W. Zimmerschied questioned whether we might not some day come to thermostatic control of oil temperature. That we shall soon have an almost constant water temperature both winter and summer seems more than probable, so having thus removed one variable, it is not unlikely that Mr. Zimmerschied's suggestion for removing another may be followed out. If this is found possible in a commercial way it should be easy to discover by proper tests what pressure variations are desirable for the oil. Pressure, temperature and load are all connected in some way. To get the lowest bearing friction they must all be proportioned.

If the subject of bearing lubrication, here briefly outlined, waits the attention of a scientific investigation, there are other factors which are purely mechanical and do not require the same sort of laboratory study. One is the relation between size of pump and of oil leads to provide a desired flow at a desired pressure, and the other is means for keeping oil away from the cylinders. Since these matters are separate altogether from the theory of bearing lubrication, they are better considered as an entirely different subject, and it is the writer's intention to attack this phase in a subsequent article.

Herschell-Spillman Co. Manufactures Water Brake

Brings Out Device for Testing Automobile Engines

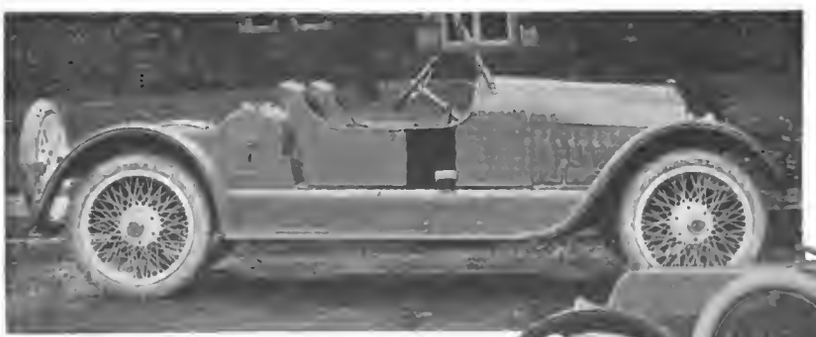
SEVERAL times during the last year THE AUTOMOBILE has been in receipt of inquiries concerning water brakes for testing automobile engines. It appears that hitherto the demand for such devices has considerably exceeded the supply. One of the most recent firms to place a dynamometer of this type on the market is the Herschell - Spillman Co., North Tonawanda, N. Y., maker of the Herschell-Spillman engines. The instrument consists of a double rotating turbine with two stationary members and two revolving ones. Water enters the brake through holes in the stationary turbine blades and the passage of water from the stationary to the revolving parts and back again into the stationary ones is controllable by opening and shutting sluices. When the passages are wide open the load is at a maximum.



The whole apparatus is mounted upon roller bearings and provided with arms to which weights can be attached in measuring the torque and the instrument is used exactly like an electric dynamometer. One size is being made, this being capable of handling the output of a 5¾ by 6 in. six-cylinder engine. It weighs 350 lb. and measures 8 ft., 2 in. from tip to tip of the two arms, as shown in the accampanying illustration.

Besides being useful for testing automobile engines, the Herschell - Spillman water brake may be employed to great advantage by manufacturers of carbureters, magnetos, battery ignition systems, etc., in ascertaining the relative efficiency of their devices at different engine speeds and under various conditions. Large service stations and repair shops, will also find it useful.

Two New Models on Daniels Eight Chassis

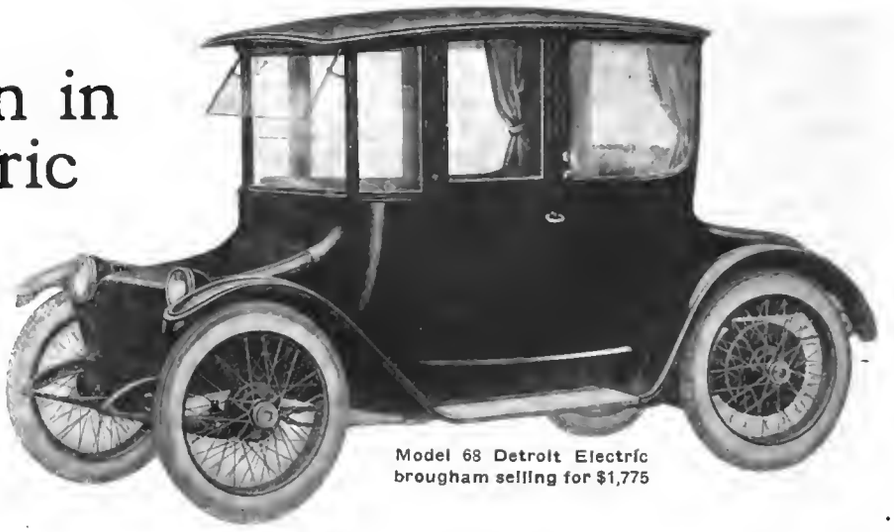


Above is the new speedster model mounted on the eight-cylinder Daniels chassis. The slanting windshield, sloping rear deck and spare tire carried at the rear aid in creating an impression of racy lines. Note step beside buffer

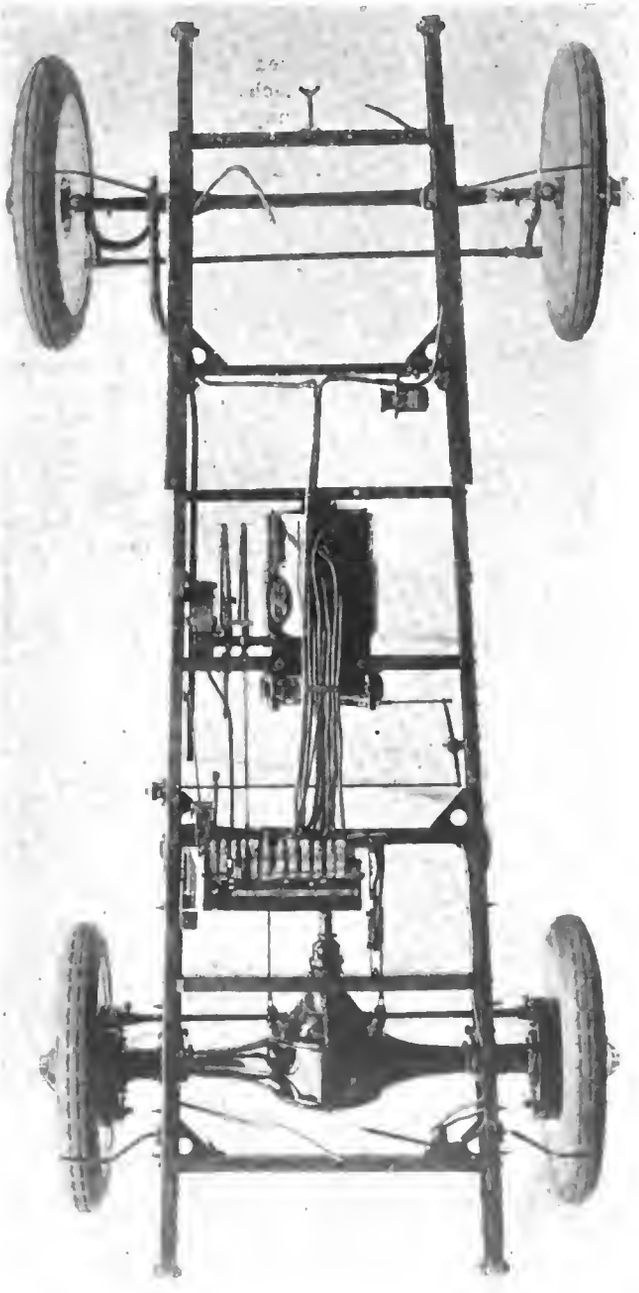
Below is the four-passenger Daniels eight-cylinder model which has an aisle between the front seats. Note the unusual lines of the top which has a rounded effect at the rear, and also the large overhang of the fenders

Standardization in Detroit Electric

Car Lightened, Tire Size Reduced, and Spring Suspension is Changed to Semi-Elliptic



Model 68 Detroit Electric brougham selling for $1,775



Plan view of the chassis illustrating the motor mounting, controller set and layout of wiring

STANDARDIZATION and all that quantity production infers have resulted in a reduction of $1,100 in 2 years in the price of Detroit Electrics made by the Anderson Electric Car Co., Detroit, Mich. The cuts last year were from $600 to $725 below the former cost, and this year $500 additional has been taken off the selling price without lowering the quality of the product, but simply by applying the rules of scientific manufacture on a quantity basis.

The reduction in price has been made possible by increasing largely the supply of up-to-date automatic and semi-automatic machinery, by using the chain method of production and by standardizing the product through the elimination of a wide variety of options in color, upholstery, finish, etc. The only changes in the specifications outside of the fewer options are a reduction in tire size from 34 by 4½ to 33 by 4½, a change in the spring suspension from elliptic rear to semi-elliptic all around and a reduction in the size of brakes and some of the dimensions due to the elimination of considerable overweight in the construction of the body. In spite of the great reduction in price this year, from $2,275 to $1,775, there was no apparent difference in the exterior of the cars with the exception that the side lamps are eliminated on the new model and the running lights incorporated in the head lamps.

Two Chassis Models

The more expensive chassis is continued, thereby giving the Anderson company two chassis models in place of one last year. The leader, however, will be the new model which is known as 68 and which is the product that is being put out on a quantity basis.

One of the important changes which has lowered the price of the car and has made it lighter, giving a considerable advantage in mileage rating, is the use of leather roof in place of the sheet aluminum. Weight has also been saved by the use of Hotchkiss drive, in the semi-elliptic spring and in the smaller wheels which have, however, the same section diameter of tire. The difference of weight is reflected in the smaller battery which is a forty-two-cell, thirteen-plate in place of a forty-two-cell, fifteen-plate which gives the same mileage as in the more expensive model. Some of the details on the new body are weight savers also, as they are in the line of greater simplicity. A good example of this is in the rear corners of the body which were formerly equipped with windows, while in the model 68 these are not installed.

Pressed Steel Used

Pressed steel is used in the structural work on the model 68 chassis, all the assembling being done in the Anderson factory. The cross members, brackets, and gusset plates are hot-riveted with automatic hammers to the side frame members. The cross members are designed to carry the electric

motor and the driving units which are assembled upon it. The motor is bolted to the frame in the center and the battery equipment is equally divided. Twenty-one cells of this are in front and twenty-one in the rear, giving a balanced car with the weight on the front and rear axles approximately equal.

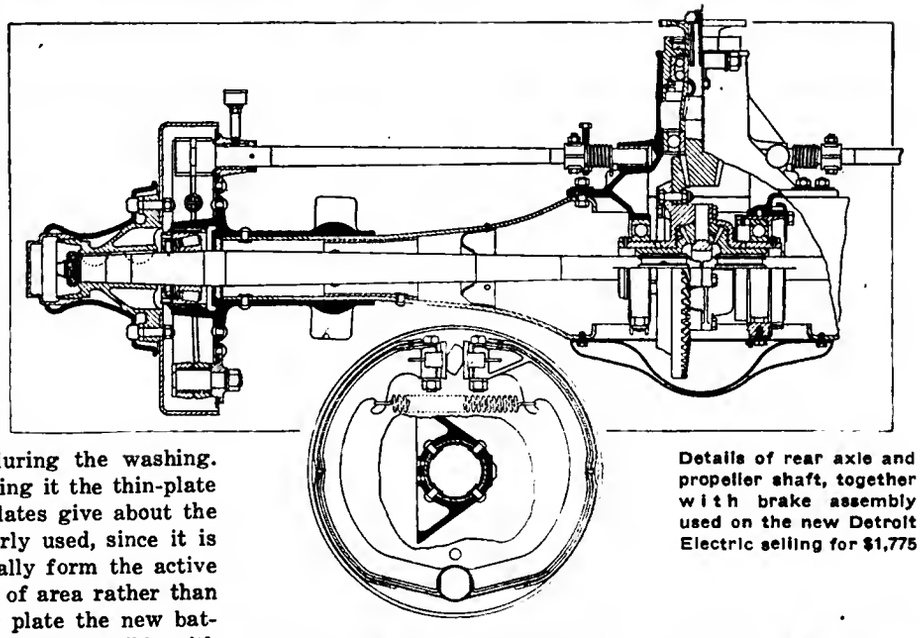
Wiring on Chassis

One of the assembly features of note is that all the wiring is made up in a standard form before it is assembled to the chassis by special cleats. The entire wiring with the exception of the body lights is carried on the chassis.

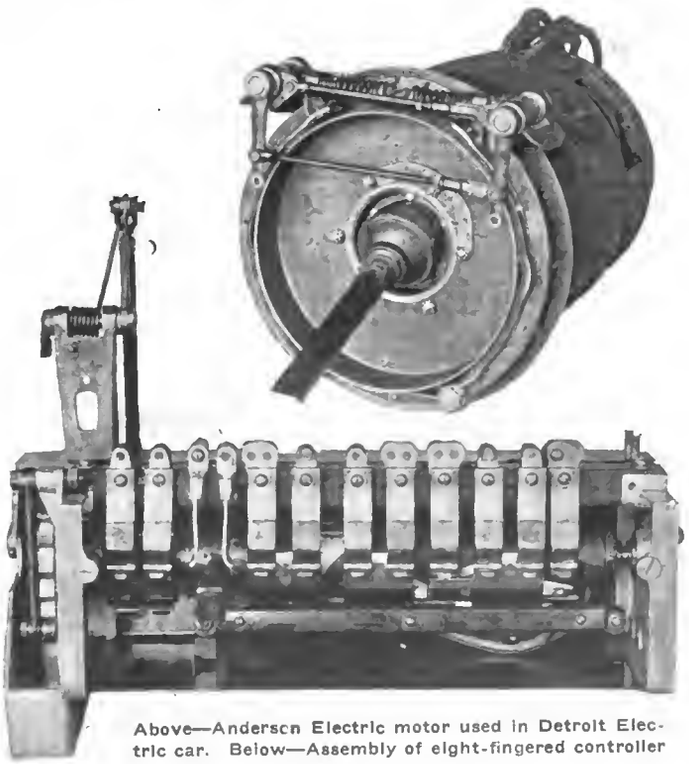
Timken bearings are used in the wheels with ball bearings for the steering parts and at the knuckles. The friction points in the majority of instances are equipped with self-lubricating bushings and the others with grease and oil cups accessibly located. The standard tire equipment is the Goodrich Silvertown cord.

High-ribbed jars are used in the new Detroit Electric batteries. These ribs are sufficiently high to hold all the active material which will come off the plates during their normal life, thus making a non-wash battery, or one that does not require washing. The purpose of this is to give the user more total life, as some of the active material is always lost during the washing.

Weight is saved in the battery by making it the thin-plate type. It has been found that the thin plates give about the same capacity as the thick plates formerly used, since it is only the surfaces of the plates which really form the active working parts and capacity is a question of area rather than plate volume. With the less weight per plate the new battery has a greater capacity per pound than was possible with the old construction. More plates can be placed in each jar, thus reducing the current used per plate and adding to the life of the battery. The Anderson company now guarantees a battery for 8000 miles or 2 years normal service. The capacity of the Model 68 with thirteen plates, six positive and seven negative, is 150 amp. hr. The battery is located under the hoods, front and rear, so that it is easily accessible for filling, etc. It can be removed by loosening the hold-down bolts.



Details of rear axle and propeller shaft, together with brake assembly used on the new Detroit Electric selling for $1,775



Above—Anderson Electric motor used in Detroit Electric car. Below—Assembly of eight-fingered controller

A series-wound motor of slow speed characteristics is used on Model 68. The feature of a series motor is that the torque increases with the load, and the electric car is thus enabled to increase its output to accommodate adverse road conditions. By using the slow speed motor, reduction gears have been eliminated with a saving of weight and an increase in transmission efficiency.

Motor 90 Per Cent Efficient

Hess-Bright bearings are used for the armature and as these are packed in grease they require minimum attention. There are four sets of carbon brushes distributed on a commutator of large area giving a high current carrying capacity. The efficiency of the motor is said by the Anderson engineers to be 90 per cent at normal running speed, this efficiency being obtained by using a large amount of copper.

Five speeds forward are supplied by the drum type of controller. This is a finger-and-blade design of large size to carry the heavy current resulting from overloads. As an additional safety precaution there is a self-lubricating felt oiler which rubs against the contacts on the controller, keeping them continually lubricated. Refinement of design has cut the number of fingers on the controller to eight, and this, together with the fact that the reverse switch aud cut-out switch are both mounted in the same housing as the con-

troller, has added simplicity and reduced weight. The controller is assembled underneath the rear seat and is covered by a dust-proof housing.

For the main circuits No. 1 wires are used and all the leads are short, as the motor, controller, cut-out and reverse switch are close together. In assembling the wires taper terminals are used sweated to the wires. These terminals fit into taper sockets and are screw-fastened.

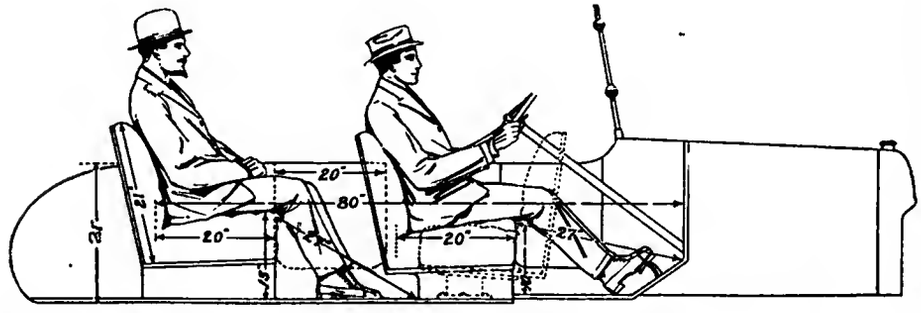
Direct drive through a short propeller shaft with two universals transmits the power to the three-quarter floating axle, the drive being through spiral bevel gears. Two separate sets of brakes are provided, those on the rear hubs being internal expanding, 16 by 2½ in., and these are operated by pedal. To the left of the brake pedal is a small pedal, pressure on which locks the hub brakes and automatically cuts off the power. This is for use when parking the car. The second brake operates on the motor and is applied by a slight backward movement of the control lever so that the motion for shutting off the power and applying the brakes is continuous.

In controlling the car, the operating levers are mounted at the side of the rear seat, in parallel position, one above the other. The longer lever is operated by the right hand and is for steering the car. The shorter lever controls the speed. When the driver leaves the car these levers may be turned up out of the way and locked, preventing theft. Speeds of from 6 to 25 m.p.h. are available, and the mileage per charge is between 75 and 100.

In finish and equipment, the electric brougham affords a vehicle of fine appearance. The fenders are pressed steel, oval-crowned designed and are skirted to the body, protecting it against mud. The standard painting is cobalt blue with white stripes. The wheels are painted in white, cream, red or blue, as specified. The upholstery offers a selection of three designs of whip-cord. It is Turkish type with deep cushions padded with curled hair. With the 100-in. wheelbase chassis a capacity of four passengers is provided.

Body features have always been carefully looked after in electrics and the new Detroit incorporates a number of comfort features. There is an upholstered package box in the left front corner which may also be used as a passenger seat. In summer weather the windows may be lowered by a patent device; and the door windows are sashless and are operated by a lever from the inside. The seat widths are generous, the rear seat being 49 in. with 18 in. depth, the door opening 24 in., and the distance from the front to the rear window, 63½ in. Houk wire wheels are furnished exclusively on this model.

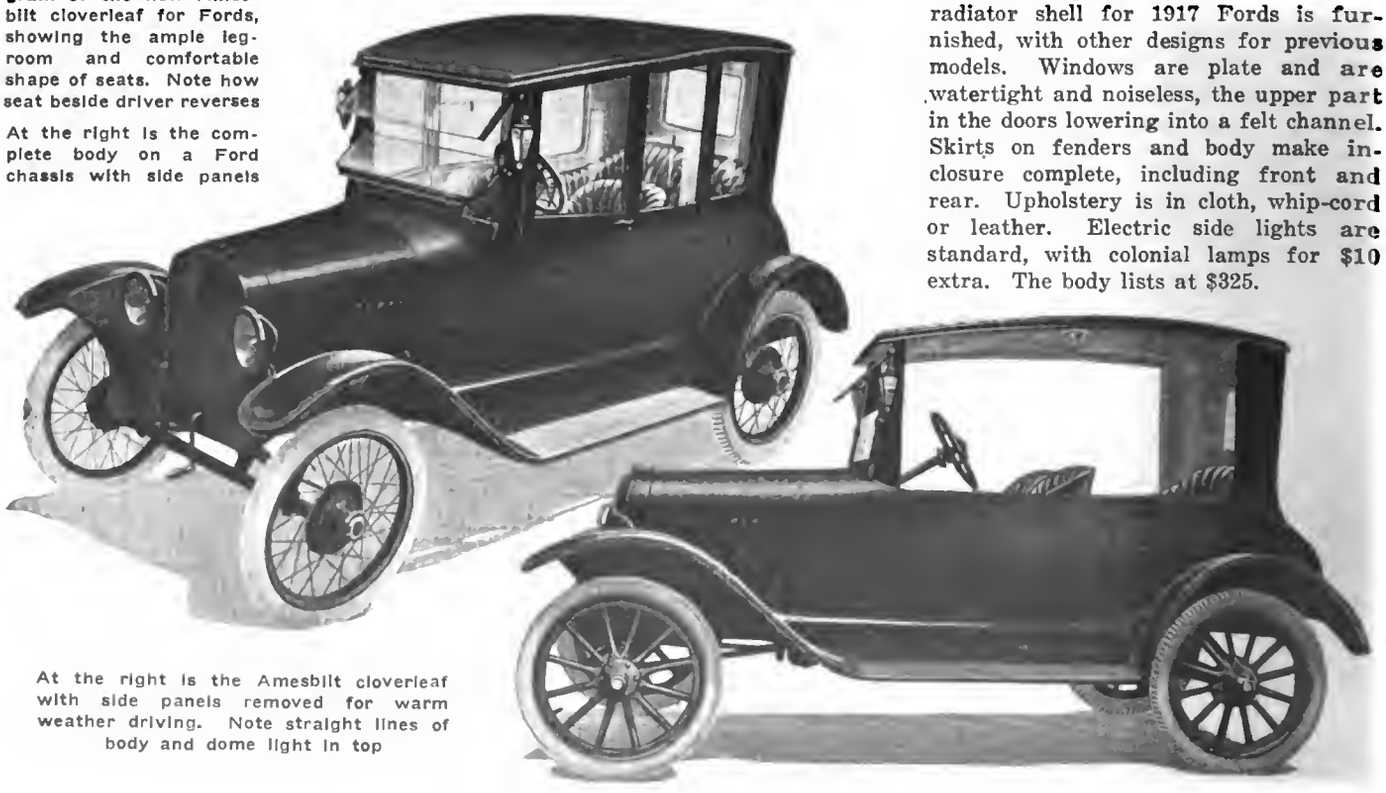
Amesbilt All-Season Cloverleaf for Fords



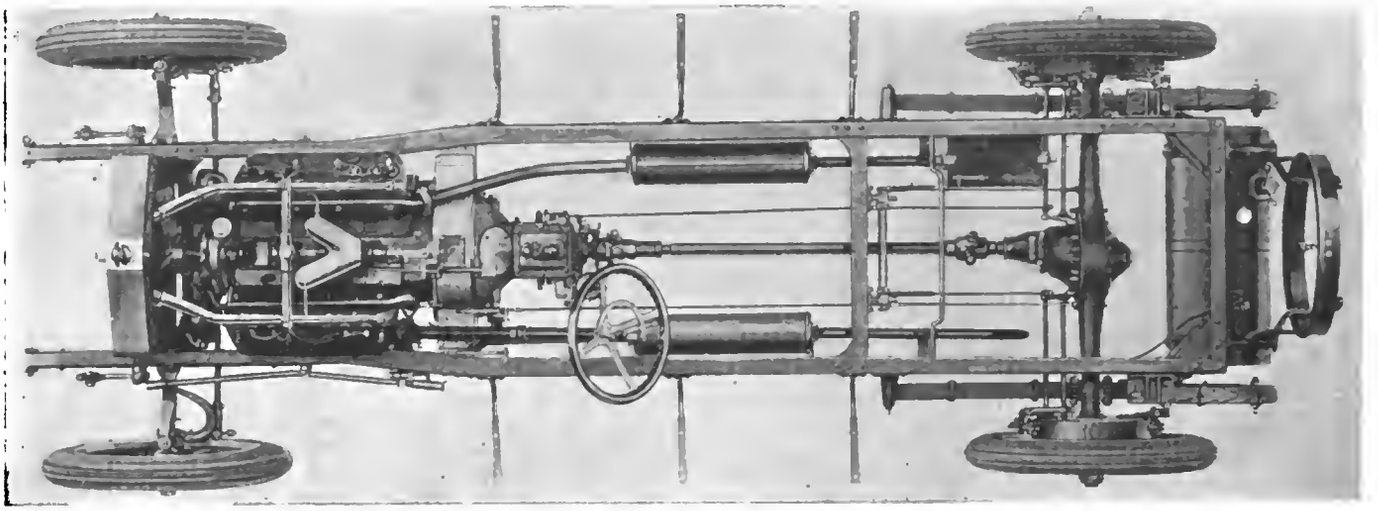
Above is a seating diagram of the new Amesbilt cloverleaf for Fords, showing the ample legroom and comfortable shape of seats. Note how seat beside driver reverses

At the right is the complete body on a Ford chassis with side panels

DESIGNED to render possible mounting an up-to-date streamline four-passenger all-season cloverleaf body on a Ford chassis, the Amesbilt construction illustrated herewith has been brought out by the F. A. Ames Co., Owensboro, Ky. As shown in the diagram, measurements have been arranged to provide ample leg-room and comfortable seating, the seat beside the driver being reversible without sacrificing rigidity. Top and side panels are removable but are securely fastened so that rattling is prevented. A special streamline hood and radiator shell for 1917 Fords is furnished, with other designs for previous models. Windows are plate and are watertight and noiseless, the upper part in the doors lowering into a felt channel. Skirts on fenders and body make inclosure complete, including front and rear. Upholstery is in cloth, whip-cord or leather. Electric side lights are standard, with colonial lamps for $10 extra. The body lists at $325.



At the right is the Amesbilt cloverleaf with side panels removed for warm weather driving. Note straight lines of body and dome light in top



Chassis of the Murray eight, showing the mounting of the unit power plant, position of storage battery, rear fuel tank and tire carrier and the layout of the double exhaust line

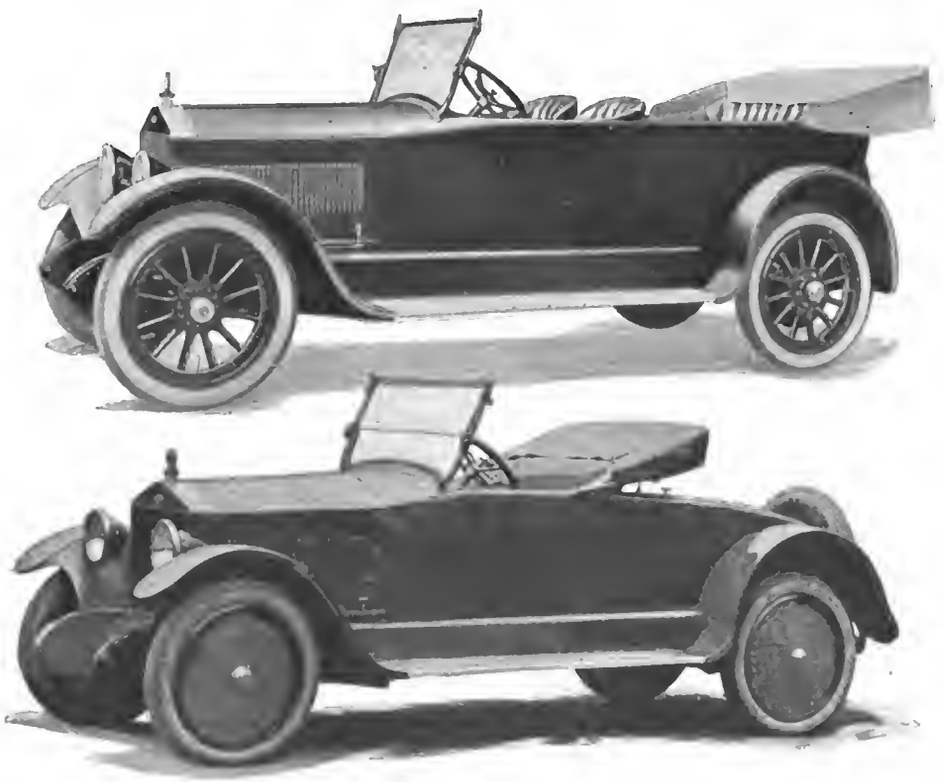
Murray Eight Has Custom Style

Standard Units Used in Substantial Chassis—Appearance Is Distinctive—Equipment Is Very Thorough

THE avowed aim of the Murray Motor Car Co., Pittsburgh, Pa., in designing the Murray eight has been to produce a car of broadly conventional design but with a distinctiveness of appearance and a general soundness of construction in excess of the normal. It is a powerful car and everything about it is after the custom-built style, the equipment being exceptionally thorough, and the price of $2,500 includes the option of finish in any color.

The power plant consists of a Herschell-Spillman engine, 3¼ by 5 in., which is claimed to have a b. hp. of 75, and a Covert three-speed gearset, the clutch being a Borg & Beck dry disk. The axles are both Timken, the floating pattern being used at the rear, and Hotchkiss drive is used, the rear springs being three-quarter elliptic. The electrical units include Westinghouse generator and starting motor with 100 amp.-hr. battery and ignition is furnished by a Dixie magneto.

Rigidity has been aimed at in designing the frame, which is of deep section, and it is dropped a little to give a low body position. The wheelbase of the chassis is 128 in. and 34 by 4½-in. Goodrich Silvertown cord tires are fitted as standard equipment. The smaller details of the chassis equipment include a Zenith duplex carbureter with a Stewart vacuum feed from a tank at the rear end of the chassis. The general equipment comprises every minor detail as well as such important features as an electric clock, a power tire pump, Hartford shock absorbers and a Boyce Moto-Meter.



Two body styles obtainable on the Murray eight-cylinder chassis for $2,500. The European influence is evident throughout the general design of both cars

Chassis Price $2,000

The chassis can be obtained without body for $2,000 and any sort of body is provided that may be called for, the illustrations showing a touring and a roadster obtainable for the $2,500 figure. It will be observed that the general scheme of the hood and body gives a European effect, making the car instantly recognizable.

Wheels are wood, of the artillery type, with the front wheels cambered, this constituting standard equipment, although wheels of other styles may be fitted.

The FORUM

Criticizes Vacuum Brake—Overlooks Important Feature

By H. M. Brayton

AS a student of mechanical engineering, I wish to submit the following criticism based on the article which appeared in THE AUTOMOBILE for Nov. 2, 1916, on the design of a vacuum brake for automobiles by the Prest-O-Lite Co. of Indianapolis, Ind.

The vacuum brakes designed by the Prest-O-Lite Co. seem to be inadequate to meet all the requirements demanded of a power brake for this class of work. Foremost among the faults of this apparatus is the fact that the brake is of absolutely no value unless the engine is running. It very often happens that the automobilist in descending a long grade, wishes to save fuel by allowing his engine to stop entirely. He could not do this unless his car was equipped with another brake and unless this vacuum brake will in itself cover all needs its field of usefulness must be very greatly reduced.

In heavy traffic where the surroundings are noisy it often happens that the engine will stop when the clutch is released and the driver be unaware of it. The brake would again fail with good chances for a smash-up and damages.

In the article mention is made that a difference of pressure of 10 lb. is available from the suction. I wish to show that in the average car with a volume ratio of 3 to 1 we have, assuming Boyle's law to hold and an isothermal suction, that

$$P^2 = \frac{PV}{V^2} = \frac{14.7 \times 1}{3} = 4.9 \text{ lb. absolute}$$

when P and V are the pressure and volume respectively, at the beginning of the suction stroke and P^2, V^2 the same quantities at the end of the suction stroke. This shows that the theoretical limit with this volume ratio is $14.7 - 4.9 = 9.8$ lb. difference of pressure available for the brake.

It is a well-known fact that gas engines nearly always exhaust above atmospheric pressure, and so it seems unlikely that the theoretical limit could be reached in practice. However, the lower pressure could readily be multiplied by leverage.

A cylinder 7 in. in diameter seems rather crude and takes up altogether too much space with this size, and a stroke of 4 in., the volume of which must be reduced in pressure before the full force can be exerted on the brake is very large and an appreciable time would be required.

The control valve is indeed an ingenious mechanism, and if the suction were only more reliable this brake would have a wide field of usefulness, especially in heavy work such as heavy touring cars and trucks.

EDITOR'S NOTE—Mr. Brayton appears to have overlooked the fact that this brake must operate as long as the gear is engaged and the car moving. When coasting with the clutch out if the engine stopped it would only be necessary to let in the clutch to obtain suction immediately.

Regarding the pressure available, running with the throttle shut in the idle position the pressure in the cylinder at the end of the exhaust stroke would not be above atmospheric. As to the size of the cylinder, this is by no means so large as a muffler and on most chassis there is plenty of room for it, since it can be mounted almost anywhere.

Melting Scrap Aluminum a Difficult Operation

THE melting of aluminum scrap, particularly chips from machine shops, might, to the uninitiated, appear a very simple process. How difficult it is to perform without excessive loss through oxidation is, however, made abundantly clear by Bulletin 108 recently issued by the Bureau of Mines. This bulletin has eighty-eight pages devoted entirely to this matter. The book is very interesting reading even to an engineer not too closely acquainted with foundry practice and in it, in addition to much very valuable information, there are some interesting figures regarding the quantity of aluminum absorbed by the automobile industry. It is stated that a conservative estimate of the amount of aluminum employed in automobile manufacture in the United States from July 1, 1914, to June 30, 1916, was 50,000,000 lb.

The percentage machined off from a rough aluminum casting in the finishing process seems, from data obtained by the writer, to average about 15 per cent, a figure which is much higher than was estimated offhand by several people connected with the automobile and aluminum casting industries, whose guesses averaged 3 to 4 per cent. The writer's result was reached by weighing rough and finished castings at an automobile plant making a car in the $700 to $800 class, and by weighing rough and finished castings made for various other motor car manufacturers at an aluminum foundry, with the results shown in the accompanying table.

The results of the tabulation, which indicate that 15 per cent was machined off, were so at variance with the estimates cited that the matter was taken up with the makers of a car in the $2,000 class, who state that on that car there are used forty-seven aluminum parts which are machined, the total weight of the rough castings used per car being 166.19 lb. The loss per car in chips is 25.15 lb., or 15.1 per cent. The weights were taken on the average of a number of like parts, in some cases as many as fifty being weighed. On the basis of 15 per cent of metal machined off, the yearly production of chips from aluminum castings in the United States will then run between 3,000,000 and 3,750,000 lb. If 20 to 30 per cent of this amount is unnecessarily lost, then 600,000 to 1,125,000 lb. of aluminum alloys worth 16 to 25 cents per pound, based on the average market quotations in normal times, is lost.

PROPORTION OF METAL MACHINED-OFF ALUMINUM CASTINGS

Casting	Weight of Rough Casting, Pounds	Weight of Finished Casting, Pounds	Percentage of metal machined off, Per Cent
Gear and transmission case	28.50	24.50	14
Small double-flanged exhaust elbows	.42	.35	15
Intake pipe for six-cylinder motor	5.00	4.80	4
Gear case for small motor	8.90	7.00	21
Gear case for very small motor	1.58	1.50	5
Crankcase for eight-cylinder motor	94.00	80.00	14.5

Self-Oiling Bushing's Many Uses

Automobile Industry Will Employ 5,000,000 During 1917

PROBABLY few people are aware that the impregnated self-lubricating bearings which are now used so extensively for light duty parts in automobiles are quite an old idea. Probably it is also seldom realized what a very large quantity of such bearings are now being used by the automobile industry. The Bound Brook Oil-Less Bearing Co., Bound Brook, N. J., will supply nearly 5,000,000 bearings of this sort solely for use on automobiles and trucks during 1917, this figure including the outputs of both bronze bushings with a special form of graphite insertion and wood bushings which are impregnated with graphite.

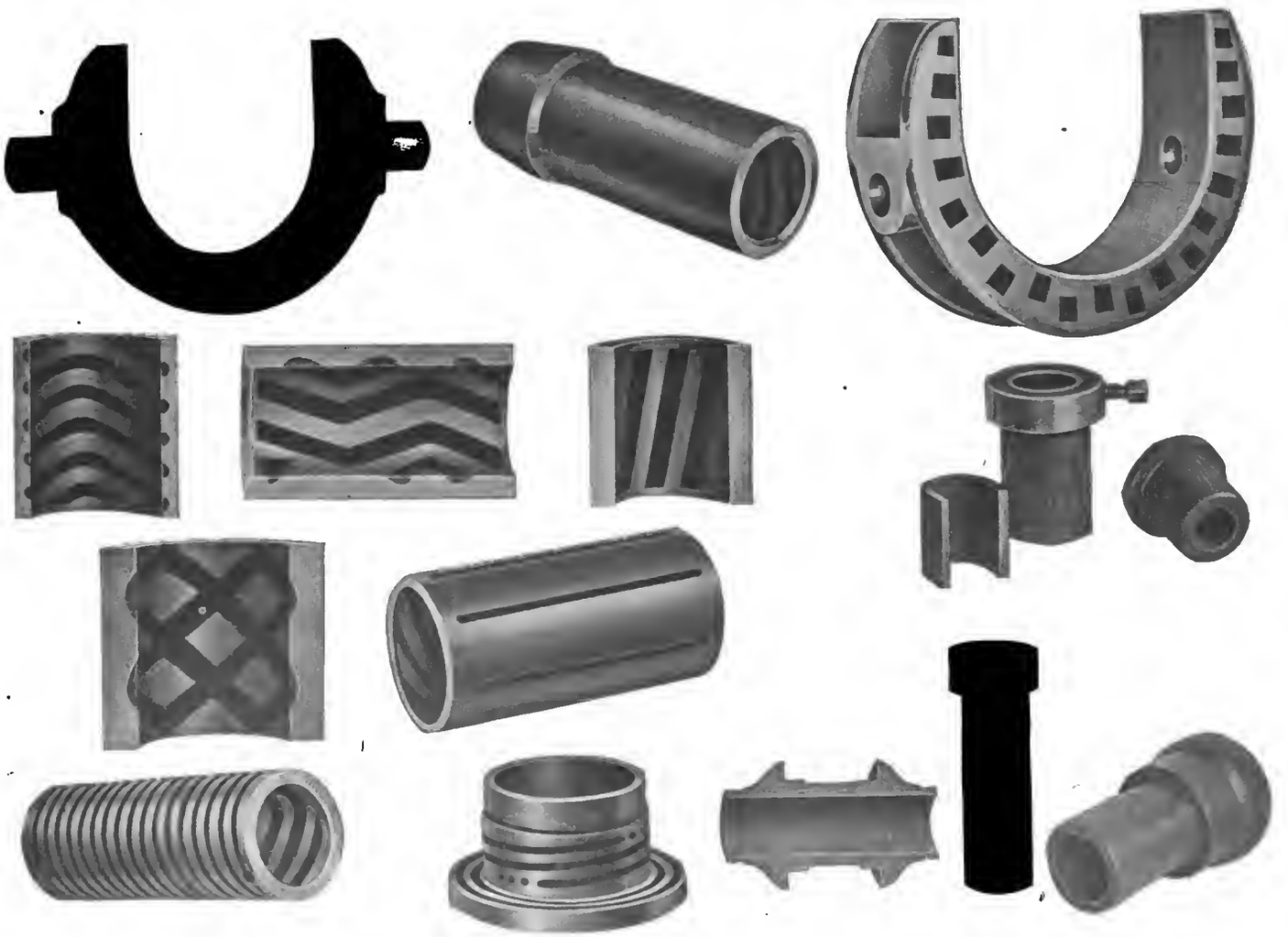
The original Bound Brook bearing was designed for use on electric trolley wheels, where the difficulty of lubrication was a serious trouble. The first batch of bronze bushings with graphite insertion was supplied for this purpose in 1889 and the output of trolley bushings alone is now in excess of a million a year.

Broadly speaking, the oilless bearing is valuable for two different classes of service. For parts with only occasional small motion, such as for the mounting of brake shafts, etc., a graphite insertion keeps the surfaces in good condition and provides all the lubrication necessary, continuing to do this for a very long time. It is even inadvisable to oil them because oil attracts dust, which it may transfer to the rubbing surfaces, while the graphite has no such tendency.

The other sphere of usefulness is in cases where a moderately light duty bearing will normally have a supply of oil, but may be allowed to run dry. A prominent example of this sort of application is the spindle of a starting motor. This is supposed to be lubricated but is often neglected. To use ball or roller bearings would be needlessly extravagant for a part of which only runs for such very brief periods. A Bound Brook bearing can be neglected even more carelessly than a ball bearing, because the latter requires to be protected from damp which would not injure the impregnated bushing.

Quite a different part which it is difficult to supply with oil or grease successfully is the thrust collar used for throwing out the clutch. Here again, we have an example of occasional use and the graphite inserted in the bronze is able to care for the lubrication unaided. Steering gears, pump shafts and many other applications will suggest themselves, and the illustrations give an idea of the many types of bushings made for automobile applications.

The wood bushing which is impregnated right through has a sphere of usefulness distinct from the bronze bushing with graphite insertion. Naturally the wood will not stand up



Bound Brook phosphor bronze self-lubricating bushings and clutch forks; the six pieces on the right are Nigrum wood bushings

under the same pressure per square inch that can be supported by the bronze, but wherever sufficient area is obtainable it can be employed because it may be oiled without producing any distortion. This probably is because the pores of the wood are completely filled during the impregnation, the bearings being finish-machined after that process.

Experiments in shackle pin bushing have shown that the wood is a much better material than the bronze, provided the spring eye is large enough to admit a bushing of such size that it will be certain not to split. Where movement is oscillatory and only over a very small angle, the graphite in the bronze bushings does not seem to spread very effectively; there should be a movement of something like 30 deg. to keep the bronze bushing in the best condition, but the wood bushing is not limited in this respect.

It is also highly probable that many uses will be found for Nigrum material, as this impregnated wood is called, in forms other than that of a cylindrical bushing; as an example experiments are being made with slip blocks on textile machines. The impregnated wood can be cut into any shape and the machining is cheap.

The process of manufacture of both the bronze and wood bushings is very simple. The wood is brought roughly to size and is then soaked in a solution containing graphite, after which it is subjected to a secret process, where fairly high temperature and pressure are applied simultaneously. After this treatment the parts are finish-machined and require nothing further done to them. The wood used is ironwood, this having proved the hardest wood that can be impregnated with certainty.

In making the bronze bushes, the grooves which are afterward filled with the graphite compound are cast, since some "tooth" is needed to hold the compound during manufacture. The bushes are finished completely before they are loaded, and to load them the bush is filled with a pasty mixture of graphite and a plunger is then driven through, forcing out the excess and ramming the groove. After this follows subjection to pressure and temperature, the details of which process are jealously guarded, this being followed by baking in ovens. The final process is to push through a plunger which removes any surplus lubricating compound and still further consolidates what is in the grooves.

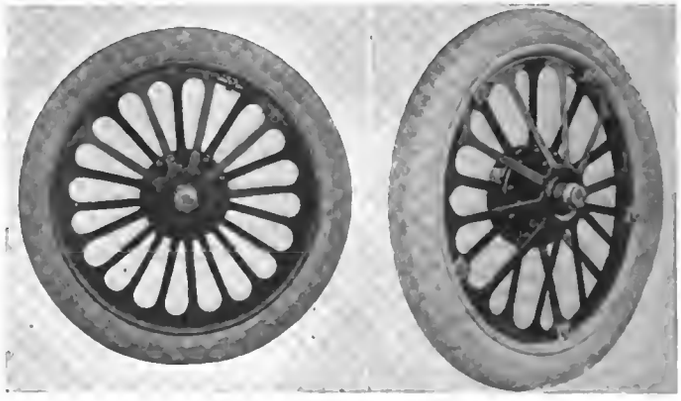
Baker Steel Wheel Has Tension Spokes

INVENTORS of steel wheels are aiming at cheap production, good appearance, strength and convenience. The new Baker steel wheel seems one of the happiest combinations of all four qualities.

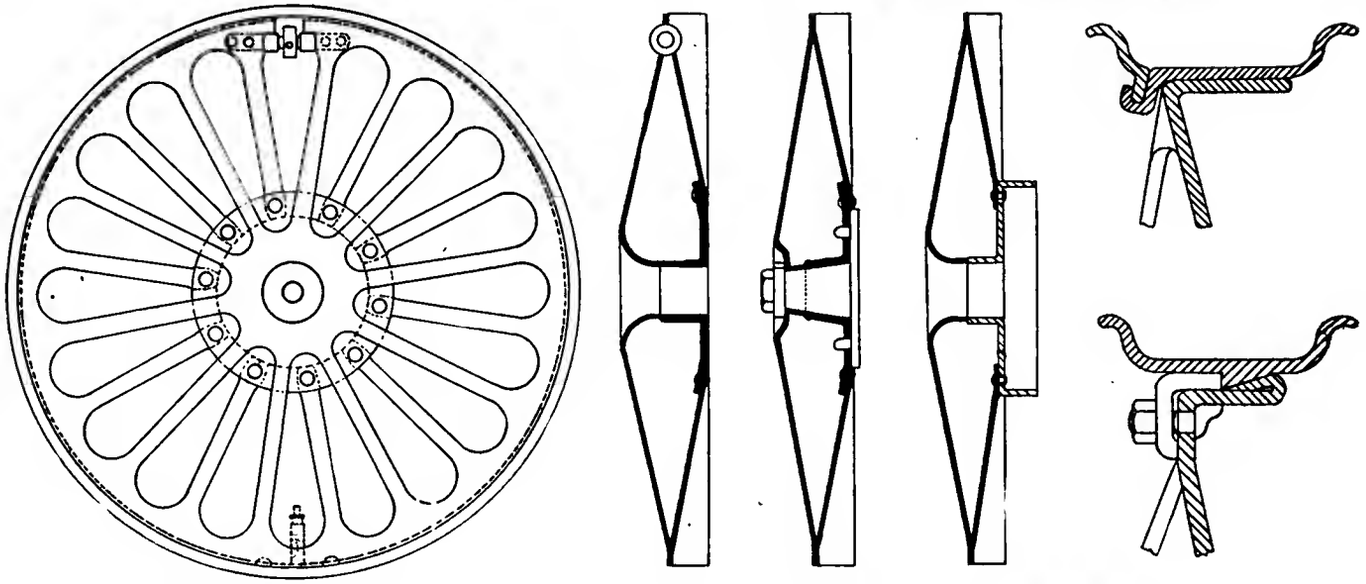
The raw material consists of a disk of thin sheet steel. The first operation is to punch out a number of pieces, so as to leave a set of spokes, joining the rim to the center. Then every alternate spoke is cut off at its inner end where it joins the center piece. This gives two sets of spokes, one set joined together at both ends, and one set with the inner ends free. The second set are then bent sideways and their ends riveted to a steel stamping consisting of a disk with a hub piece pressed out from it, the "hub" being welded or otherwise secured to the center of the original disk; and thus we have a complete wheel needing only the attachment of the rim. Any form of demountable rim can be used and any kind of hub design.

A special rim has been designed for this wheel, this being cut through at a point opposite the valve hole, and a turnbuckle used for contracting it, this being the only part that has to be unscrewed for detaching the rim; there are, of course, some studs or dowels to take the drive.

Plans are well advanced for the manufacture of the wheel on a large scale, both for passenger cars and trucks. The inventor is E. K. Baker, of demountable rim fame, and the patents are held by a new corporation, the Baker Wheel and Rim Co., Chicago.



Examples of finished Baker wheels



Sketches showing the construction of the Baker steel wheel and a few variations upon the basic idea of the device

Lower Fuel Is Greatest Carbureter Problem

Increased Heat, Better Atomization and Higher Jet Velocities the Remedies—Few New Models But Many Refinements

By J. Edward Schipper

ONE consideration, the descending grade of fuel, stands out so prominently as an influence of carbureter design for 1917, that everything else is insignificant by comparison. Mechanically, every manufacturer of carbureters has a different solution for the problem. From an engineering standpoint, however, there are just three classifications of the methods used to meet the issue. These are, in the order of importance, heat, atomization and velocity. The latter two are correlated to a certain extent, but as will be seen by a study of the different types, there is a distinction.

There is a great amount of uncertainty, and has been for some time, regarding the matter of where the carbureter manufacturer ends and the car manufacturer begins in meeting the requirements of the heavy fuel. There is no doubt but that the problems of carburetion and intake manifold design are bound closely together. In fact, the best carbureter made will show poor results on an engine with an improper manifold. Hence the improvements which have been made by the engine and car designers in this respect have advanced the art of carburetion in its broad sense.

No Change in Fundamentals

A year ago, in its review of the subject of carburetion, THE AUTOMOBILE gave a complete classification of the types of carbureters used on American cars. The elapsed period has seen no change in these fundamentals; they remain the same, and yet it can be said that the art of carburetion has gone forward in the past year because the instrument is now coping with conditions which are far more difficult than they were then. The improvements are largely in detail. The details of manifold design, and of carbureter arrangement which have been improved all line themselves under one of the methods of betterment mentioned above; heat, atomization or velocity.

Manufacturers of cars demand from the carbureter manufacturer what the public demands of them. They are asking, in spite of the heavier fuel, for more acceleration, better and quicker starting on frosty mornings, better low-speed, high-gear performance, greater economy, lower idling speed, better hill climbing ability—that is, increased torque or crank effort at slow speeds with wide open throttle. In fact, everything that goes to make up good car performance is being demanded more vigorously every year by the car-buying public in every grade of car.

Classifying the Carbureters

The manner in which the desired result is attained forms the basic classification of the carbureter. This is really the starting point in carbureter design. The higher speeds, where the energy is at hand, are simple compared to providing an accurate, well broken up mixture at the lower end of the speed range. At the same time, this main jet, or primary device, which supplies the engine at low speeds, must play its part in the wider throttle openings. The ways in which this compensation is made have been classified as follows:

The air valve type, where compensation is made by the opening of an air valve.

The metering pin type, where compensation is made by raising and lowering a measuring pin which governs the jet size.

The expanding type, where the number of jets in action corresponds to the throttle opening.

The compensating jet type, where an auxiliary jet comes into action at wider throttle openings.

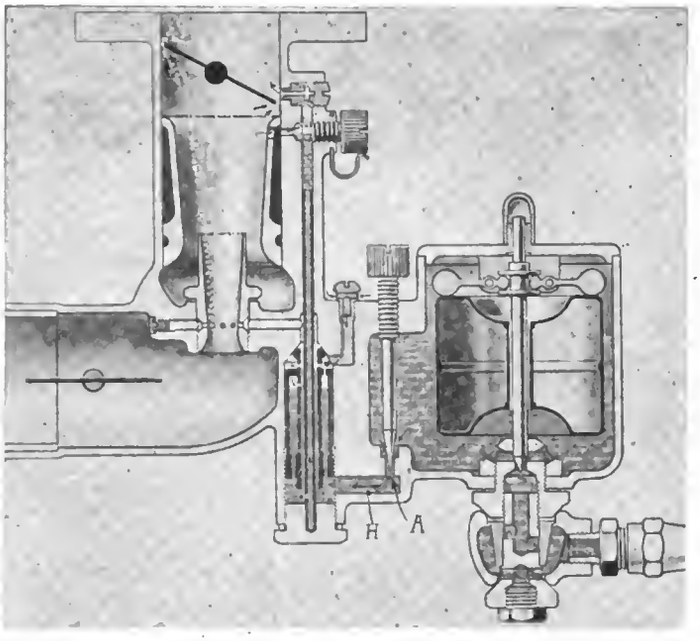
Besides these there are miscellaneous special divisions. As carbureters are classified according to these divisions, the well-known makes would be arranged under the heads in the accompanying table.

It will be noted that some makes, such as Stromberg and Rayfield, fall under different heads. This is because they do not purely belong to one class, but employ principles and are of such construction that they fall under more than one head.

This year engines are returning more for a unit of weight and for a unit of displacement than ever before. The carbureter manufacturer is playing an important part in this. The same elements that go to make for economy in carburetion go largely to make good rated performance in an engine. The manner in which carbureters generally have been improved in the lines mentioned differs according to the basis type of the carbureters. What representative makers have

Carbureters Classified

AIR VALVE	Heath	Ball & Ball
Air Friction	Newcomb	Tillotson
Breeze	Rayfield	Flechter
Zephyr	Tom Thumb	Sunderman
Shain	H & N	
K-D	Webber	EXPANDING
Browne		Master
Branford	COMPENSATING JET	Carter
Stromberg		Juhasz
Ensign	Zenith	
	Holley	MISCELLANEOUS
METERING-PIN	Stromberg	
	Longuemare	Stromberg
Schebler	Johnson	Rayfield
Stewart	Marvel	Kingston



In the new Stromberg model L a little mixture flows directly into the manifold above the throttle for starting and providing a good mixture when throttle is practically closed. A is the gasoline feed adjustment and H is the passage to the acceleration well through which the fuel passes from the float chamber

done forms an interesting study, the developments of each being taken up in detail on pages 1022 to 1031.

Stromberg Has a New Design

Stromberg has added an entire new carbureter to its line to take care of the dual problems set up by the higher demands and the lower fuel. In this new plain tube carbureter the general heads under which the improvements are found are atomization and velocity. The atomization is secured by introducing air into the fuel jet so that when it is drawn out it comes out not as raw fuel but as a partially mixed super-saturated vapor, which combines readily with the main flow of air.

The increased-velocity method is used particularly for high accelerative qualities and is used in connection with an acceleration well. When the carbureter is set for ordinary speeds at economy, as a general rule the flexibility has to be sacrificed to some extent. To overcome that the new Stromberg is so arranged that an extra supply of gasoline and air is supplied for acceleration when it is needed. The well fills with gasoline when idling or upon increased suction due to throttle opening, and in answer to the throttle demand this gasoline is drawn at high velocity into the main jet.

New Holley Uses Acceleration Well

A good example of the acceleration well is given in the new Holley. Under ordinary running conditions the well is dry. The well is formed by a bowl-shaped depression below a standpipe through which the mixture is drawn at high velocity. The air enters the standpipe through the bowl-shaped well space and the nearer empty it is the more air in proportion to the gasoline will enter, thus giving the compensation required.

These two makers, Stromberg and Holley, represent the only two who have so far carbureters of new type, and both have retained the fundamental features of their own designs. In practically every other case, the changes may be called refinements of existing types rather than alterations or additions of new principles.

Taking up the matter of acceleration, Schebler will soon be out with a new type, with low-grade fuel, which is one that is uppermost in the minds of carbureter and car makers alike. It will be worth while to note that in both the cases mentioned where marked changes have been made to attain higher acceleration, the acceleration well has been employed where the little supply of gasoline is held always ready to meet the requirements of the engine in picking up.

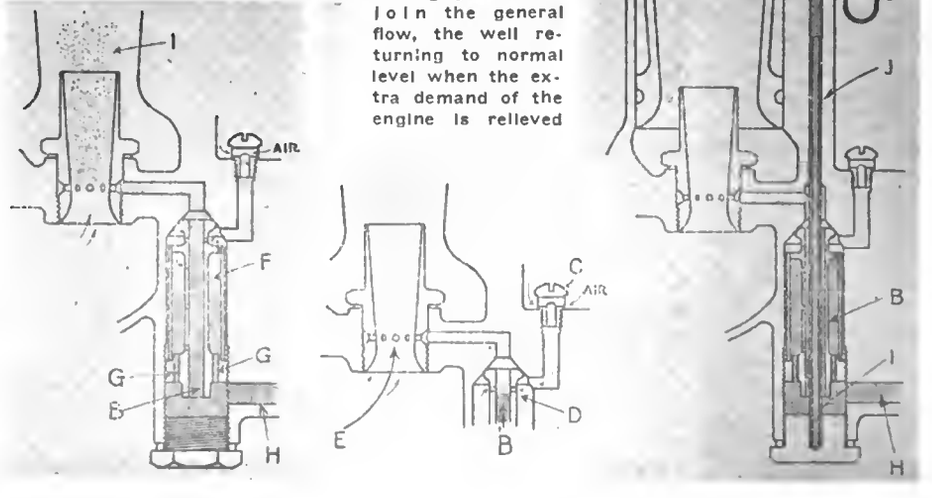
Full Hot Air Another Improvement

The use of full hot air rather than semi-heated air is another of the changes which are of use in increasing the accelerative qualities. The Master carbureter is an example in which full heated air is now employed instead of semi-heated, that is with primary air hot and auxiliary cold.

Another distinctive carbureter which should be mentioned in connection with improved acceleration devices is the Ball & Ball made by the Penberthy Injector Co. For easy starting and for acceleration there is a passage from the float bowl to a point above the throttle. This passage contains a plunger and when the vacuum increases it rises and shuts off the flow of gasoline from the intake passage. As the throttle is opened the vacuum in the intake passage is broken and the plunger drops, causing gasoline to gather above it. This is immediately drawn through the passage, giving the extra supply for acceleration.

The above examples are some of the special means taken to increase the accelerative qualities of the carbureters. It requires an additional flow and this must be instantly available or the carbureter will choke and sputter, before picking up its work. In the compensating jet type of carbureter this supply is given by jets uncovered by the opening of the throttle or which are brought into action in some other way by increasing the throttle opening. Carbureters such as the Master, in which the wider open the throttle is the more jets are uncovered, the Johnson, in which the suction raises a sleeve that covers the jet openings, and the Zenith, with a secondary jet surrounding the main jet, are all examples where the compensating jet takes care of acceleration. On the Zenith there is also a well, but this is used to supply

In the Stromberg L air enters at E, and through C and B, carrying fuel which is sprayed into the main channel. An accelerating well F concentric with passage B is filled with fuel. At speed air is drawn through C, forcing gasoline to join the general flow, the well returning to normal level when the extra demand of the engine is relieved



the secondary jet and is not open like that of the Marvel, Stromberg and Holley types.

Securing Easy Starting

The problems of acceleration and easy starting are somewhat allied, but differ in one material respect, and that is in the amount of throttle opening. When starting the throttle is nearly closed, when accelerating it is wide open. In both cases, however, a quick supply of gasoline is required, with a mixture richer than in ordinary running. For this reason on some of the carbureters the same device that acts for easy starting also helps in the way of acceleration. A good example of this is the Zephyr, which is a plain tube type of carbureter. A ball valve has been added at the bottom of the air tube and when the throttle is opened it causes a lag of the air behind the gasoline. A sudden throttle opening for quick acceleration will cause a spurt of gasoline to enter the intake, thereby enriching the mixture and giving the qualities necessary for acceleration.

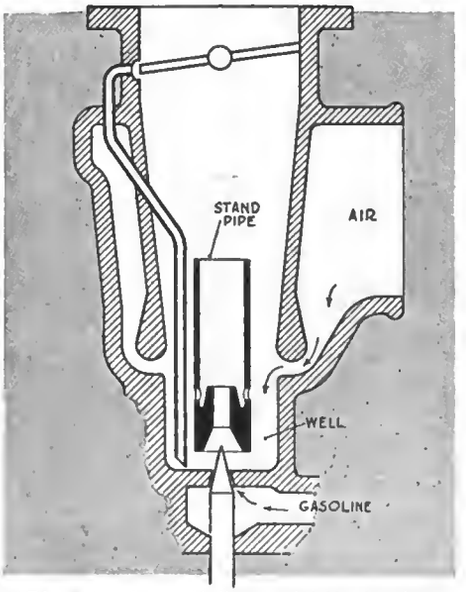


Diagram of new Holley model K, showing provision for feeding mixture direct into manifold above throttle for starting and low-speed work

This same device acts as a help for easy starting. When the engine is stopped the ball valve drops to the bottom, thereby cutting the air supply and causing the primary starting suction to fall on the nozzle and the supply of raw fuel needed is given.

As far as methods of securing easy starting are concerned there have been no innovations during the year. The majority of carbureter manufacturers have come to use an easy starting tube which connects the intake above the throttle directly with the float bowl. This provides the heavy mixture for idling as well as for starting. When the throttle is closed a high vacuum is created even at slow rotative speeds, and this vacuum falls on this easy starting passage taking in a flow of pure gasoline. There are several variations of this basic method used on the different makes.

New Air Regulation Features

Two trends in connection with the starting problem are noteworthy. These are in the increased use of dash controlled air, to help out the automatic devices used on the carbureter, and the use of an increased proportion of heated air. Both these are matters which are up to the car manufacturer as well as to the carbureter maker. The use of jacketed intakes and steering column and dash controls has increased to such a large extent that one carbureter maker, Marvel, has had to bring out a modified design intended particularly for cars with very hot intakes. The modification was made by taking the standard model E design and removing the exhaust-heated jacket. The new carbureter is called model F. It is provided with a full heated air intake and it is claimed that with a well-heated intake and this preheated air, the carbureter is particularly suited to the low grades of fuel now in use.

Low Speed Performance Problems

While the demands for acceleration and easy starting have been high, it is doubtful if they have been as difficult to meet as the low speed performance requirements. When the eights and twelves began to show 3 and 4 m.p.h. on high gear, with ability to accelerate from that speed advantageously, the makers and users of sixes and fours, regardless of the fewer impulses per revolution, demanded quite close to the same thing for their cars, and put the matter up to the carbureter manufacturer.

It has always been recognized that carburetion difficulties are great at low motor speeds, because of the lack of energy at the carbureter jet. The mixing of air and gasoline in the proper condition for combustion is, after all, a mechanical proposition. It means so much work done, and therefore must involve the factors of load and distance. The energy supply is provided by the vacuum or suction. It is utilized in breaking up the gasoline, in drawing in the air, and carrying the combined charge into the intake manifold.

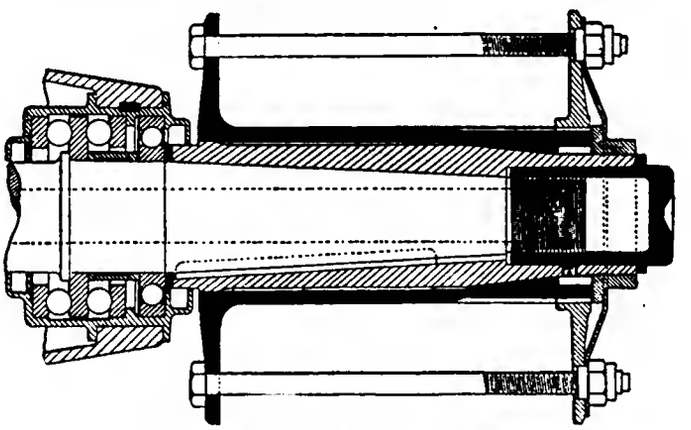
When an engine is turning over slowly the gas is not pouring into the cylinder at a high rate of speed, and naturally the kinetic energy necessary to break up the fuel is lower just at the time it is necessary to have the fuel well broken up to provide a good explosion for low speed work. By various means carbureters are arranged to give a richer mixture at these low speeds so that what air is drawn in will be thoroughly saturated with the gasoline vapor.

Elsewhere the different types of carbureters are discussed individually. The constructions of carbureters are in as many different forms as there are carbureters. The problems all have to meet are the same and the foregoing will show what these problems are and how, in general, carbureter manufacturers are meeting them.

A German Aeroplane Propellor Hub

THE Aeronautic Engine Division of the Standards Committee of the Society of Automobile Engineers has been devoting considerable attention to the design and possible standardization of propeller hubs. At the first meeting it was suggested by Howard E. Coffin that a quick-detachable device similar to that of the Rudge-Whitworth wheel might be used and shortly afterward almost precisely this idea was patented by the Rolls Royce of England.

The accompanying illustration shows an application made to the British patent office by a German company shortly before the war. It will be noticed that there is a bush secured to the shaft by a key and a nut and that the actual propeller hub fits over the bush. Driving is done by teeth cut on the outer end of the brush and on the inside of the hub. These teeth are tapered so that when the hub is locked into position by the securing nut there can be no shake.



A German design of aeroplane propeller hub

Few Changes in Carbureter Design

Four Fundamental Types Still Unaltered—Two New Carbureter Constructions—Principles in Use Are Greatly Intensified as Compared with Models of a Year Ago

INDIVIDUALLY, carbureters have not been changed materially during 1916. The four fundamental types described in THE AUTOMOBILE classification of a year ago still hold true. Up to the date of going to press there are two new carbureters which differ materially from the products of the same makers of a year ago, and even these are not changed in basic principle as much as in mechanical structure.

Along the line, however, there have been refinements which are more in the nature of intensifying the principles already in use rather than in the introduction of new ones. The increased demands of the public and, in turn the car manufacture, on one hand, and of the descending grades of fuel on the other, have made necessary alterations which carry out to an even greater extent the purposes which were clearly defined in carbureters a year ago.

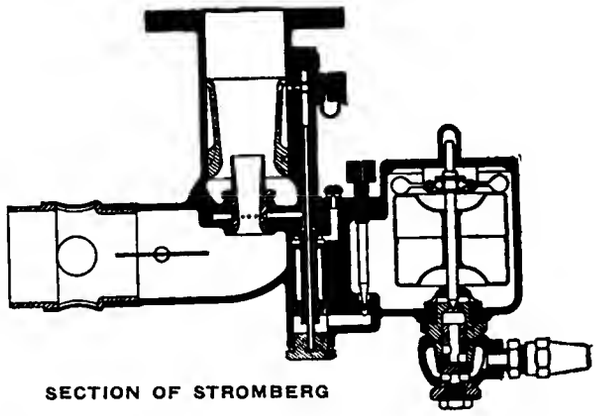
A greater amount of heat, a finer division or atomization of the fuel and a higher velocity of the mixture are the three basic improvements. All three of these can be traced directly to the heavier fuel to a greater extent than to the higher demands of the manufacturer, although both play their parts.

Three types of carbureter are almost equally popular. The air valve type, in which compensation for varying throttle openings is made by the air valve, has 28 per cent. The metering pin and compensation jet classes each have 25 per cent. The expanding type numbers 11 per cent, and the miscellaneous groups, which are not distinctively under any of the above heads has also about 11 per cent. There are some carbureter manufacturers whose products fall under more than one of the above classifications.

While the air valve type is numerically slightly stronger than any of the other classifications, the compensating jet class has gained two powerful recruits during the year. Stromberg is just adding a new carbureter of this type whereas its former designs were of the air valve class. There is also the new Holley which belongs under this head.

Differences in Stromberg

The new Stromberg compensating jet carbureter is a plain tube type, all air being preheated and taken through a straight, uninterrupted tube. It is made in both horizontal and vertical types and in style adapted to passenger cars, as well as constant load vehicles, such as trucks, marine engines and tractors.



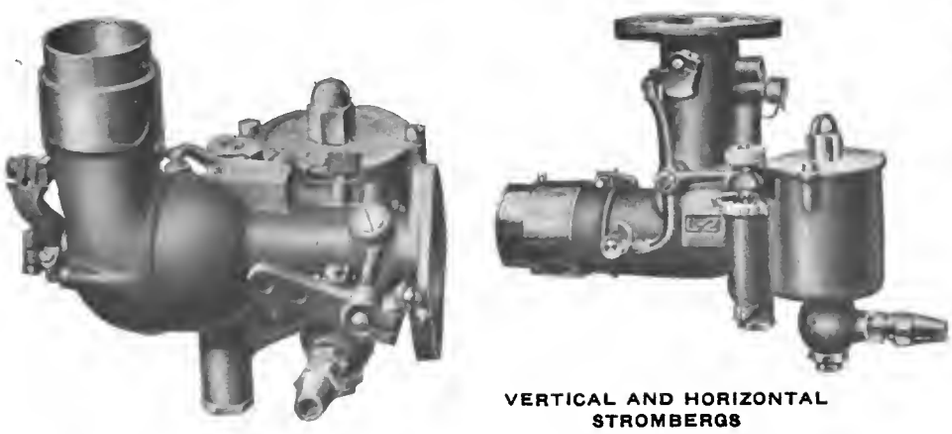
SECTION OF STROMBERG

The new plain tube carbureter differs from the previous types of Stromberg, particularly in what the Stromberg company calls an air-bled jet. In this the air is introduced into the gasoline before it emerges from the jet. The jet has a series of holes drilled around the throat of the venturi. There is also an arrangement for supplying a small quantity of gasoline above the throttle in idling.

Three features are incorporated in the new carbureter to meet the demands for easier starting, better idling, and acceleration with low grade gasoline. The first of these is the air-bled jet which consists in the introduction of a small, measured amount of air into the gasoline jet before it sprays out into the main air passage. This air forms a series of small bubbles which atomize the fuel and break the surface tension, causing it to flow readily at a low vacuum. The introduction of the air is dependent upon the suction in the manifold and thus the flow corresponds to the vacuum in the intake and is proportional to the air flow through the plain tube.

Referring to the sectional view of the carbureter, it will be noted that gasoline leaving the float chamber through a regulating orifice rises through a vertical channel, while air drawn in by suction through the protecting cap discharges into the gasoline channel or air-bled jet, breaking up the gasoline which issues in a number of small jets into the high velocity air stream in the venturi passage.

The second feature is the accelerating well. A small pool of gasoline is kept in communication with the main fuel passage so that at low throttle a supply of gasoline accumulates here and is held ready to supply the needs of a quick throttle opening for acceleration. When the extra demand is relieved, the gasoline in the well again returns to the normal level of the



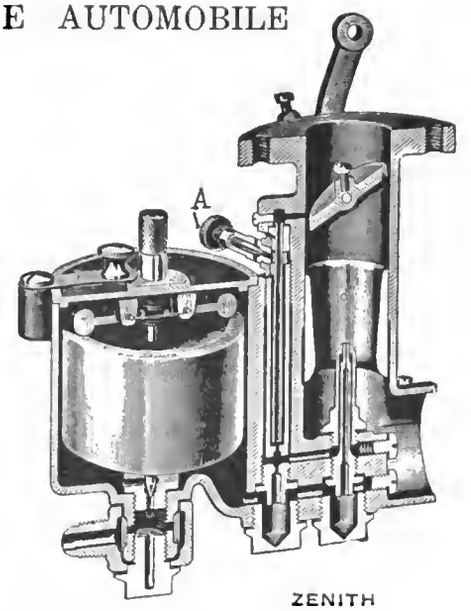
VERTICAL AND HORIZONTAL STROMBERGS

fuel in the float chamber of the carbureter.

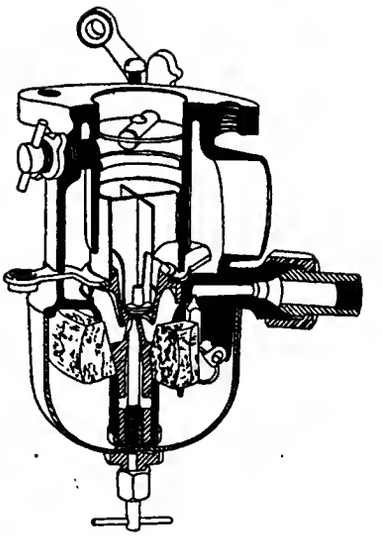
The third feature of the new Stromberg is its idling arrangement by means of which at closed throttle a small quantity of mixture flows directly into the manifold above the throttle so that the suction at idling speeds is sufficient to carry into the intake a column of gasoline from the float chamber.

Starting with fully closed throttle, the carbureter first draws gasoline from the small idling opening above the throttle. Then, as the throttle is opened further, gasoline is drawn from the main orifice into the venturi in the plain tube. At high speeds the air velocity through the venturi in the plain tube is so great that practically no fuel passes through the idling nozzle.

An economizer has been added to the Stromberg carbureter which is designed to produce a richer mixture needed for power at wide open throttle. This is a T-shaped part, having at its upper end a roller resting on a cam which turns with the throttle, and its lower end resting on a second cam operating the main air shutter. The horizontal portion of the T ends in a shoe upon which rests the adjusting nut, controlling the high speed gasoline meter. The shape of the cam on the throttle is such that the needle is raised slightly at closed throttle, lowered for ordinary driving positions ranging from 15 to 35 m.p.h., and raised again as the throttle is opened for speeds above this. A rich mixture for starting also is provided by cam on the main air shutter which raises the needle slightly, giving a rich mixture.

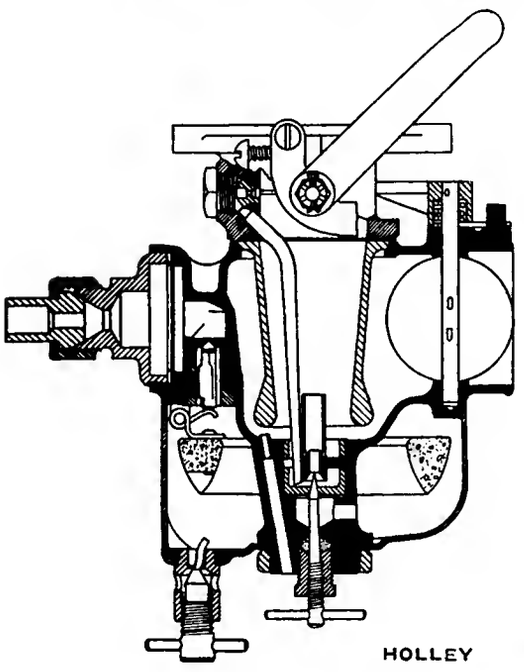


ZENITH


JOHNSON

New Holley Instrument

The new Holley compensating jet carbureter is an improvement over the previous Holley in that it has an increased capacity with decreased fuel consumption. The new model is known as K and the model G, Ford type, and the HA are continued without change, except for detailed alterations in the float mechanism, giving a better fuel control. The mixture flow is regulated by the vacuum at the jet, the intensity of which is controlled by the amount of throttle opening and by the varying positions of the actual air throat in the choke tube from which it is transferred to the jet by means of a standpipe, the constructional being shown in the illustration. The standpipe extends up from an accelerating well, in which gasoline lies in a pool for use when throttle is closed.


HOLLEY

As the throttle is opened wider, the gasoline does not have time to fill the well and hence a mixture of air and gasoline is taken up. The wider open the throttle, the greater the proportion of air, giving the compensation effect for high speeds. The only adjustment is the needle valve at the bottom which governs the flow of gasoline into the well.

The Ford type is the same as the above in principle but has no standpipe. It has, however, a well and all the Holley models have an easy starting tube which leads the gasoline from the well to a point above the throttle. There is also a dash-operated choke on the air line.

Zenith Unchanged

No new Zenith carbureters have been introduced during the past year. The models which are being continued over are L, O, HP and OD (Duplex). The only alteration on these is that on the Duplex type there are individual butterfly adjustments.

The flow in the mixture in Zenith carbureters is accomplished by regulation of the nozzle opening and by regulation of the air supply. This brings the carbureter into the compensating jet class. Uniform vacuum is maintained in venturi and elements depended on to secure vaporization of low grade fuel are, finely divided jet spray, high velocity and heat.

The carbureter has as a primary the fixed nozzle in the venturi. The secondary jet surrounds the primary and feeds fuel through the same venturi. The secondary jet draws its supply of gasoline from a well at the bottom of the easy starting tube. At idling speeds this tube is full of gasoline up as far as the level in the float chamber, thus feeding a rich mixture. At running speeds the gasoline in the tube is exhausted and the flow is sucked through the well passage into the secondary jet along with a supply of air. There is an idling adjustment on a needle valve and no other adjustments on the carbureter.

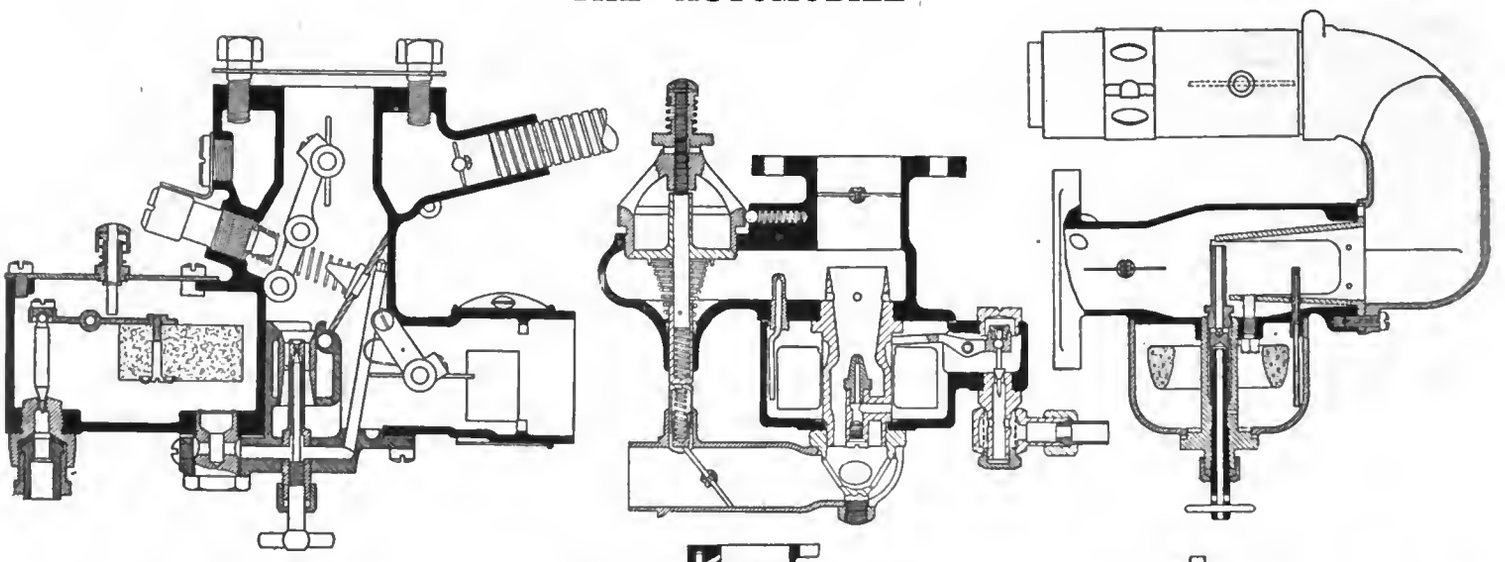
In buying Zenith carbureters the make and year of the engine should be known as the jets and choke passage must correspond. As in all carbureters the intake should be the same diameter inside as the carbureter. There are no special points in installation which do not apply to all carbureters.

No New Johnson Models

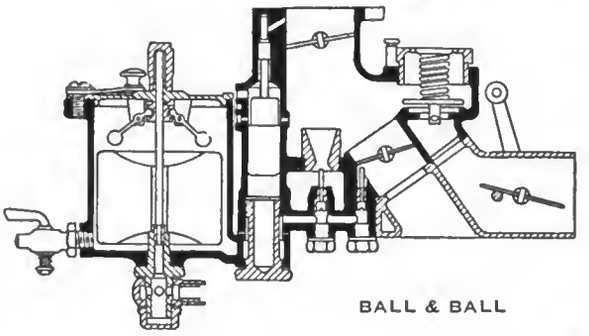
No new models have been added to the line of Johnson compensating jet carbureters. In this, the fuel flow is governed by an automatic sleeve air valve in a cylindrical mixing chamber. The cylindrical sleeve is concentric and carries a small plate at the bottom which regulates the jet passages and governs the mixture. In operation, suction of the engine raises the sleeve, allowing it to float automatically at the proper level to secure the correct jet area. There is a dash choke which rotates the strangling tube, shutting off all air.

Marvel Adds New Model

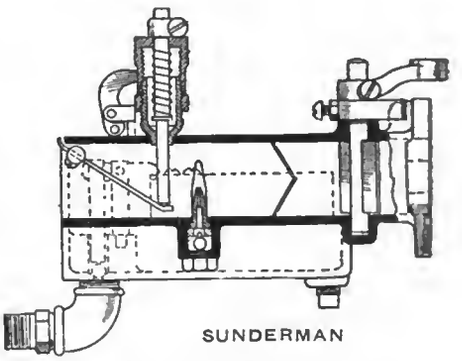
A new compensating jet model, known as F, has been added by the Marvel company. As far as the carburetion



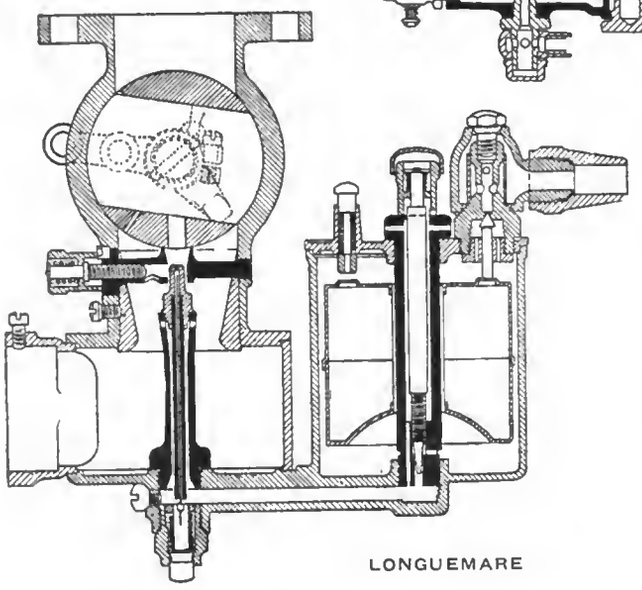
ABOVE FROM LEFT—MARVEL, FLECHTER AND TILLOTSON



BALL & BALL



SUNDERMAN



LONGUEMARE

elements are concerned this is the same as the previous model, E, but it is designed for engines with hot intakes and consequently it is made without the exhaust-heated jacket used on other Marvel carbureters. In addition to the new model, the standard model E and the model N Ford type have been continued with improvements. The alterations are in the nozzles, jets and air valves, which increase the velocity and at the same time atomize the fuel more finely. The fuel flow is regulated by an auxiliary high speed jet which is uncovered by the auxiliary butterfly air valve. The fuel is vaporized by the spray nozzle jet in the venturi and by the application of heat.

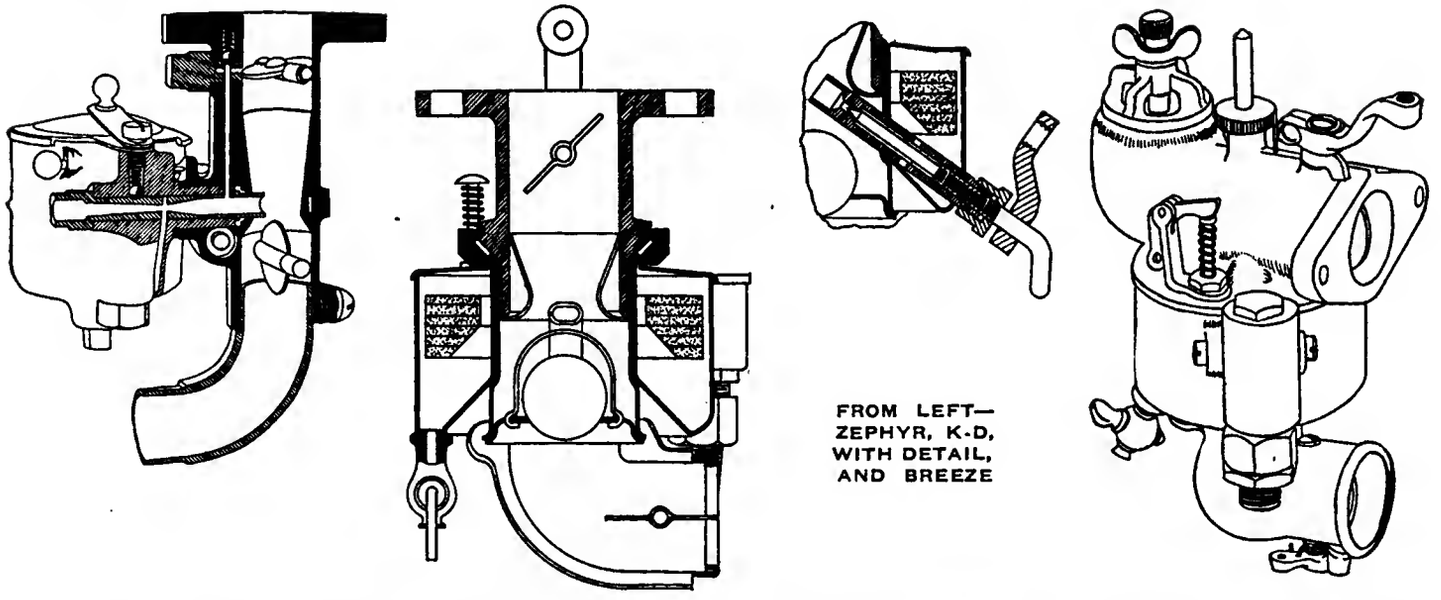
Ball & Ball Two-Stage Type

An interesting compensating jet model is the Ball & Ball, which its manufacturers call a two-stage instrument. It is really two carbureters in one, the primary being made up of a simple jet in a venturi passage. The second stage comes into play when the throttle is open and is made up by an independent air passage containing a separate air valve which uncovers the compensating jet. For easy starting, there is a passage which leads from the float bowl to a point above the throttle. In this passage there is a plunger which acts as a pick-up device. As the throttle is opened the vacuum in the intake passage is broken, allowing the plunger to fall and causing gasoline to gather above it. This is immediately drawn through the pick-up passage, giving the desired mixture for acceleration. There are no adjustments on this carbureter.

Tillotson, Flechter and Longuemare Unchanged

Three other carbureters, the Tillotson, Flechter and Longuemare, which are in the compensating jet class are unchanged. The Tillotson, which is known for its use on the Willys-Overland cars, has added a new model, however, which is simply the previous model B converted into a vertical type instead of being horizontal. In the Tillotson carbureters, a uniform partial vacuum at the fuel nozzle is maintained by means of two easy-yielding flexible reeds mounted on a cage designed so that the maximum opening takes care of the volume required to fill the combustion chamber at maximum speed. When the reeds are seated the primary nozzle supply is located in a small choke passage to give the highest possible vacuum at low throttle openings. The virtual effect of these flexible reeds is to give a variable venturi. only one air inlet is used so that a sufficient amount of heat is supplied for vaporizing the heavy fuel.

In the Flechter carbureter, the mouth of the venturi inclosing the main nozzle is carried up higher than the compensating nozzle. In operation the primary nozzle takes care of low speeds and when the throttle is open the auxiliary air valve drawn air passed the compensating jet. The latter leads into a well which is open to atmospheric pressure, so that at high speed air is taken through this jet, while at lower speeds gasoline also enters through it. This gives the necessary compensation.



FROM LEFT—ZEPHYR, K-D, WITH DETAIL, AND BREEZE

In the Longuemare, the main jet is shut off with closed throttle. As the throttle is opened the main nozzle comes into use and a further opening draws a mixture of air and gasoline through the supplementary nozzle. Thus, the compensating jet is directly functioned by the throttle.

Sunderman a Compensating Jet Type

Sunderman carbureters belong in the compensating jet class. There are two tapered nozzles at right angles to the air flow and the passage of the air past them creates a high vacuum directly at the nozzles. The mist thus formed is further broken up and gasified by passage through a screen.

In operation, as the motor is started, the suction raises the air valve which is held closed merely by gravity. The valve opens just sufficient to permit the air to sweep over the lower of the two nozzles. As the engine speed increases, thus increasing the suction, the air valve raises higher, thus bringing into play the second nozzle which is higher.

Air Valve Types Are Most Numerous

INCLUDED in the air valve types are the Zephyr, Air Friction, Browne, Branford, Breeze, Shain and K-D. Of these, alterations have been made during the year by Zephyr and Air Friction. The Branford, which at present is supplied only in the Ford size, will be made in all sizes after Jan. 1, 1917, without change in principle.

The air valve carbureters are probably the most simple of all types. Either automatically or mechanically an auxiliary valve opens at higher speeds, decreasing the richness of the mixture to take care of the needs of increased speeds. Primarily, the auxiliary air valve is necessary to relieve the vacuum at the main jet caused by the increased velocity of the air current. As engine speeds increase beyond 1000 r.p.m. the auxiliary air valve become necessary, and it was from this type that the inspirations for the more complicated automatic devices were drawn.

Zephyr Adds Ball Valve

The Zephyr is a plain tube instrument which has been refined this year by the addition of a ball valve at the bottom of the tube. The object of the change is to put more suction on the gasoline jet, thus securing better atomization of the heavier gasoline. The standard Zephyr type without the ball valve is being continued. A uniform partial vacuum is maintained by the venturi shaped air passage, through which the air flows at right angles to the main jet. In the new model the ball valve is seated at the bottom of the tube with a smaller air valve above it, so that primary air is taken above the ball and the auxiliary air secured by lifting the ball with the vacuum in the intake. The air through the primary opening is heated, and through the opening below the ball is cold.

The atomizer and jet runs from the float bowl into this air passage at right angles and the velocity of the air over the interior end of the atomizer creates sufficient vacuum within it to spray the fuel into the venturi-shaped mixing chamber. The atomizer has four different jet openings which line up with the intake from the float chamber. The adjustment is made by turning it until the proper opening is in line. There is also a throttle jet which is in the form of a tube running above the throttle, acting as an easy starting device and idling feed, on closed throttle. A starting shutter in the bottom of the air tube throws all the suction on the atomizer and insures a good starting mixture.

Browne Has Changeable Intakes

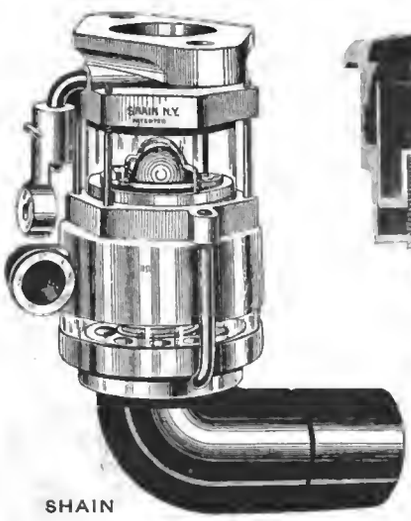
Browne carbureters belong in the air valve class though the air valve in this case is controlled directly by the suction in the venturi. The auxiliary air valve is an aluminum cup held on its seat by a spring and sucked open in proportion to the speed of the engine by the rush of air passing and opening directly opposite the fuel nozzle. Therefore, any change in the fuel flow automatically changes the quantity of air mixed with the fuel. The internal construction of the Browne is scientifically proportioned to the requirements of the motor. The size of the venturi and of the auxiliary air inlet is changeable, and is determined by the piston displacement of the motor.

Breeze an Air Valve Construction

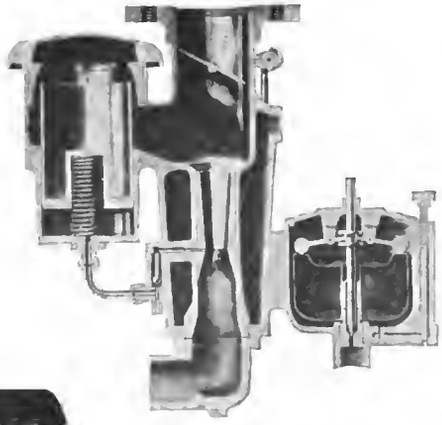
The Breeze carbureter is a simple air valve type. The incoming air passes through a venturi inclosing the fuel nozzle so that the suction determines the quantity of fuel drawn through the nozzle. As the mixture would be too rich at high speeds without the addition of more air, there is an auxiliary air valve controlled by a spring.

Air Friction Is Unchanged

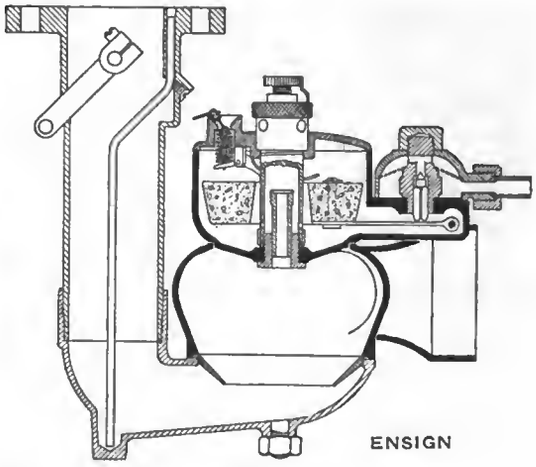
Air Friction carbureters are of the air-valve type in which the auxiliary air valve maintains the proper proportions of



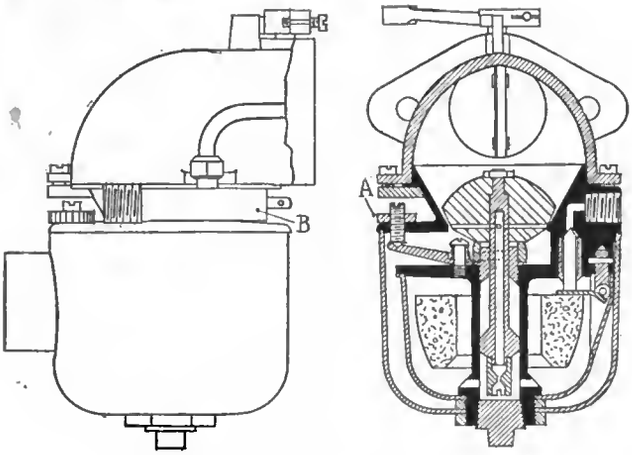
SHAIN



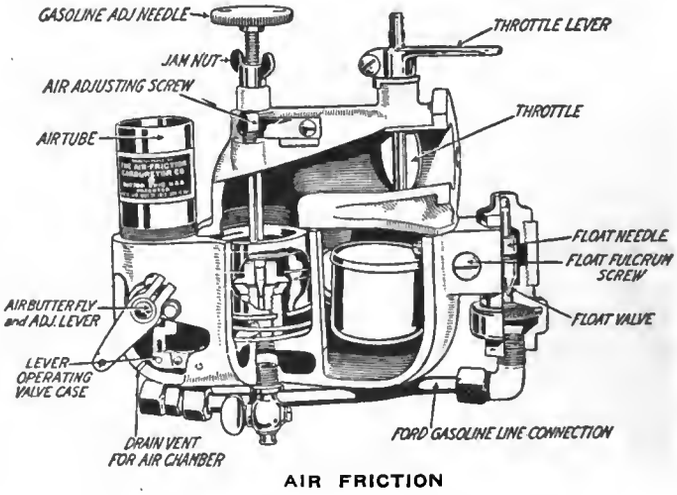
BROWNE



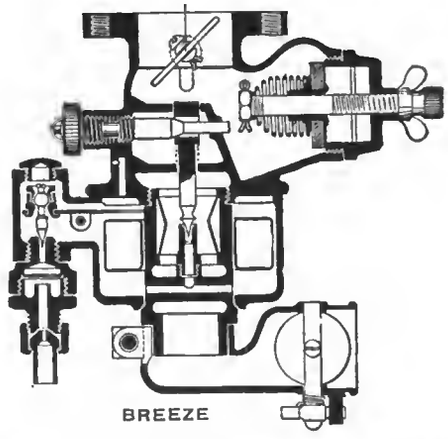
ENSIGN



TWO VIEWS OF BRANFORD



AIR FRICTION



BREEZE

gasoline and air. There has been only one change in this carbureter for 1917 and this consists in an improvement in the spray nozzle, holes being drilled in the lower collar.

K-D Has One Adjustment

Belonging in the weighted air valve class, the K-D is a simple instrument in which there is but one adjustment. Air entering the intake lifts a ball which permits the proper amount of air to enter the carbureter in proportion to the speed of the engine. As the air enters it picks up fuel from a single nozzle which projects into a venturi.

Shain Uses No Float

The Shain carbureter is a combination of weighted air valve single jet types. The jet is normally closed by a bronze ball which is raised off its seat by the rush of air thus permitting a certain quantity of fuel to mix with the air. There is no float, the ball over the jet preventing leakage of fuel when the motor is stopped.

In operation, the rush of air causes the ball to rotate and thus to throw out a thin mist of gasoline which is mixed with the air, which also is rotating, and thus passes on to the cylinders.

Branford Employs Constant Vacuum

The Branford carbureter belongs in the constant-vacuum weighted air valve class. The fuel is drawn up through the center of this weighted air valve and issues from orifices around the circumference of the valve where the velocity of the air is greatest. Inasmuch as the amount of fuel picked up is governed by the velocity of the air passing the fuel nozzles and the velocity in turn is controlled by the vacuum which remains practically constant, the quality of the mixture does not change with the change in volume required by the motor.

At present but one size for Fords is made but at the New York shows there will be on exhibit a full line operating on the same principle and intended for all makes of cars.

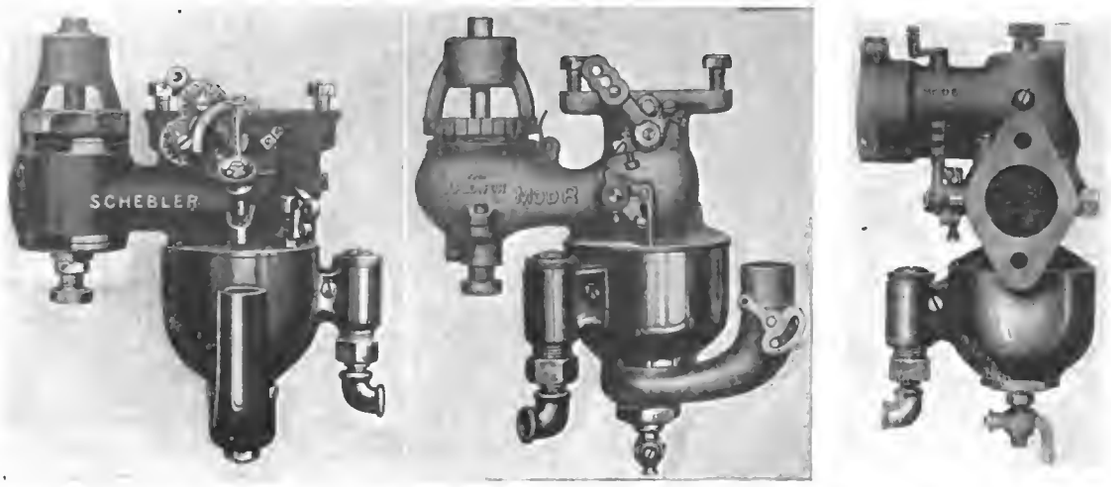
Ensign Is Different

The Ensign carbureter is radically different from anything else of the kind. The mixing chamber is directly beneath the float chamber. Air enters the mixing chamber and is converted into a whirling current which centers about the fuel inlet. Suction on the fuel inlet draws fuel into the air where it is thoroughly mixed. Admixture is assisted by the passage of the mixed gasoline and air through a constricted area before it enters the outlet to the manifold.

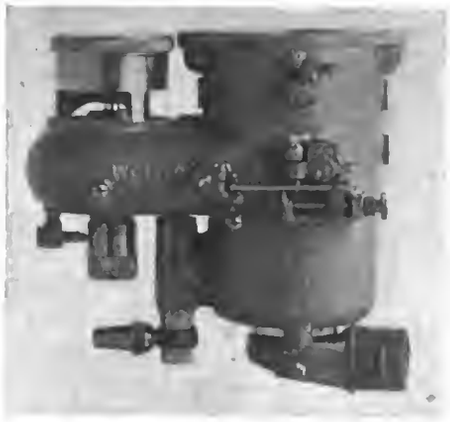
To permit the richer mixture required by extreme low running there is an unbalanced butterfly valve in the intake. This is horizontally placed and when the motor is idle hangs down so that the intake is partly closed. The slowest air movement causes it to shift its position so as to increase the amount of air admitted. It affects the working mixture only at extremely slow speeds.

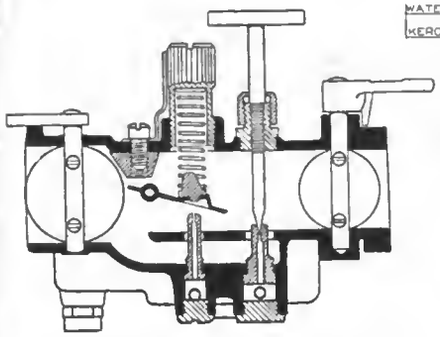
The carbureter is made in three types, for gasoline, distilate and heavier fuels and is made in all the usual sizes from 1 in. to 2½ in. varying by ¼ in. sizes.

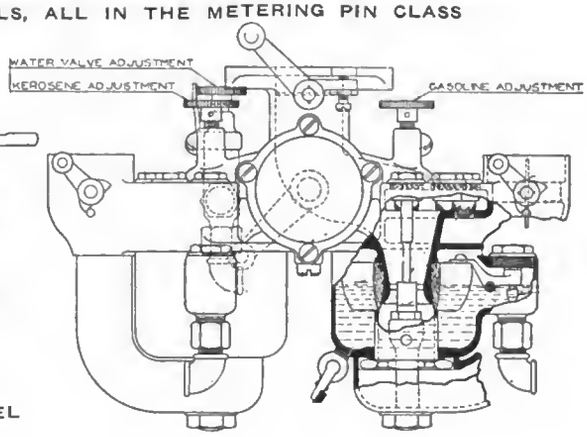
Some Standard Carbureter Designs



THREE SCHEBLER MODELS, ALL IN THE METERING PIN CLASS



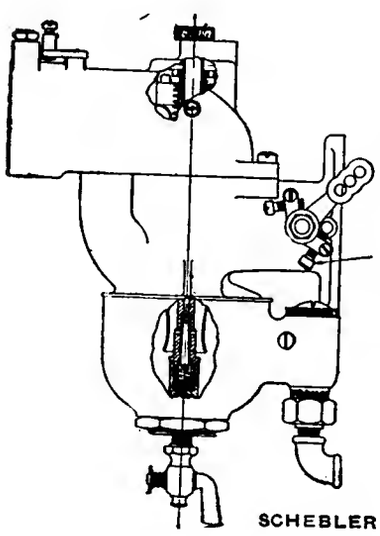




FROM LEFT, WEBBER, MARVEL AND KINGSTON

Carbureters of the Metering-Pin Class

SOME of the best known carbureters used on up-to-date cars are classified as metering-pin carbureters. They include such makes as Schebler, Stewart, Rayfield, Newcomb, H & N, Webber, Heath and Tom Thumb. In this type, the raising and lowering of a calibrated pin governs the size of the fuel opening in proper relationship to the engine requirements.

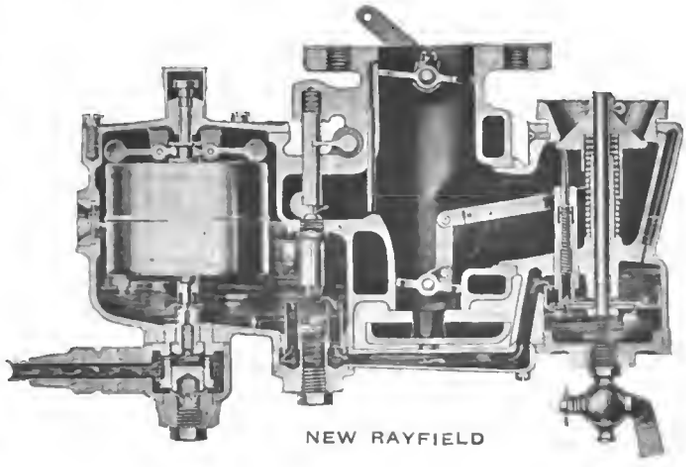


SCHEBLER

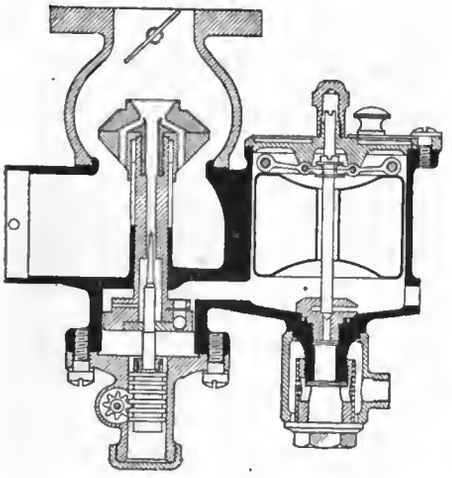
Wheeler & Schebler has a new model which is just about ready for announcement, although details cannot be furnished at this time. Aside from this, there are no new models, those which are carried over being R, L and P. These are what may be termed the overcompensated type in which the needle is lifted to a greater extent than normally would be required giving a wider fuel opening with the proper air compensation secured through the air valve. The needle is hooked to the air valve and when the latter lifts it lifts the needle. This applies directly to the model L and the model T is inverted type of model L and R, in which the needle is depressed to open. Proper atomizing of the fuel is provided by the velocity of the air carrying the fuel off the nozzle, by maintaining a large velocity and by heating the air.

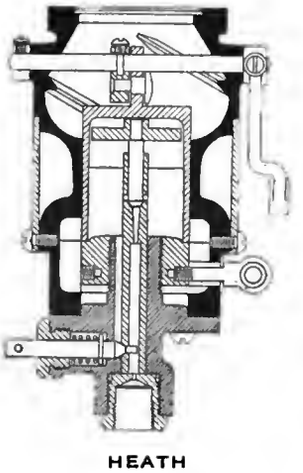
Rayfield Metering Pin Improved

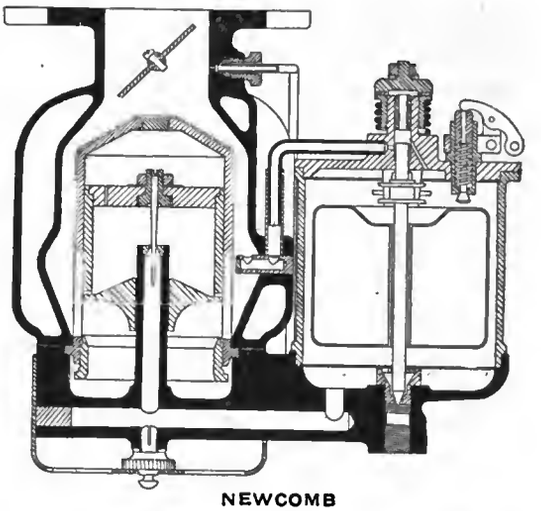
The chief improvement in Rayfield carbureters is the re-

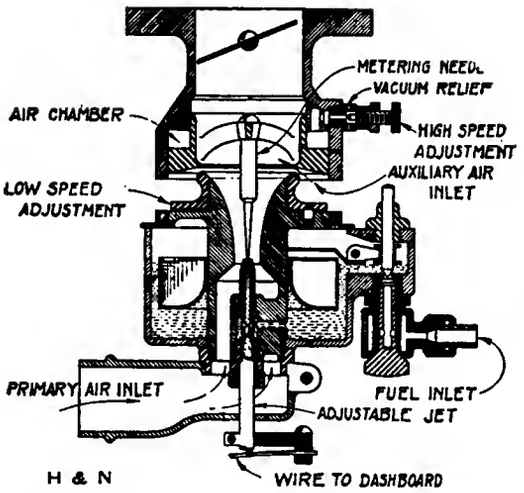


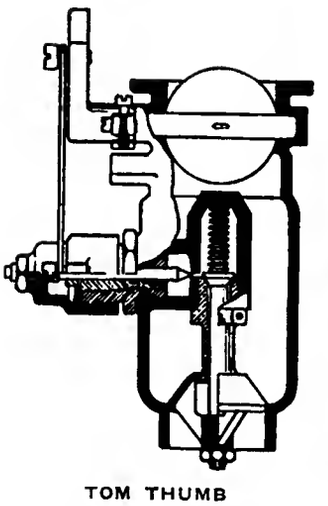
NEW RAYFIELD

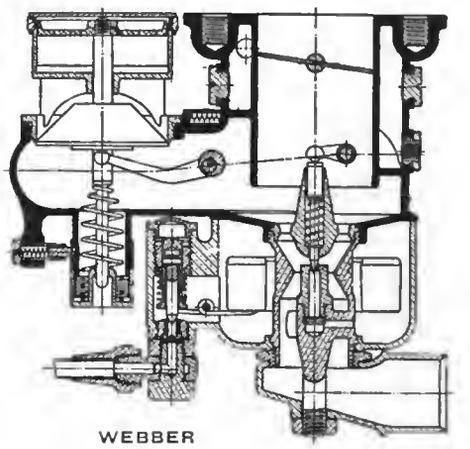












arrangement of the metering pin, which is operated by the upper air valve. Previously this pin was held against the air valve by a spring, and the valve had to overcome the reaction of the spring to operate it. Now the metering pin rides on the dash pot piston, which is on the lower end of the air valve stem, and moves upward and downward with the valve, but without requiring any greater effort by the valve.

Findeisen & Kropf, the manufacturers, are continuing the model G as the chief feature of its production program for 1917. This is not a new model, but the above detail refinements designed to give quicker acceleration and take care of the lower grades of fuel have been made. While the model G is the prominent one of the line, there is a model L the same in every respect except that it is not water-jacketed, which is the horizontal type of the model L.

Rayfield is classified as a metering pin type, but it goes further: It incorporates an auxiliary nozzle, which also has a metering pin which is depressed when the auxiliary air valve opens. Thus by having two distinct nozzles it establishes its right also to be classified as an expanding type of instrument. But Rayfield goes still further in that it combines a pumping action on the gasoline in the auxiliary nozzle whereby a very rich mixture is furnished for acceleration whenever the air valve is opened suddenly. This is accomplished by the piston on the lower end of the air valve stem, this piston working in a dashpot filled with gasoline. Gasoline enters the dashpot above the piston and is admitted to the space below the piston by the disk valve in the piston. When the air valve suddenly opens, forcing the piston downward, this disk valve is closed automatically, forcing or pumbping the gasoline upward through the fuel passage into the nozzle, where it is sprayed into the inrushing air. Only when the valve opens is this pumping function occurring and at other times the gasoline issues through this auxiliary nozzle according to the suction of the motor. Thus Rayfield is a compound of two metering pins in conjunction with the pumping function for acceleration. The dashpot also prevents air valve fluttering.

Stewart Line Unaltered

No new models and no changes are incorporated in the Stewart line. This is a metering type of carbureter in which the vacuum at the jet is controlled by the weight of the metering valve surrounding the upright metering pin. The only moving part is the metering valve which rises and falls with the changes in vacuum. The air chamber surrounds the metering valve, and there is a mixing chamber above. As the valve is drawn up, the gasoline passage is enlarged on account of the predetermined taper on the metering pin and the air passage is also increased propertionately, giving the correct mixture. A dashpot at the bottom of the valve checks flutter. In idling the valve rests on its seat practically closing the air and giving the necessary idling mixture. There is a passage through the valve which acts as an aspirating tube. When the valve is altogether closed the primary air passes through ducts in the valve itself, giving the proper amount for idling.

Newcomb Adds Pulverizing Plunger

Newcomb carbureters belong in the metering pin class and have had a pulverizing plunger added. The reason for this plunger is to more thoroughly mix the gas line and air and thus to assist in its vaporization. In addition to the main nozzle there is an auxiliary nozzle which leads to a point opposite the throttle to assist in starting.

Air entering the carbureter lifts the pulverizing plunger

which in turn lifts the needle out of the nozzle, permitting a certain quantity of fuel to escape into the chamber. This fuel passes through a number of small holes at the bottom edge of the plunger, these holes registering with an equal number of narrow air slots in the plunger tube. The air rushing through these slots mixes thoroughly with the fuel. The head of the plunger and the upper end of the plunger chamber form a dashpot.

Webber Metering Pin Models

Several models of metering pin types of Webber carbureters are made and they all operate on the same general principle. The nozzle is located in a venturi, as usual and the size of the orifice is altered by raising a needle, or pin, out of it through interconnection with the auxiliary air valve. The peculiarity of the Webber is that the mixture of air and gasoline, after leaving the nozzle, is caused to pass through a series of smaller venturi tubes arranged in a circle around the main venturi and above it. This causes the air and gasoline to be thoroughly mixed and vaporized.

H & N Control by Auxiliary Air

H & N carbureters belong in the metering pin class in which movement of the measuring device is controlled by the auxiliary air through an air dash pot. The primary air passes through a venturi, picking up its fuel from the nozzle in passing. For low speeds the fuel nozzle remains unchanged but at higher speeds the opening of the auxiliary air valve raises the metering pin and proportions the gasoline to the air which is flowing through the carbureter.

Heath Employs Vacuum

The Heath carbureter belongs in the metering pin class in which the quantity of fuel is proportioned to the air by the action of an air valve operated by the vacuum induced in the carbureter. In principle there is a valve floating on a tubular shaped column of air which rushes past the six openings of the fuel stud. The position of this valve depends upon the volume of air going through the carbureter and as the valve lifts it lifts the metering pin with it.

Tom Thumb

The Tom Thumb carbureter is a metering valve type in which the opening of the throttle increases the opening of the fuel port around the needle. This is accomplished by a connecting rod which turns the needle on a coarse thread to pull the needle away from the opening. When the engine is at rest a shut-off valve is pushed to a closed position by a spring. When the engine is running this valve is held open by the air valve. The fuel outlet is through six small holes.

Expanding Types Include Interesting Designs

ALTHOUGH the expanding types of carbureters are only 11 per cent of the total, they include some of the most interesting of all the modern designs. Among them are the Master and Carter. In these carbureters the jets come into action as they are needed starting with a primary for idling with jet after jet contributing its share of fuel as the throttle is opened further.

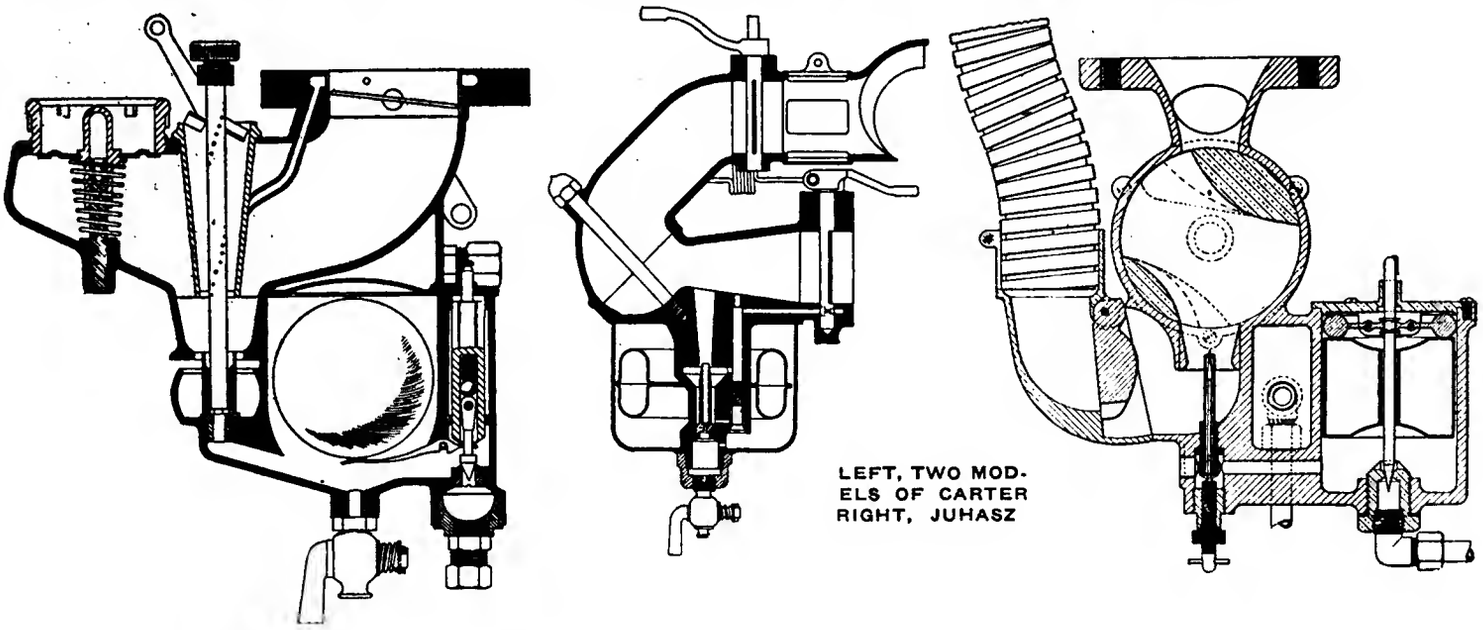
Master in Single Model

The Master carbureter is continued as a single model. Its principle of operation is the breaking up of the fuel by means of a series of jets which vary in number from 14 to 21, according to the size of the carbureter. These are uncovered by opening the throttle which is curved—a patented feature—in order to secure the correct progression of jets. The carbureter has an eccentric float chamber from which the gasoline is led to the jet piece from which the jets stand up.

The tops of these jets are closed until the throttle is opened far enough to pass them, which it does progressively. The air opening is at the bottom and the throttle opening is such that a modified venturi is formed. The throttle is carried in a cylindrical barrel with the jets placed below it and the passage from the barrel to the intake is arranged so that there is no interruption in the flow. For easy starting there is a dash-controlled shutter which closes off the air, throwing the suction on the jets, thus giving a rich mixture.

The only adjustment is for idling and once that is fixed it need never be touched. This is in the form of a screw and regulates the position of the throttle when at idling position. The dash control has high-speed, normal and rich starting positions.

The minor modifications on the Master are as follows: New design brackets for float weights, formerly integral lugs on cover. New steel stamping locked to float chamber with projections which fit into slots. This locks cover on float, whereas a circular wire was used. Float needle now monel

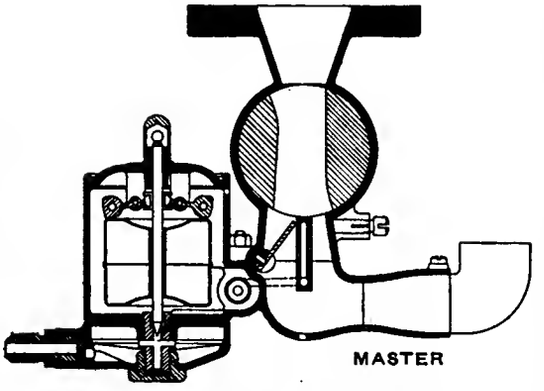


LEFT, TWO MODELS OF CARTER RIGHT, JUHASZ

metal instead of brass. All hot air now instead of semi-hot air.

New Carter Warms All Air

It has been mentioned that the three basic methods for taking care of the heavier fuel are by increased heat, better atomization, and higher velocities. The Carter carbureter uses all three, in its new model L which has just been put on the market. All the air that enters the new Carter instruments is warmed and comes through one opening. It is brought into contact with the various jets by means of venturi tubes permitting the passage of an exceptionally large volume of air to the engine with noteworthy increase in power and passing the jets at a very high rate of speed, thus greatly assisting in the atomizing process.



MASTER

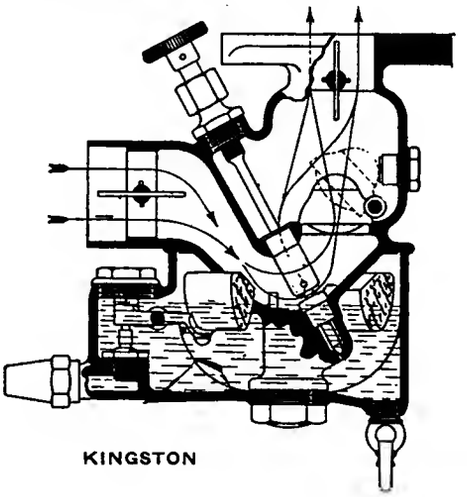
Five Models of Same Type

There are five models of Carter carbureters, all being the automatic expanding type. These are models C, hot water jacketed with low and intermediate adjustments which can be sealed after being set, designed for replacement business, on account of adjustability to varying conditions; Model CH, similar but designed for six, eight and twelve-cylinder cars; Model F, used for equipment purposes and also for special Ford outfit. It has no adjustment except a limited one for the float level. Model H is similar except that it has a steel float chamber. Model L has all the air received through one intake. It is designed especially for speed and power and easy starting. It is used only for equipment purposes except in the Ford outfit.

Juhasz Has Fixed Orifices

The Juhasz instrument belongs properly in the expanding carbureter class. It has a number of fixed orifices which are uncovered progressively as the rotary throttle is opened. Each orifice gives in effect an independent carbureter. At slow speed only one orifice is in operation and as the throttle is opened the second, and then the third, orifice comes into operation.

There are only three moving parts: the rotary throttle, the float and an auxiliary gravity operated air valve to control the admission of air to the middle carbureting chamber. With the throttle closed this valve is on its seat and permits just sufficient air to pass to give a rich mixture for idling. As the speed of the engine is increased the air valve lifts, increasing the flow of air in proportion to the increased flow of fuel and thus keeping the fuel supply in the proper proportion for various throttle conditions.



KINGSTON

Kingston in Miscellaneous Class

NONE of the four classifications given above suits the Kingston carbureter. Several Kingston carbureters are produced. For pleasure car use there is the Model L, which is applied as stock equipment on a large percentage of the Ford cars, and developed with slight changes for application to other cars. In addition, there are a number of models brought out for tractor, marine and stationary service under the general designation of Inclosed type, being designed for operation under conditions in which there is a great deal of dirt and dust in the air, the feature being that all the air is taken in at one intake, which may be protected from dirt. Of these, the Kingston Duplex is the most interesting, as it is arranged to operate both on kerosene and gasoline, having two float chambers, two nozzles, two mixing chambers, with a three-way valve to the manifold. Thus, it is in fact two distinct carbureters, one for gasoline and one for low-grade fuel, having only the connection to the manifold as a common part. This carbureter retains the old Kingston feature of ball valve.

Model L Heats All Air

The model L, which is the later design, has a concentric cork float around a jet placed at an angle from the vertical. The air, all of which is heated, is taken in through a single opening and swept downward through a curved passage whose shape gives it the proper velocity and direction to sweep across the end of the flat nozzle, thus picking up the fuel. The suction is regulated automatically by means of a flapper valve which assists in acceleration and whose action is explained below.

There is always a pool of gasoline at the base of the tube when the motor is not running. This is for the purpose of positive starting. When the motor starts this pool is quickly lowered to a lower portion of the tube, depending on the adjustment of the needle valve and continues to feed from this point until the motor is stopped.

When the motor is running slowly the air valve rests lightly on its seat, allowing no air to pass, consequently all air must pass through the low-speed tube, as the lower end of this tube is close to the spray nozzle and all the air at low speed has to pass this point, the atomized gasoline drawn from the nozzle becomes thoroughly mixed with the air in its upward course.

As the throttle is opened the air valve rises, permitting a small volume of mixture to pass by, due to the suction of the engine. At this point a change in operation occurs. The low-speed tube still continues to deliver a perfect mixture, but is being assisted by the air valve opening. The air must pass across the spray nozzle between it and the low-speed tube. As the motor speed is increased up to its maximum the air valve continues to rise higher, permitting more and more air, which passes across the spray nozzle with no increase in velocity and picking up the gasoline from it.

Industrial Miscellany

Factory

American Auto Trimming Co., Cleveland, has leased quarters in which it will establish a plant.

W. A. McManus and **F. A. Hagner**, of Newark, N. J., have formed the General Safety Signal Co., with a capital of $500,000 to manufacture safety signal devices for automobiles.

Crown Tire & Rubber Co., Omaha, Neb., is about to start the building of the first unit of a tire and rubber plant, for which 5 acres has been purchased in a manufacturing suburb of Omaha. The company will produce 300 tires and 250 tubes daily. It is planned to have the building up and machinery installed about Aug. 1 next. An output of fifty tires a day, both cord and fabric types, will be undertaken in a temporary location.

K. D. Carbureter Co., Cleveland, will erect a new three-story concrete factory, 100 by 250 ft.

Sayres & Scoville Co., Cincinnati, carriage builder, will enlarge its factory to devote its manufacture to automobiles and special motor trucks.

H. P. Miller, Fort Worth, Tex., plans to build a plant at Dallas for the manufacture of an automobile appliance.

Saunders Motor Power Co., East St. Louis, Ill., is preparing to equip a plant for the manufacture of a rotary motor operated with steam, gas or gasoline. J. H. Keys is president.

Midcontinent Tire Mfg. Co., Wichita, Kan., will build the first unit of its plant. This will cost $65,000 and will be two stories, 60 by 280 ft.

Pierce-Arrow Motor Car Corp., Buffalo, N. Y., will erect a sand blast and pickling building of steel construction.

Anger Engineering Co., Milwaukee, will build a plant at Twenty-sixth and State Streets.

Locomobile Co. of America will erect a one-story, 100 by 160-ft. addition.

B. P. Motor Car Co., Peoria, Ill., has been incorporated to manufacture motors for automobiles and other machines. Temporary quarters have been secured at 418 Main Street. A new building is planned on Hamilton Street, to be erected as soon as the old opera house structure is demolished. The officers of the company are as follows: President, E. T. Beatty; vice-president, R. U. Pfeiffer; secretary-treasurer, J. S. Pfeiffer.

DeLion Tire & Rubber Co., Trenton, N. J., is about to erect a three-story, 65 by 175-ft. addition.

Alpha Rubber Mfg. Co. will locate its plant in Genoa, Ill. The company is capitalized at $1,000,000 and will occupy the piano factory in the west end of the city. It will manufacture tires. Seventy-five men will be employed at the beginning. J. A. Berger is president and general manager.

Atwater Kent Mfg. Co., Philadelphia, manufacturer of ignition systems, is erecting a one-story factory building at 4937 Stenton Avenue.

Autocar Co., Ardmore, Pa., recently marked the close of one of the most successful years in its history by entertaining its salesmen and branch managers at the factory. Among those in attendance were W. T. Savoye, New York; J. E. Higgins, Providence; R. P. Page, Boston; M. S. Bulkleym, Los Angeles; K. B. Harwood, Chicago; A. H. Bishop, Baltimore, and A. E. Fisher, Newark.

J. B. D. Resilient Wheel Mfg. Co., Milwaukee, which was organized about 3 years ago to manufacture and market a solid-tire wheel for passenger cars and trucks, has changed its corporate style to the Motor Parts Machine Co. The plant at 675 Smith Street has been extended and enlarged to include the production of a varied line of car, truck and tractor parts for the trade.

The Automobile Calendar

ASSOCIATIONS

Jan. 6-13—New York, Mid-Winter Meeting of Society of Automobile Engineers, Engineering Society Bldg.
Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.
Jan. 9-11—New York City, Society of Automobile Engineers' Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.
Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.
Feb. 1-2—Chicago, Ill., Annual Convention American Assn. of Garage Owners, Auditorium Hotel.

CONTESTS

1917

April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 14 — Des Moines, Iowa, Speedway Race, Championship.
July 4—Tacoma, Wash., Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15 — Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race, Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13—Chicago Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Dec. 9-16—Akron, Ohio, Show for Passenger Cars Only, Market Street Gardens, Akron Automobile Dealers' Show Assn.
Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel, I. R. Gates, Mgr.
Dec. 26-27—Olean, N. Y., Show, Armory Hall.
Dec. 30-Jan. 6—Cleveland Automobile Accessory Show, Dreamland Auditorium.
Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.
Jan. 6-11—Milwaukee Auditorium, Milwaukee Automobile Dealers.
Jan. 6-13 — New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 12-20—Philadelphia, Show, Philadelphia Automobile Trade Assn.
Jan. 9-10 — Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.
Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.
Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 22-27—Manchester, N. H., Academy.
Jan. 22-27—Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jsn. 23-27 — Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 25-27—Asheville, N. C., Show, Asheville Automobile Trade Assn.
Jan. 27-Feb. 3—Columbus, Ohio, Show, Memorial Hall, Columbus Dealers' Assn.
Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Jan. 27-Feb. 5—York, Pa., Show, York Automobile Dealers' Assn.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Jan. 28-Feb. 3—Wilmington, Del., Show, Hotel duPont.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 5-9—Boston, 8th National Good Rosds Show, Mechanics' Bldg.
Feb. 5-10—Bangor, Me., Bangor Automobile Assn., Auditorium.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 12-17 — Louisville, Ky., Show, First Regiment Armory, Louisville Automobile Dealers' Assn.
Feb. 12-19—Indianapolis, Ind., Show, Steinhart Bldg., Indianapolis Automobile Trade Assn.
Feb. 19-24—Grand Rapids, Mich., Show, Automobile Business Assn. of Grand Rapids.
Feb. 14-17—Peoria, Ill., Coliseum, Automobile and Accessory Dealers' Assn.
Feb. 18-25 — St. Louis, Mo., Show, Automobile Manufacturers' and Dealers' Assn.
Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.
Feb. 19-24 — Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.
Feb. 19-24—Bridgeport, Conn., Show, Armory, Coast Artillery Corps.
Feb. 19-24—St. Louis, Overland Bldg., St. Louis Auto. Dealers' Assn.
Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.
Feb. 24-March 3 — Brooklyn, Show, 23rd Regiment Armory.
Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.
March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co. Armory of the University of Ill.
March 3-10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 14-17—Davenport, Iowa, Show, Coliseum Bldg., Tri-City Automobile Trade.
March 18-23—Cedar Rapids, Ia., Cedar Rapids Automobile Trades Assn.
April—Calumet, Mich., Show, Coliseum, Frank Ketchell, Mgr.

Elgin Motor Car Co., Chicago, has completed a ¾-mile test track, over which every car is tested before shipment. The Elgin factory is also located near a steep hill, which provides opportunity to test the hill-climbing qualities of every car.

Sheller Wood Rim Mfg. Co., Portland, Ind., manufacturing single-piece wooden rim automobile steering wheels, is making plans for a factory.

Davis Mfg. Co., Milwaukee, a manufacturer of gasoline engines for trucks, tractors, railway coaches and similar purposes, is reported to be preparing to make important works extensions, made necessary by the extraordinary demand for its products. The new building, it is said, will consist of a shop, 124 by 225 ft., and a pattern shop, 30 by 90 ft.

Elwell-Parker Electric Co., Cleveland, maker of storage battery industrial trucks and tractors, will enlarge its plant by the erection of a four-story building, 60 by 120 ft. This will be a duplicate of an extension built some time ago. A third unit of the same size is contemplated early next year.

Personals

J. F. Douse has been appointed sales manager and advertising manager of the George W. Miller Co., Seattle. Previous to this change Mr. Douse was manager of the Seattle branch of the Fisk Rubber Co. Mr. W. P. Williams will remain as general manager of the George W. Miller Co.

Herbert Dovey has been appointed manager of the Sturgis & Storie Co. of Walla Walla, Wash., agent in Walla Walla for the Buick, G. M. C. trucks and Bull tractors.

H. C. Plow has purchased the Automobile Owners' Accessory Co., Ltd., of Montreal, Can. Mr. Plow, who is known to the industry as "Hy" Plow, was at one time treasurer of the Hartford Rubber Co.

J. E. Morehouse is manager of the Detroit branch of the Scripps-Booth Corp. The branch was recently opened.

George Grow, Boston, used-car dealer, has purchased from the Willys-Overland Co. the four-story building on West Newton Street that had been used by the Connell & McKone Co., eastern Massachusetts Overland dealer, as a service station for the past 5 years.

R. C. Wilson has been appointed general manager of the Columbus Cadillac Co., Columbus, Ohio, succeeding E. C. Moliter. Mr. Wilson has been a director and sales manager of the Standard Motor Car Co. there.

V. A. Seiders has been appointed Southern sales agent for the Bell Motor Car Company, York, Pa., and will cover the States of Virginia, North Carolina, South Carolina, Georgia, Alabama, Florida and Tennessee.

A. B. MacGowan, formerly in the sales promotion department of the Chase Motor Truck Co., Syracuse, N. Y., is now city sales manager for that company at its Philadelphia branch.

D. F. Shanahan of Covington, Va., has joined the sales force of the Chase Company as special traveling representative.

F. L. Terry, who for the past 4 years has had service on S. G. V. and Fiat cars, has taken in a partner, R. E. Hardy, and opened an accessory store at 1441 Bush Street, San Francisco. The firm is known as Terry & Hardy, accessory dealers and Firestone distributors.

H. E. McEldowney of Seattle, Wash., has been appointed agent for the Hendrick's 1-ton truck attachment in Tacoma, Wash., and surrounding territory.

S. W. Dorman has become purchasing agent of the automobile accessory department of the Biddle Purchasing Co., New York.

Jack De Mont, Atlanta, Ga., for more than a year manager of the Willard Storage Battery Co. branch, has been transferred to New York and Al. C. Hyser of Cleveland, Ohio, succeeds him as Atlanta manager.

A. H. Abel, Birmingham, Ala., has become sole owner of the Abel-McCay Wagon Co. and has changed the name to A. H. Abel Wagon Co. In addition to automobile repairing the company will sell Redden trucks.

N. B. Ford, who for 10 years traveled for the Corbin Screw Corp. from its Chicago office, having his headquarters in Kansas City, and who left some 2 years ago to become connected with the Ford Chain Block & Mfg. Co., Philadelphia, has re-entered the employ of the Corbin Screw Corp. as salesman, with headquarters in New Britain and covering the territory formerly traveled by A. H. Harrop.

C. B. Lindeman, formerly Western advertising representative of the Firestone Tire & Rubber Co., has been appointed head of the creative division of the company with offices in Akron.

W. J. Denning has recently been appointed manager of the cataloging and advertising departments of the Auto Parts Co., Chicago.

J. L. Hamilton, secretary of the Bay State A. A., has formed a partnership with Stanley Hall, one of the directors, and it is named the H. & H. Motor Specialties Co., to handle accessories.

W. E. Hennigan, for many years with the Winton New England branch, and Herbert Ramsey, a former Hupmobile man, have joined the sales force of the Harry Fosdick Co., handling the Pathfinder at Boston, Mass.

J. J. Devaux has resigned as Oregon distributor in Seattle for the Chevrolet car in order to take the agency for the Regal car in Lower California.

F. H. Downes has been appointed head of the Smith Form-A-Truck department of Ballou & Wright of Portland, Ore.

W. E. Duersten, formerly production and efficiency expert of the Western Electric Co., and later connected with the Hudson factory, has been named factory superintendent for the Macon Motor Co., Macon, Mo.

O. R. Randall, for 7 years sales manager of the Middle Western and Southwestern territory of the J. I. Case T. M. Co., Racine, Wis., has resigned, effective Jan. 1, to engage in business at Atlanta, Ga., as State distributer for Georgia of a line of pleasure cars, trucks and tractors, the names of which are not yet divulged. Mr. Randall joined the Case Company in 1901, first as agent in Atlanta. In 1909 he was called to the home offices to accept one of the most important posts in the sales organization. His son, E. A. Randall, now associated with the Western Advertising agency of Racine, will become associated in the new venture at Atlanta.

E. A. Jacob succeeds J. W. Wildman as manager of the Des Moines, Iowa, branch for the Portage Rubber Co. Mr. Wildman leaves to take charge of the Chicago Portage branch.

J. B. Brugler has been appointed manager of the new Indianapolis branch of the Racine Horse-Shoe Tire Co., Racine, Wis., which has just been opened at 249 North Pennsylvania Street.

H. P. Nelson has become treasurer and sales manager of Robert Lurie & Co., New York, handling the Metz.

Dealers

Kelly-Springfield Tire Co. has opened a factory branch at 1225 Harmon Place, Minneapolis, succeeding the Boger-Stiess Rubber Co., its agent for 2 years. G. M. Martin, manager for the Firestone Tire & Rubber Co. branch at 1635 Hennepin Avenue, is appointed manager. The territory is Minnesota, the Dakotas, western Wisconsin and western Canada. A. C. Searles is new manager for the Firestone company.

F. B. Stearns Co. of New York announces that the wholesale end of its business is now in charge of the factory branch. The wholesale business was formerly handled by Charles E. Riess & Co., metropolitan distributor of the Hupmobile.

Metz cars will be distributed in Chicago by James Haddie at 729 Lyman Avenue, Oak Park.

Troy motor truck trailers will be handled by the Barden Electric & Machinery Co., Houston, Tex., and by the O'Rourke-Muller Motor Co., New Orleans.

Chalmers Motor Co., Detroit, has issued to all its dealers plans for an effective service inspection. During 1917 each Chalmers dealer or distributor will maintain a Standard Chalmers service car which will be distinguished by its color scheme of red and black. This car will have a red body, black hood and running gear.

Willard Storage Battery Co., Cleveland, has added during the past month about sixty new service stations, making the total up to 831.

Benton County Hardware Co., Rogers, Ark., a wholesale hardware concern, which operates a string of retail stores and travels a number of salesmen, has added automobile accessories to its jobbing line. The company is contracting accessories on a jobbing basis and compiling an extensive catalog.

Packard Motor Car Co., Philadelphia, will build an eight-story steel and concrete service plant, 70 by 185 ft., at Broad and Wood Streets.

Padgitt Bros. Co., Dallas, Tex., has closed contracts for the Texas agency for the Kelly-Springfield and Commerce trucks and for the Babcock and Parry commercial bodies and for the Racine tires.

Cole Automobile Co., Peoria, Ill., has removed from 1812 Main Street to a new location at 103 Ellis Street, and will operate a sales agency, garage and service station. Eugene Hayden is now distributor for the Cole in Peoria and vicinity.

Denver Auto Goods Co., Denver, has taken the Colorado distributing agency for Pennsylvania tires.

R. E. Williams Motor Car Co., Denver, a new concern, has secured the Abbott-Detroit distributing agency for Colorado and southern Wyoming.

The AUTOMOBILE

Vol. XXXV
No. 25

NEW YORK, DECEMBER 21, 1916

Ten cents a copy
Three dollars a year

Advertisers' Index—Next to last page

Stewart Products

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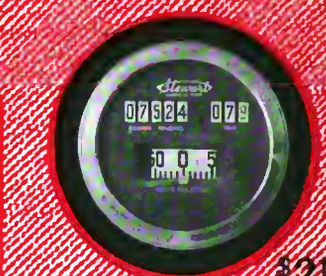
Auto-Meter



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Stewart
Speedometer

ANOTHER WINTER BUSINESS LEADER

All Stewart Products are necessities for winter driving. That is why they are such big sellers every day—week in, week out—in all seasons.

Of these, the Stewart Vacuum System is very important. In winter, a positive, unfailing gasoline feed is necessary to insure quick starting, and smooth running of the motor.

The Stewart Vacuum System maintains a constant supply of gasoline above the carburetor. This insures a perfect gasoline feed; besides, keeps the gasoline warm, which makes starting easy.

Most new cars are equipped with the Stewart Vacuum System. Thousands of old cars are not. The owners of these old cars would quickly install a Vacuum System if some enterprising dealer would point out its advantages, particularly for winter driving.

Here is a big opportunity for dealers to add to their winter business. Drive away the dull-winter-business period by going after this business which is plainly in view.

There is also a big business awaiting dealers on the Stewart Speedometer, Warning Signal, Tire Pump, and V-Ray Spark Plug.

"It will pay you to see that every car is Stewart-equipped"

Stewart-Warner Speedometer Corporation
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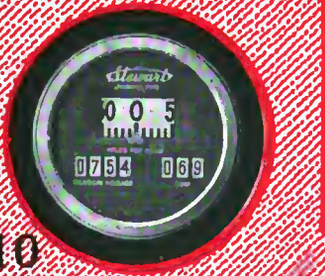

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for Fords

$1

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PRODUCTS

PRESTIGE
QUALITY
SERVICE
SATISFACTION

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Stewart
Vacuum System

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The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, DECEMBER 21, 1916—CHICAGO NO. 25

"Automotive" Saves Industry

Aviation Industry Threatened by Patents Looks to Automobile Example for Salvation

NEW YORK, Dec. 20—The budding industry of aeroplane manufacture has been threatened by a claim from the holders of the Wright patent for the double-acting aileron, much as the automobile industry was threatened years ago by the Selden patent. The Wright patent is not upheld any more strongly than the Selden patent was at first, but it seems that the situation may serve to weld the aviation industry, just as the Selden patent helped to weld automobilism. The patent refers to warping the ends of the wings for stabilizing purposes.

The Wright patent has 6 years to run, and the holders, the Martin-Wright Co., is asking all users of the patent to pay 5 per cent of the *gross* price of their product as royalty. With firms that have taken government contracts this represents all the difference between profit and loss. The near $30,000,000 which the United States Government is going to spend on aeroplanes is enough to establish a free industry that may be of inestimable value to the nation in years to come. The imposition of so great a tax upon this sum at the outset may easily be the equivalent of throttling an infant industry of vast national importance before it has drawn its first full breath of life.

Following the Wright patent announcement the Curtiss company, which owns uncontested master patents covering the hydro-aeroplane, has stated that if one tax is placed upon the industry it will also claim its rights. It is understood that the attitude of Curtiss has been taken partly with a desire to bring matters to a head so that some rational settlement can be reached. The Curtiss patents are of very recent date and, like the Wright double-acting aileron patent, are susceptible to much litigation.

Referred to Government

The matter has been referred by the industry to the Aero Club of America, which has turned it over to the Council of National Defense, since it affects the nation much more than any individuals. The United States Government has decided that the safety of the country is wrapped up with the efficiency of the air services of the army and navy to the extent that it is going to spend huge sums to establish the young industry. The club considers that anything that will restrict the growth of aeroplane manufacture at the present time is inimical to the safety of the nation. For this reason it is putting the matter before a body than can call upon the National Automobile Chamber of Commerce and use its organization for dealing with patent questions; that can deal directly with the contestants as representative of the government, and that is above any possible suspicion of personal favor. The Selden patent took years to settle; the Aero Club hopes that the N. A. C. C. and the Council of National Defense may be able to settle the present problem in as many days as the Selden patent took years.

The automobile industry was not in its early days regarded of national importance. It had no $30,000,000 grant from the government, no huge organizations to look to for support in difficulties. The aviation industry, already helped into existence by the automobile, is going to lean upon its parent in this, the first great problem of its young life.

No doubt what will happen is that the patent holders and those who want to use the patents will get together and settle the question. They will have the experience of the N. A. C. C. to call upon, the prestige of the government to dignify the consultation. Thus an early and satisfactory settlement is to be expected.

Highway Tractor Co. Incorporated

Organization of $2,000,000 Concern Completed—McCutchen Is President

INDIANAPOLIS, Dec. 19—The Highway Tractor Co., capitalized at $2,000,000 and headed by Carl G. Fisher, James A. Allison and Henry F. Campbell, of this city, was incorporated here last week to manufacture tractors with 10-ton drawing power for highway and military use. Work is to be started immediately on a site of 25 acres near the Indianapolis Motor Speedway on the first unit of a plant to cost $200,000. The company expects to have the plant in operation by May 1, employing 300 men, and working on material that has been purchased for the manufacture of 5000 tractors next year.

McCutchen Heads Co.

Charles G. McCutchen, who recently resigned the presidency of the Ross Automobile Co., of Detroit, will be president of the Highway company, and Mr. Fisher will be secretary-treasurer. Plans call for the construction of a concrete and steel plant 200 by 400 ft. The tractor will feature many of the inventions of B. R. Parrott of Jackson, Mich. A. E. Schaaf of Poughkeepsie, N. Y., recently with the Fiat Automobile Co., and formerly manager of the Pope-Toledo Automobile Co. of Toledo, Ohio, will be factory manager. Other stockholders in the company are Louis Goodhart of St. Louis, Dr. M. N. Stewart and Forrest C. Badgley, both of Jackson, Mich.

The company announces it probably will build a tractor with a 5-ton drawing power in the near future, and later may enter the farm tractor field. The price of the 10-ton drawing power machine will be approximately $1,250.

400 at Manufacturers' Banquet

Speeches by Prominent Men in Automobile Industry Enthusiastically Received

DETROIT, Dec. 15—The Manufacturers' Banquet, given by the Society of Automobile Engineers, last night witnessed the attendance of more than 400 guests and members, and a most enthusiastic spirit blended with serious discussion and wholesome and enjoyable entertainment.

Brilliant, substantial and amusing speeches, an orchestra, several singers, and a moving picture combined with the dinner served to make the evening one of solid pleasure. Among the speakers were Coker F. Clarkson, general manager of the S. A. E.; Job Hedges, of New York, Captain L. E. Goodier, Jr., of the aviation service; H. M. Leland, president of the Cadillac Motor Car Co., Russell Huff, president of the Society of Automobile Engineers, and Howard Coffin, director of the Hudson Motor Co. K. W. Zimmerschied, engineer for the General Motors Co., acted as toastmaster.

Growth of the S. A. E.

D. McCall White, chairman of the Detroit section, introduced Mr. Zimmerschied, who made an entertaining speech and introduced Mr. Huff, who discussed the future outlook for automobile engineers. Mr. Clarkson told of the growth of the Society and of the probable amalgamation of other societies working in similar fields with the Society of Automobile Engineers. Mr. Leland commenced his address with a number of humorous stories and later developed the serious and important subject of industrial unrest and its possible consequences. Mr. Hedges in a speech filled with amusing critical shafts aimed at different guests and members present, brought rounds of laughter, and completed his discussion with a thoughtful talk on the need of patriotism, the deplorable lack of sentiment that exists in the country to-day and its importance above more material things. Captain Goodier and Howard Coffin discussed at length the subject of aviation and the general need for industrial preparedness. Captain Goodier told of the vast increase In appropriations for army aviation and of the gap it caused in the number of men and machines required, and wound up his address with an appeal to the engineers and manufacturers to join in the aviation reserve with their mental and physical strength and manufacturing resources. Mr. Coffin told of the aviation work he had witnessed at General Pershing's camp. He stated that aviators made many daily trips over mountains, requiring 2 days' travel in an automobile, and carried the mail from the camp to its destination in less than 70 min. He told of a route proposed over the Lincoln Highway which will be dotted with landing places within the next 8 months and will be known as the Lincoln Aereo Highway, and predicted that the use of aircraft of all sorts will be a common matter in the very near future.

In the course of his discussion, Mr. Coffin pointed out the vast quantity of aircraft now in use in the war and compared it with the few machines in the army of this country, showing how slow our manufacturers of aircraft and other war supplies are in the making of them, and urged the makers of automobiles to throw their resources into the work in accordance with the plea of Captain Goodier.

The evening wound up with the display of the moving picture The Eagles Wings, which dwelt on industrial preparedness, and was discussied, while shown, by Mr. Coffin.

Among others who attended were W. C. Anderson of the Anderson Electric Co., Hugh Chalmers of the Chalmers Motor Car Co., R. D. Chapin, of the Hudson Motor Car Co., George Dunham, John F. Dodge, of Dodge Brothers, Garvin Denby, of the Denby Motor Truck Co., H. W. Ford, of the Saxon Motor Car Corp., Professor Walter T. Fishleigh of the University of Michigan, Alfred Giauque of the Puegeot Co., of Paris, Christian Girl, president of the Perfection Spring Co., H. M. Jewett, president of the Paige-Detroit Motor Car Co., Paul E. Kelecom, of the Peugeot Co., of Paris, F. E. Moscovitz of Nordyke & Marmon, Percy Owen, of the Liberty Motor Car Co., W. C. Rands of the Motor Products Co., and Artemus Ward, Jr., of the King Motor Car Co.

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Meyer Resigns from Maxwell Directorate

NEW YORK, Dec. 19—Eugene Meyer, Jr., has resigned from the directorate and executive committee of the Maxwell Motor Co., Detroit. A meeting of the directors will be held soon to elect a successor. Mr. Meyer, who is the head of the Stock Exchange house of Eugene Meyer, Jr., & Co., has been associated with the Maxwell company since its organization.

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Heater Heads Bucyrus Rubber

BUCYRUS, OHIO, Dec. 14—Philip Heater was elected president of the Bucyrus Rubber Co., this city, to succeed R. O. Perrott, who resigned 6 months ago. The balance of the officers were re-elected at the annual meeting, as follows: Vice-president, George Donenwirth; secretary, C. P. Mador; and treasurer, W. A. Blicke.

$1,000,000 Additions for Buick

To Produce 750 Cars a Day—Gross Sales for 4 Months Total $57,516,876

DETROIT, Dec. 16—The Buick Motor Co., Flint, Mich., will be enlarged by an expenditure of $1,000,000 to enable it to produce 750 cars per day. The company is producing 550 cars per day at present.

Gross sales of the General Motors Corp. for the four months ending Nov. 30 were $57,516,876.12 and net earnings for that period were $9,195,733.64 applicable to the common stock. November business was the greatest in the history of the company.

—

$1,010,000 Back Royalty for Perlman

NEW YORK, Dec. 18—The Perlman Rim Corp. has received a check for $1,010,000, covering back royalties from the Standard Welding Co., Cleveland, as determined by the special master appointed by the court. This brings to an end the famous legal battle between L. H. Perlman, inventor of the demountable rim, and the Standard Welding Co., the decision in favor of Mr. Perlman having been handed down in August, 1915, in the district court and confirmed by the circuit court of appeals in February, 1916. The Standard Welding Co. is now a unit of the Standard Parts Co., having merged with the Perfection Spring Co. The Standard Parts Co. name appears on the check.

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Ford Loses First Court Tilt

DETROIT, Dec. 19—Henry Ford and the Ford Motor Co. were losers in their effort, yesterday, to obtain a reopening of the preliminary decision rendered in the injunction suit brought by the Dodge brothers to stop the plans for erection of a huge smelter plant at River Rouge for the transforming of crude ore into finished castings for Ford cars by a single heating process.

Attorneys for Ford stated that the injunction against the smelter would cost the company $6,000,000 a year, and Henry Ford offered to indemnify and pay the plaintiffs any damages that might later be awarded them as stockholders in the Ford Motor Co., by reason of the construction of the blast furnace, foundry, etc., if such works would be held illegal or unlawful, and further promised to pay all costs individually, that might accrue to the company if the later decision is against the erection of the smelter. The court refused to heed either promise and the injunction remains until the final hearing.

Standard Parts Co. to Expand

Perfection Spring Co. Sale Ratified and New Co. Will Double Factory and Force

CLEVELAND, Dec. 20—The Standard Parts Co., merger of the Perfection Spring Co. and the Standard Welding Co., will double its factory facilities and also the force of employees during the next 8 months. The company now occupies 800,000 sq. ft. and employs 4500 workers.

The sale of the Perfection Spring Co. to the Standard Parts Co. has been ratified by 95 per cent of the stockholders and the remaining 4 per cent are expected to follow suit. The board of directors announced in THE AUTOMOBILE last week will be augmented to fifteen when complete, the new members being presidents of automobile companies now negotiating to join the Standard Parts Co.

Of the $5,000,000 preferred stock issued, $4,000,000 was taken up in this city in 24 hr., the remaining $1,000,000 being held to exchange for old Perfection stock.

Net earnings of the Standard Parts Co. for the past 3 months are $450,000, or at the rate of $18 yearly per share of common stock.

There will be three departments. The spring department will continue the manufacture of Perfection springs, business in which is now running close to $3,500,000 yearly, nine contracts having been closed in the last 3 months for over $1,000,000; the rim and tube department will make demountable rims under the Perlman patents only and all types of unpatented rims and also truck bands. Business in this department is running at $600,000 a month, with future contracts on the books for over $5,000,000 worth of rims and $3,500,000 in tubes. The heater department business is increasing very rapidly, the company selling 2000 in December, 1916, as compared with 100 in December of last year. Several car makers with 100,000-car outputs yearly are negotiating for the heaters as standard equipment.

Under the new merger total net assets of the company must be 200 per cent of the preferred issue and the net quick assets must be 100 per cent thereof. No new preferred stock can be issued unless net earnings for the previous 2 years are three times the preferred dividend required for each of these years.

Taylor Is S K F Vice-President

HARTFORD, CONN., Dec. 19—S. B. Taylor, sales manager of the S K F Ball Bearing Co. of this city, has been appointed vice-president of the company, succeeding F. B. Kirkbride, who remains on the board. Mr. Taylor will remain in charge of sales.

G. A. Ungar, former representative of the company in Cleveland, Detroit and Pittsburgh, has been appointed technical manager and chief engineer, succeeding Uno Forsberg, who returns to Sweden after completing his work of creating the manufacturing organization of the S K F Ball Bearing Co. in this country.

Reo Stockholders Re-elect Officers

DETROIT, Dec. 19—Stockholders of the Reo Motor Car Co., of Lansing, Mich., met to-day and re-elected the officers and board of directors.

Covert Retires from Gear Co.

DETROIT, Dec. 19—B. W. Covert, president of the Covert Gear Co., Buffalo, N. Y., will retire from the company on Jan. 1, having disposed of his common stock. Control will pass to P. A. Clum of Rochester, N. Y., and F. E. Mosher of Buffalo.

Metz Announces 1-Tonner at $695

WALTHAM, MASS., Dec. 15—In order to meet the demand for lower-cost transportation by business men, the Metz Co. announces a high-duty 1-ton truck to sell for $695. The chassis frame is of 5 in. heavy channel steel, capable of more than its rated capacity load. The wheelbase has been lengthened to 130 in.

The final drive is by internal gear, direct on each wheel. The front wheels carry 32 by 3½ pneumatic tires, while the rears are equipped with 34 by 3½ solid rubber tires. It is built to speed up to 20 m.p.h. and weighs complete 2500 lbs.

The ½-ton Metz delivery car that stores throughout the country have found so valuable, will still be continued. This is a ½-ton truck, and sells for $500 to $600.

King Increases Prices Again

DETROIT, Dec. 19—The King Motor Car Co. has again increased its prices above those stated Nov. 15, when the last increase was made. The seven-passenger and four-passenger touring cars and the three-passenger roadster have been increased from $1,400 to $1,585, a raise of $185. The seven-passenger sedan has been increased to $2,150.

Stanley Steamer Prices Advanced

NEWTON, MASS., Dec. 18—The Stanley Motor Carriage Co. advanced its prices on Dec. 4, the five-passenger touring car going up from $1,975 to $2,200, the seven-passenger touring car from $2,075 to $2,300 and the three-passenger roadster from $1,950 to $2,200.

Eight Car Makers Increase Prices

Buick, Maxwell, Franklin, Standard, Paige and Auburn Included in List

DETROIT, Dec. 14—The Buick Motor Co., this city, will increase the prices of all its models on Jan. 15. Prices will be as follows: D-4-34, from $650 to $660; D-4-35, from $665 to $675; D-6-44, from $985 to $1,040; D-6-45, from $1,020 to $1,070; D-6-46, from $1,425 to $1,440; and D-6-47 from $1,800 to $1,835.

Maxwell Raises Car Prices

DETROIT, Dec. 19—The Maxwell Motor Co. has increased the prices of its touring and roadster models to take effect Jan. 1. The new price of the touring car is $635 as against $595 which was the old price. The new price of the roadster is $620 as against $580.

Franklin Price $100 Higher

SYRACUSE, N. Y., Dec. 18—The Franklin Automobile Co., this city, will advance its prices on all models $100 on March 1, 1917.

Standard Eight Prices $100 Higher

PITTSBURGH, PA., Dec. 18—The Standard Steel Car Co., this city, has raised the price of the Standard Eight $100, on its open models, effective Jan. 1. Seven-passenger touring car now sells at $1,900 and the four-passenger roadster at $1,850.

Paige Raises Open Car Prices

DETROIT, Dec. 19—The Paige-Detroit Motor Car Co. has advanced the prices on all its models. The new prices are Model 51 Stratford, seven-passenger touring, $1,495. Model 51 Brooklands, convertible roadster, $1,695. Model 39, Linwood, five-passenger touring, $1,175. Model 39, Dartmore roadster, $1,175. Prices of all closed cars remain unchanged.

Auburn Six Is $60 Higher

AUBURN, IND., Dec. 18—The Auburn Automobile Co. has increased its five-passenger light six $60, to take effect Jan. 1, 1917.

Allen to Drop $795 Car

FOSTORIA, OHIO, Dec. 20—The Allen Motor Co. will discontinue the manufacture of its $795 touring car and roadster after Jan. 10, 1917, and, in open models, will confine the 1917 production to the special finished Allen Classic touring cars and roadsters listing at $850.

Enlarge Standards Committee

Inclusion of New Branches of Automotive Engineering Means Great Expansion

DETROIT, Dec. 14—To provide for the broader activities of the standards committee work of the Society of Automobile Engineers it was voted to-day by the council of the society to reorganize the standards committee and enlarge it, so as to practically have a separate department for such work as aviation, agricultural tractors, marine engineering, and automobile engineering. With this object in view a committee of nine was appointed. The contemplated plan is to so organize the committee that much of the load of work will be taken off the shoulders of the chairman. An organization on similar lines to that of a government is possible, in which the chairman will be assisted by a cabinet or executive council of perhaps five or six. Each representative on the council will represent a department of the committee's activities such as aviation, tractor work, or marine or automobile engineering. Each member of the executive committee will in this way share the responsibility of the work with the chairman and be perhaps directly responsible for the standards work in the particular department he represents.

The committee reorganization consists of Coker Clarkson, general manager of the S. A. E.; A. L. Clayden, present chairman of the standards committee; John G. Utz, Perfection Spring Co.; K. W. Zimmerschied, metallurgist of the General Motors Co., and chairman of the standards committee in 1915; George H. Dunham, nominee for president of S. A. E. for 1917; Henry Souther, first chairman of the standards committee and now with the federal government in charge of aviation work; A. L. Horning, Waukesha Motors Co., as a representative of the agricultural tractor interest; Chas. E. Manly of the Curtiss company, representing aviation interests, and R. C. Coombs of the Prest-O-Lite Co., who has had a wide experience in marine engineering. The committee is expected to report at the January meeting of the society.

Additional Divisions?

In connection with standards committee work for next year it is generally understood that Mr. Utz will accept the position of chairman of the standards committee to succeed Mr. Clayden, engineering editor of THE AUTOMOBILE, who has held the position for the present year. Mr. Utz has for years handled divisions of the committee and is particularly well qualified to take up the work. His duties in this respect will be ably assisted.

The question of creating additional divisions of the standards committee was considered, particularly such divisions as relate to marine engineering and lubricating oils. The matter was referred to the special reorganizing committee. Other work to be assigned to the standards committee included: Test of wire wheel rims, thickness of pneumatic tire rims, and pneumatic tires for motor trucks.

It was decided that the consideration of aviation matters during the week of the New York aviation show should be handled by the Metropolitan section, in which connection it is probable that an afternoon will be given to the consideration of aviation standardization work and that a dinner in the evening will be followed by a meeting at which papers on aviation will be presented.

In addition to general routine work of the society, the council admitted sixty-six applicants into the various grades of society membership.

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Hilborn Co. Takes Over Answer Plug Distribution

NEW YORK, Dec. 20—The Hilborn Co., Inc., has been formed here to handle the entire output of the Hill Insulating & Mfg. Co., which produces the Answer spark plug. The Hilborn company will handle a number of accounts of which the Answer plug is the first. The Hilborn company will control the entire distribution of the Answer plug, the Hill Insulating & Mfg. Co. hereafter confining its efforts exclusively to manufacturing. The Answer plug is mica insulated and the makers have placed themselves in a unique position by guaranteeing its operation for a definite mileage. The plug is guaranteed to operate perfectly for a minimum of 10,000 miles, and if it does not it will be replaced. Headquarters of the Hilborn company are at 535 Canal Street.

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McLeod Concentrates on Fabricord Co.

ST. LOUIS, Dec. 18—N. W. McLeod, president of the Fabricord Tire Co., has severed his connection with the German Savings Bank of this city, of which he was president, to devote his entire time to the tire company.

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Boydston Dauch Sales Manager

SANDUSKY, OHIO, Dec. 15—L. H. Boydston has become sales manager of the Dauch Mfg. Co., this city, maker of tractors. He was formerly sales manager for the company in Los Angeles. This company is now putting out a new tractor, known as the 10-20 model.

Indiana S. A. E. Talks Carburetion

Prof. Berry Emphasizes Correct Proportions—F. C. Mock Discusses Methods

INDIANAPOLIS, IND., Dec. 15—Two papers on carburetion were read and discussed to-night before the Indianapolis Section of the Society of Automobile Engineers. One was by Professor Berry of Purdue University and the other by F. C. Mock, chief engineer of the Stromberg Motor Devices Co. The conclusion reached by Professor Berry was that the correctness of the proportions of air and fuel in the gas is very important. Mr. Mock gave his attention mainly to the means for obtaining the perfect mixture called for by Professor Berry and described at considerable length some experiments made with glass carbureters and manifolds. He analyzed the widely varying conditions which a carbureter has to meet, showing how difficult a thing it is to design an automatic carbureter.

The discussion, which was thorough, had as its main topics the influence of the size of manifold and of heating the charge. In this prominent speakers were J. W. Esterline of the Esterline Co.; V. R. Heftler, Zenith Carbureter Co.; Frederick Purdy, of Findeisen & Kropf Mfg. Co., and A. P. Brush of the Brush Engineering Assn.

Discuss Difficulties

The speakers confined themselves mainly to a discussion of the difficulties of the problem, and it is hardly possible to say that any very definite conclusions were reached as a result of the meeting. There is no question, however, but that is was very valuable since a number of different viewpoints on the same subjects were explained so fully.

The major portion of Professor Berry's paper describing his experiments follows:

The carbureter performance is so often interpreted in terms of engine performance that it seems to me we ought to have a better standard of performance than this. To arrive at such a standard, we ran a series of tests at the university, undertaking to show the change in effect of gasoline and air mixture on performance. We tried to find what mixture gave the most economy and what mixture the most power, and the results of this I wish to report this evening. Before I do that, however, I want to enumerate the three requirements that it appears to me a carbureter should meet in order to give perfect performance, the three requirements our imaginary perfect carbureter would meet, as well as many other detail ones.

In the first place, it should be a good mixing valve; that is, the gasoline should be very thoroughly atomized. That is absolutely necessary. Future work may find another way of getting the mixture without this, but at the present time a good atomizing carbureter is superior.

Second, we want to get the proper amount of heat into the mixture. The first requirement, then, is to get gasoline and air thoroughly mixed in such a way that the mixture will get to the cylinder in exactly the same proportion as it left the carbureter. The carbureter must not cut down the volumetric efficiency. One case where it would do this is where it does not get to the throttle at atmospheric pressure. Then the mixture must not be heated. If it is heated at all, it cuts down the volumetric efficiency. The perfect carbureter will not do that. Third, the carbureter must furnish the engine with exactly that mixture which will give best performance at each speed and each load throughout the entire motor range.

The Best Mixture

The next question is, what is this mixture, and how does it vary? Do we need a rich mixture for idling, and a lean one for speed? Many experts seem to think both are needed, and there is another class that says neither is correct; that they want the same mixture for all speeds and at all loads. Which one is right? Does the mixture which gives the best power give the best efficiency? If not, how much difference is there between the mixture which gives best power and that which gives best efficiency? It is in an attempt to answer these questions that we have run these tests.

We had a six-cylinder engine, with the intake manifold inside. This helped to maintain a dry manifold and gave a satisfactory performance under circumstances which were adverse. The engine would idle, and hit every cylinder with very poor mixture.

We ran this test at 400, 700, 1000, 1300

(*Continued on page* 1043)

Corcoran Mfg. Co. Expands

Buys Properties of Two Cincinnati Concerns and Will Build Body Plant

CINCINNATI, OHIO, Dec. 14—The Corcoran Mfg. Co., maker of automobile bodies, fenders, hoods and radiators, has bought the properties of the Jacob Freund Roofing Co. and the Cincinnati Tile and Terra Cotta Co.

The company is planning the construction of a fireproof building of four stories, 472 by 76 ft., to be used for the exclusive manufacture of automobile bodies. This will give employment to 500 men and will cost approximately $125,000.

When the company was formed, about 6 months ago, the result of the sale of the present officers' interests in the Corcoran and Victor corporations, it leased the manufacturing property at Winton Place. This lease does not expire for 3 years, at which time the company will erect a duplicate of the building now to be built, which will make the total plant area approximately 275,000 sq. ft.

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Doehler Adopts 10 Per Cent Wage Dividend for Employees

BROOKLYN, N. Y., Dec. 16—Beginning Jan. 1, 1917, the Doehler Die-Casting Co. will declare a wage dividend at the rate of 10 per cent yearly to employees who have been with the company a year whenever the regular quarterly dividend on the stock is declared. The wage dividend, when declared, will be paid in full to employees with the company for over 3 years; two-thirds will be paid to those with the company from 2 to 3 years; and one-third for employees of 1 to 2 years' service.

Also beginning Jan. 1 employees who have been working on a basis of 50 hr. per week will be put on a 48-hr. basis at the same pay. The company employs 1200 men with a weekly pay roll of $25,000.

These announcements were made at a complimentary dinner last night tendered to the Doehler Executive Club, composed of all executive heads of the company, which has factories at Brooklyn, Newark, N. J., and Toledo.

—

Johns-Manville Gives Employees 10 Per Cent Bonus

NEW YORK, Dec. 20—Employees of the H. W. Johns-Manville Co. with the company a year or more received Christmas greetings signed by President T. F. Manville announcing the board of directors' decision to give a bonus equal to 10 per cent of the year's salary.

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Princess Motor Corp. Now

DETROIT, Dec. 19—The Princess Motor Corp. of Delaware has been admitted to do business in the State of Michigan and has taken over the Princess Motor Co., which has heretofore handled the Michigan sales. Officers of the corporation are: O. C. White, president and managing director; I. N. White, vice-president and treasurer; H. C. Dawson, assistant sales and advertising manager.

—

Comet Buys Plant Site

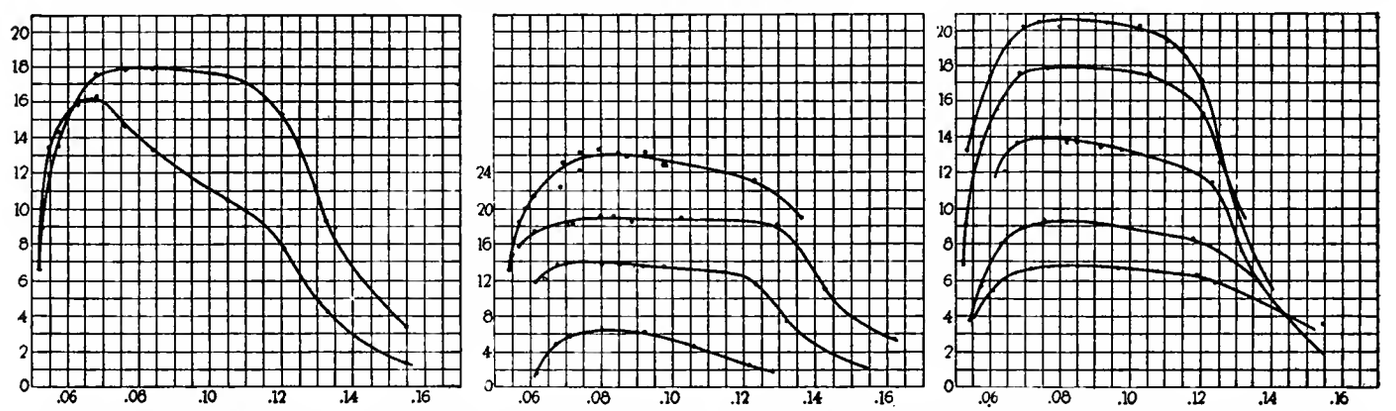
DECATUR, ILL., Dec. 18—The Comet Automobile Co. recently incorporated for $1,000,000 has purchased 20 acres of land upon which it plans to erect a factory and build a six-cylinder car to sell at $1,000.

—

Livingston Receives Perpetual Injunction

NEW YORK, Dec. 16—A decree of perpetual injunction carrying costs and reference to a master of accounting for assessment of damages has been signed in favor of D. McRa Livingston and his licensee, the Ospeco Mfg. Co. against the Lowe Motor Supplies Co.

As reported in THE AUTOMOBILE for Nov. 23, the suit alleged that the Lawco



Figs. 1, 2 and 3, reading from left to right. Fig. 1 shows horsepower curves as the mixture strength varies from .05 to .16 lb. of gasoline to 1 lb. of dry air. Fig. 2 and Fig. 3 show similar curves taken at different speeds and loads. All the curves show the mixture has a great effect on power, but that there is a "flat" period where slight variation in mixture does not greatly affect the power

radiator shell and hood made by the F. H. Lawson Co., Cincinnati, Ohio, and sold by the Lowe concern infringed the Livingston patent No. 1,156,017 covering a mask for concealing the engine and radiator casing of a car. Judge Sheppard held the patent valid and infringed, although commenting that no wilful infringement was evident. The case was in the U. S. District Court for the Southern District of New York.

—

Nelson Builds Four at $2,350

DETROIT, Dec. 20—E. A. Nelson, designer of Hupmobile models 20 and 32, has started the manufacture of a high quality light weight four, selling at $2,350 with a sedan body. The enterprise is financed by Mr. Nelson and the plant has a capacity of ten cars per day. Dealers have been closed in the principal eastern centers and cars shipped. The car incorporates a 3⅛ by 4¾-in. overhead camshaft engine with clutch, gearset and axle in a unit. It is designed for high economy and low grade gasoline, a mileage of 25 and better to the gallon being guaranteed; acceleration is 5 to 35 m.p.h. in 13½ sec. Wheelbase is 104 in. and the cord tires are 32 by 4. Carbureter is a Zenith, and starter is U-S-L. The entire car will be made in the Nelson plant.

—

Globe Tire Co. Buys Plant

LAPORTE, IND., Dec. 19—The Globe Tire Co., a corporation capitalized at $2,500,000, has bought the plant of the H. B. Glover Co. A. A. Peterson, formerly assistant superintendent of the Fiske Rubber Co., who will be superintendent of the plant, states that the company expects to have the plant in operation by March 1 manufacturing semi-solid rubber tires and inner tubes.

—

Hutchinson to Make Truck Equipment

MILWAUKEE, Dec. 16—R. W. Hutchinson, for the past 3 years general sales and advertising manager for the Sterling Motor Truck Co., Milwaukee, and its predecessors, the Sternberg Mfg. Co. and Sternberg Motor Truck Co., has resigned, effective Feb. 1, to devote himself to the manufacture of motor truck efficiency auxiliary equipment.

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New Company Takes Schmid-Lyon

DETROIT, Dec. 18—Ossian G. Lyon has taken out papers for a new rubber concern at Akron, Ohio, with a $150,000 capital. The new organization will take over the factory buildings and business of the Schmid-Lyon Rubber Co. Mr. Lyon, who is the president of the new concern, states that it is planned to widely extend the business.

Line Drive Tractor Factory

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$1,000,000 Company Plans To Establish Permanent Plant at South Milwaukee

MILWAUKEE, Dec. 18—The Line Drive Tractor Co., Pierre, S. D., organized recently with $1,000,000 capital and financed to a large extent by Milwaukee capital, is preparing to establish its permanent factory at South Milwaukee. Materials have been purchased for the initial issue of 1200 machines, which are unique because steering and operation is manipulated by a pair of lines, the operator being seated on the wagon, implement or vehicle being drawn by the tractor. The organization includes the following well-known engineers: David E. Ross, of the Ross Tool & Gear Co., Lafayette, Ind., chief consulting engineer; I. W. Davis, superintendent of the Stowell Co., South Milwaukee, superintendent of construction; R. S. Strader, manager of the service department. Mr. Strader for eight years was associated with the M. Rumely Co., Hart-Parr Co. and Detroit Tractor Co.

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Brunswick Tire Plant Nearly Ready

MUSKEGON, MICH., Dec. 20—The Brunswick-Balke-Collender Co., by Jan. 15 will be manufacturing Brunswick tires and tubes at the rate of 500 per day. Before that date the new buildings will be completed and the machinery installed. Already the superintendents for the different departments of the factory are on hand and the manufacturing organization practically completed. In addition to manufacturing tires and tubes a line of rubber accessories will be produced.

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K. W. Ignition Buys Land

CLEVELAND, Dec. 15—The K. W. Ignition Co. has purchased a parcel of land adjoining the company's plant. The recently acquired land is 60 by 245 ft.

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Willard to Erect New Building

CLEVELAND, Dec. 18—The Willard Storage Battery Co. will erect a factory building to cost $35,000, and a storage building at $7000.

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Reo Employees Co-operate to Reduce Cost of Living

LANSING, MICH., Dec. 16—More than 4500 employees of the Reo Motor Car Co. are experimenting with a co-operative purchase plan in an endeavor to reduce the cost of living. The first experiment was the purchase of two carloads of potatoes which effected a saving of 25 per cent above all cost. The workers are now bargaining for several carloads of canned goods which will be sold to the individual employees in case lots from the cars. Plans for a co-operative coal yard and general store are contemplated.

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Harrison With Harroun

DETROIT, Dec. 14—John B. S. Harrison has been appointed the manager of the foreign department of the Harroun Motors Corp. Mr. Harrison was formerly a member of the United States embassy at Rome.

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Republic Workers Have Co-operative Store

DETROIT, Dec. 16—The employees of the Republic Motor Truck Co., Alma, Mich., have organized a co-operative store which will purchase every kind of merchandise for its 900 members.

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New International Rubber Sales Co.

LOUISVILLE, KY., Dec. 16—The New Tread Tyre Co. has changed its name to the International Rubber Sales Co.

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Shaler Acquires Vulcanizer Patents

WAUPUN, WIS., Dec. 18—The C. A. Shaler Co., this city, has absorbed the vulcanizer business of the 5-Minute Vulcanizer Co., Kansas City, and the Vulcan Mfg. Co., Denver. The Shaler company states that it has recently acquired from W. H. Miles of Longton, England, and A. B. Low, of Denver, three basic patents, covering types of vulcanizers in which a solid fuel is used to produce the heat.

—

Parker Rust Proof Buys Patents

DETROIT, Dec. 14—The Parker Rust Proof Co. of America has completed negotiations for the purchase of the Thomas Watts Coslett patents No. 870,937 and No. 1,007,069, and all other improvements which may be made in rust proofing by Mr. Coslett. This purchase, according to officials of the Parker Rust Proof Co., gives that company control of the entire rust proofing art.

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Lytle Joins Anderson Motor Co.

ROCK HILL, S. C., Dec. 15—R. W. Lytle has joined the Anderson Motor Co., this city, as production manager. He was formerly engineer and production of the Bimel Automobile Co., Sidney, Ohio.

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Peerless Asks New Trial

CLEVELAND, Dec. 20—The Peerless Motor Car Co. has asked for a new trial of the suit brought against it by Henry S. Chapman for $800,000 alleging violation of contract. A verdict of $375,000 with interest, totaling $412,812, was recently awarded Chapman.

154,525 Overland Cars Sold

More Than 6,500 Dealers and Guests Entertained at 2-Weeks Convention

TOLEDO, Dec. 16—Contracts totaling 154,525 automobiles with a value of $131,346,250 have been signed during the first two weeks of the Willys-Overland Co.'s dealers' convention. More than 6500 dealers and guests have been entertained during that length of time.

The business of this past week, amounting to 66,975 cars with a value of $56,928,750, was received from dealers from the zones of the Middle West, New England and the South. The first group ordered 29,200 cars, the second 24,025 and the third 13,700 cars. The convention will come to a close next week. The South Dakota, Minnesota, Wisconsin and Eastern Iowa dealers will visit the company on Monday and Tuesday, and the New York, Indianapolis, Cincinnati, Lexington, Louisville, Lima and Evansville dealers will bring the event to its end on Wednesday and Thursday.

The most important feature of this week, aside from the industrial achievements was a parade held on Thursday, when the various guests and many employees joined a march, with many novel floats, through the city. More than $150,000 worth of cars were used.

Kelly-Springfield Tire May Show 40 per Cent for Common

NEW YORK, Dec. 20—The Kelly-Springfield Tire Co., it is stated, will show earnings of at least 40 per cent for its $5,000,000 common stock. This compares with 29.67 per cent in 1915. Earnings of 40 per cent would be two and one-half times the present dividend rate.

$10,500,000 Profits for Studebaker

DETROIT, Dec. 20—The Studebaker Corp., this city, it is stated, will show profits of between $10,500,000 and $10,800,000 during its fiscal year ending Dec. 31. The smaller figure is equal to 32 per cent on the $30,000,000 common after taking out the approximately required $800,000 for the preferred dividend on $10,965,000 stock. This compares with 27.4 per cent for the common stock in 1915.

Willys Addresses Insurance Presidents

TOLEDO, Dec. 15—John N. Willys, president of the Willys-Overland Co., accepted the invitation of the Association of Life Insurance Presidents and appeared before that body last night, with an address on the public services and patriotism of the American business man. In the course of his speech, Mr. Willys pointed out the vast growth of the automobile industry, assured his listeners that, in event of war, the automobile makers could be relied upon to use their machinery and factories for defense, and showed how France had twice been saved by automobile. He spoke optimistically of the future following the war, and dwelt at length on the vast welfare wrought to every human being by the automobile.

Governors Plan Uniform Laws for Pa., N. J., Md. and Del.

WILMINGTON, DEL., Dec. 18—Governor Charles R. Miller and Secretary of State George H. Hall of Delaware a few days ago attended a conference of similar officials representing Pennsylvania, New Jersey and Maryland, which was held in Philadelphia, the purpose being to consider the matter of uniform motor laws for the four States.

A thorough understanding was reached, according to one of those who attended the conference, and it is believed that the desired object will be accomplished in the near future.

To License Repair Men

DETROIT, Dec. 18 — Representative Charles W. Clark of Michigan, is planning to introduce a bill in the State Legislature which will provide for the licensing of all garage men who are employed in automobile repair work.

Inasmuch as every member of the Legislature is a car owner it is believed that he has an excellent chance of getting his proposed bill passed in the next session.

$70,000,000 Sales for Goodrich

AKRON, Dec. 15—Sales of the B. F. Goodrich Co. for 1916 will total nearly $70,000,000, as compared with 56,000,000 in 1915 and $43,000,000 in 1914. Earnings in the first 6 months of this year amounted to 6½ per cent on the $60,000,000 common.

G. M. C. Certificates Listed

Temporary Certificates on N.Y. Stock Exchange Balance Sheet as of Dec. 9.

NEW YORK, Dec. 19—The temporary certificates of the General Motors Corp., of $20,000,000 preferred and $82,600,000 common, have been listed on the Stock Exchange. The corporation was formed to take over the stock of the General Motors Co. Of the $45,314,000 common of the corporation outstanding on Dec. 9, the Chevrolet company held $16,644,500 in its treasury in one certificate.

It is also stated that the Chevrolet Motor Co. agrees that the shares of common stock of the General Motors Corp. acquired by it will be kept in its treasury and that the Chevrolet Motor Co. will not part in any manner with any of these shares without first publishing notice of its intention to do so at least 60 days in advance.

The balance sheet of the General Motors Corp. of Delaware as of Dec. 9, 1916, appears herewith:

Pyrene to Increase Capital

NEW YORK, Dec. 20—The Pyrene Mfg. Co., this city, has called a meeting of the stockholders on Jan. 2, at which action will be taken on a proposed increase of capital from $1,050,000, divided into 100,000 shares of common, and 5000 shares of preferred, each to $3,050,000 divided into 300,000 shares of common of $10 par value, and 5000 shares of preferred, of $10 par value.

Simplex Capital Now $9,000,000

DOVER, DEL., Dec. 15—The Simplex Automobile Co. of New York has increased its capital from $5,000,000 to $9,000,000.

Dixie Increases Capital to $400,000

LOUISVILLE, KY., Dec. 16—The Dixie Motor Car Co. has increased its capital from $150,000 to $400,000, divided into 4000 shares of a par value of $100 and

Balance Sheet of General Motors Corp. of Delaware as of Dec. 9

Assets	
91,664 shares preferred stock General Motors of New Jersey	$12,221,867
90,628.25 shares common stock General Motors of New Jersey	45,314,137
Cash in bank	3,528
Organization expense to Dec. 9, 1916	11,472
Total	$57,551,004
Liabilities	
Preferred stock authorized	$20,000,000
Less amount to be issued in exchange for preferred stock	7,804,000
General Motors of New Jersey	$12,196,000
Preferred outstanding	
Common stock authorized	82,600,000
Less amount to be exchanged for General Motors of New Jersey	37,285,900
Common outstanding	*$45,314,100
Bills payable	15,000
Accounts payable	25,904
Total	$57,551,004

*Of this amount $16,644,500 is owned by Chevrolet Motor Co. and held in its treasury in one certificate.

authorizing an indebtedness not to exceed $1,000,000. One-half of the stock is to be common and one-half preferred and the additional issue of 1000 shares of common is to be held in the treasury of the company and issued to the present owners of common stock as it is subscribed for them by them and paid for in cash.

The preferred stock is to pay 7 per cent dividends, one-half Jan. 1 and one-half July 1 of each year.

Midland Tire Capital Now $500,000

COSHOCTON, OHIO, Dec. 18—Papers have been filed with the Secretary of State increasing the authorized capital of the Midland Tire & Rubber Co., from $10,000 to $500,000. The concern has taken over the plant of the McClurg Tire Co.

Lockwood-Ash Increases Capital

JACKSON, MICH., Dec. 18—The Lockwood-Ash Motor Co., Jackson, Mich., has increased its capital stock from $20,000 to $150,000. A distribution of $89,500 surplus furnished the increase with a balance of $40,000 which will be left open for future needs.

East Palestine Capital $1,000,000

EAST PALESTINE, OHIO, Dec. 15—The East Palestine Rubber Co., this city, manufacturing tires, has increased its capital from $500,000 to $1,000,000 to take care of additions to the plant. A new building will be erected, 200 by 55 ft., and will have a capacity of 200 tires a day.

Warner Cuts Capital Stock

DETROIT, Dec. 16—The Warner Mfg. Co. of Toledo has reduced its capital stock from $500,000 to $50,000. The Toledo plant of this company was recently sold to the Chevrolet Motor Co.

Briggs-Detroiter Capital Reduced

DETROIT, Dec. 16—The Briggs-Detroiter Co. has decreased its capital stock from $200,000 to $2000, and has changed its name to the United Detroiter Corp.

Gasoline Goes Up 1 Cent

Advance Throughout Country —Standard Oil and Other Companies Join In

NEW YORK, Dec. 18—Gasoline is higher throughout the country, especially throughout the western States. As yet no rise has occurred along the Atlantic Coast. One-cent rises are reported from Chicago, Milwaukee, Tacoma, St. Louis, and Minneapolis.

The Standard Oil Co. of Indiana to-day advanced its tank wagon price 1 cent a gallon in Chicago to 17½ cents. In the Northwest prices are now quoting at 20½ cents at filling stations. This figure is a new record there. In the Twin Cities, gasoline is retailing at 17½ cents. This is the first advance since the agitation was begun for investigation of the gasoline situation. Standard Oil gasoline in St. Louis is quoting at 16.9 cents a gallon at stations and on tank wagons. Naphtha is selling at 16.4 cents. Independents have been selling gasoline for 17 cents. Pierce Oil Corp. is still selling gasoline in St. Louis for 15.9 cents a gallon, but an advance is expected soon.

Hayes Capitalization Plans Perfected

DETROIT, Dec. 18—If the present plans of the Hayes Mfg. Co. are approved, stockholders will receive a stock dividend of 75 per cent, as it is proposed to increase the capital to $1,750,000 of which $250,000 will be 7 per cent cumulative preferred stock. Under the plan the present preferred stock will be retired.

Westinghouse Limits Stock Subscription

CLEVELAND, Dec. 15—Notices will be sent to Westinghouse Electric stockholders shortly after Dec. 30, specifying the amount of stock to which the stockholder is entitled to subscribe. Warrants entitling the holder to subscribe will be issued only for amount of $50 or multiples thereof. For each fraction of a share, a fractional warrant or fractional warrants will be issued. After Feb. 19, 1917, fractional warrants will be void. No subscription may be made on a fractional warrant but if surrendered on or before Feb. 19, 1917, to the United States Mortgage & Trust Co. with other fractional warrants aggregating at least $50, a subscription warrant for one share will be issued in exchange.

United Motors Co. Raises Capital

DETROIT, Dec. 18—The United Motors Co. of Grand Rapids, has increased its capital from $1000 to $750,000. The increase has been paid in in cash by the incorporators, and officials of the company state that the concern is in excellent financial standing with no bonded or floating debts. Officers of the company recently elected, are: Frank D. Hulswit, president; George P. Sweet, vice-president; H. R. Green, treasurer; L. H. Einke, secretary, and K. A. Myers, assistant treasurer.

Two Companies Will Pay Off $4,000,000

DETROIT, Dec. 18—The Youngstown Sheet & Tube Co. and the Brier Hill Steel and Trumbull Steel companies will pay off bonds totaling $4,000,000, canceling all of their outstanding surplus of the character in January. They will also grant employees a 10 per cent advance, the third for the year, which will contribute approximately $600,000 to the workers.

Material Prices Drop

NEW YORK, Dec. 18—Materials dropped considerably in price last week. Copper went down 1 cent to 34 cents a lb., lead dropped to $7.63, a loss of 47 cents per 100 lb., both Para and Ceylon grades of rubber closed yesterday lower, and tin was also lower. Only one gain occurred and that was Kansas crude, which rose to $1.20 per barrel, a gain of 10 cents.

Fostoria Co. to Change Name

DETROIT, Dec. 18—The Fostoria Light Car Co. stockholders will meet Jan. 8 to reorganize the company and elect new officers, besides changing the name of the concern to the Seneca Motor Car Co.

McCord Assets $1,875,000

NEW YORK, Dec. 20—The McCord Mfg. Co., Detroit, maker of automobile radiators, which last week authorized an issue of $1,000,000 of 7 per cent cumulative preferred stock and 75,000 shares of common stock, no par value, reports net tangible assets over $1,875,000, or two and one-half times the preferred issue. Net quick assets alone are $1,000,-

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Aluminum, lb.	.63	.63	.63	.63	.63	.63	...
Antimony, lb.	.14½	.14½	.14¾	.14⅞	.14⅞	.14⅜	— .00⅛
Beams and Channels, 100 lb.	3.42	3.42	3.42	3.42	3.42	3.42	...
Bessemer Steel, ton	55.00	55.00	55.00	55.00	55.00	55.00	...
Copper, Elec. lb.	.35	.35	.35	.34	.34	.34	— .01
Copper, Lake, lb.	.35	.35	.35	.34	.34	.34	— .01
Cottonseed Oil, bbl.	12.40	12.35	12.20	12.48	12.20	12.25	— .15
Fish Oil, Menhaden, Brown, gal.	.72	.72	.72	.72	.72	.72	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.30	1.30	1.30	1.30	1.30	1.30	...
Lead, 100 lb.	8.10	7.90	7.75	7.63	7.63	7.63	— .47
Linseed Oil, gal.	.93	.93	.93	.93	.93	.93	...
Open-Heartb Steel, ton.	55.00	55.00	55.00	55.00	55.00	55.00	...
Petroleum, bbl., Kans., crude	1.10	1.10	1.10	1.10	1.20	1.20	+ .10
Petroleum, bbl., Pa., crude	2.75	2.75	2.75	2.75	2.75	2.75	...
Rapeseed Oil, refined, gal.	.98	.98	.98	.98	.98	.98	...
Rubber, Fine Up-River, Para, lb.	.81	.81	.80½	.79	.79	.79	— .02
Rubber, Ceylon, First Latex, lb.	.80	.77	.77	.77	.75	.75	— .05
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	42.75	43.00	43.00	43.00	43.00	42.63	— .12
Tire Scrap, lb.	.06¼	.06½	.06½	.06½	.06½	.06½	+ .00¼

000, or one and one-third times the preferred issue.

Net earnings for 12 months ended Oct. 31, 1916, were over $563,000 or more than ten and one-half times the preferred dividend requirements. In 1915 the company did a business amounting to $2,569,051, and earnings amounted to $324,472.

The company was organized in 1909 and has increased its plant space from 40,000 sq. ft. to approximately 300,000 sq. ft., with a capacity of 2000 radiators a day. It also manufactures gaskets for steam and gas engines, lubricators, etc.

Dividends Declared

Electric Storage Battery Co., 1 per cent from net earnings on both common and preferred, payable Jan. 2 to stock of record Dec. 18.

Keystone Tire & Rubber Co., quarterly of 3 per cent on common and 2 per cent and an extra of 1-3 of 1 per cent on preferred. Three months ago the company declared quarterly of 2 per cent and extra of ¾ of 1 per cent on common and quarterly of 2 per cent and extra of ¼ of 1 per cent on preferred.

National Carbon Co., quarterly of 2 per cent and extra of 2 per cent on common, payable Jan. 15 to holders of record Jan. 15.

Pyrene Mfg. Co., 2½ per cent on common, payable Feb. 1, 1917, to stock of record Jan. 25, 1917.

Saxon Motor Car Corp., 1¾ per cent, payable Jan. 17 to stock of record of Jan. 3.

Big Drop in Motor Securities

General Motors Down 50 Points—United Motors Falls 93¾—Fisk Strong

NEW YORK, Dec. 18—The automobile issues joined in the general slump of stocks which has for the past two weeks been the cause of heavy losses in speculation. With few exceptions was there any tendency toward strength in the issues. Not only was there liquidation in the automobile issues but also in the tire stocks.

One of the most prominent drops last week was that of General Motors, which went down to 600, a loss of 50 points. Another stock, which has been speculated on to a great extent, but which has failed to hold up to the estimation predicted for it, is United Motors. This stock is one of the strongest in point of assets on the motor securities market, yet it has failed to show any material strength during the present slump. Yesterday it quoted at 49¾, as against 69 several months ago. Willys-Overland has been holding better lately. Chevrolet, on the other hand, probably in sympathy with the General Motors slump, has fallen down to 142, a drop of 28 points in the past week.

Tire issues were in the majority of cases lower. Ajax went down 6⅛ points; Goodrich common dropped 4⅜ points and the preferred 2½ points; Goodyear common dropped 3 points; Firestone went down 15 points to 135, and United States Rubber common dropped 3¼ points.

Winther Truck Elects Officers

KENOSHA, WIS., Dec. 18—The Winther Motor Truck Co., Kenosha, Wis., organized recently with $300,000 capital to manufacture motor trucks, has perfected its organization with the election of these officers: President and general manager, Martin P. Winther; vice-president and factory manager, William Martinson; secretary, treasurer and sales manager, Walter D. Rightmire; directors, M. P. Winther, William Martinson, W. D. Rightmire, Jerry W. DeCou and Walter M. Burke. The truck will be known as the Winther. A specialty will be made of fire-fighting apparatus, and the Winther company has effected an alliance with the Peter Pirsch Co., Kenosha, Wis., fire apparatus, for the joint production of such cars, to be trademarked Pirsch-Winther. A factory will be erected by the Winther company immediately on a 4-acre site just purchased at the western limits of Kenosha.

Temple of Flowers for New York Show

NEW YORK, Dec. 18—The Temple of Flowers is the theme selected by Manager S. A. Miles, of the N. A. C. C., for the decorative plan of the New York Show at Grand Central Palace.

Mammoth lattice boxes containing flow-

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.	80	81	—6½
J. I. Case T. M. Co. pfd.	85¼	87	—1
Chalmers Motor Co. com.	130	150	—5
Chalmers Motor Co. pfd.	105	115	..
*Chandler Motor Car Co.	103	105	—7
Chevrolet Motor Co.	142	147	—28
Fisher Body Corp.	38	41	..
Fisk Rubber Co. com.	70	80	..
Fisk Rubber Co. 1st pfd.	110	115	+10
Fisk Rubber Co. 2d pfd.	90	100	..
Firestone Tire & Rubber Co. com.	135	140	—15
Firestone Tire & Rubber Co. pfd.	107	108	— ½
*General Motors Co. com.	600	800	—50
*General Motors Co. pfd.	114	118	— ½
*B. F. Goodrich Co. com.	63⅜	64¼	—4⅜
*B. F. Goodrich Co. pfd.	113½	113⅝	—2½
Goodyear Tire & Rubber Co. com.	290	295	—3
Goodyear Tire & Rubber Co. pfd.	108¾	109¾	— ¼
Grant Motor Car Corp.	7	9	..
Hupp Motor Car Co. com.	3½	4½	..
Hupp Motor Car Corp. pfd.	80	100	..
International Motor Co. new com.	10	20	—4
International Motor Co. 1st pfd.	50	80	—10
International Motor Co. 2d pfd.	30	50	..
*Kelly-Springfield Tire Co. com.	67½	68	—4¾
*Kelly-Springfield Tire Co., 1st pfd.	95	99	..
Keystone Tire & Rubber Co.	17⅜	17½	+1⅝
*Lee Rubber & Tire Corp.	33	33½	+1¼
*Maxwell Motor Co. com.	59	60	—11¾
*Maxwell Motor Co. 1st pfd.	70	70¼	—9⅜
*Maxwell Motor Co. 2nd pfd.	40	42	—7
Miller Rubber Co. com.	250	257	—3
Miller Rubber Co. pfd.	106	107½	..
Packard Motor Car Co. com.	170	180	—3
Packard Motor Car Co. pfd.	100	103	—1
Paige-Detroit Motor Car Co.	40½	41	—1
Peerless Truck & Motor Corp.	18	22	—3
Portage Rubber Co.	..	181	..
Regal Motor Car Co. pfd.	20	30	..
Reo Motor Car Co.	40	42½	—5¾
Saxon Motor Car Corp.	73	74	—3
A. O. Smith Corp. pfd.	96	..	— ½
Springfield Body Corp. com.	90	105	—5
Springfield Body Corp. pfd.	120	130	..
Standard Motor Construction Co.	5	7	—1¾
Stewart Warner Speed. Corp. com.	102	103	..
Stewart Warner Speed. Corp. pfd.	..	..	..
*Studebaker Corp. com.	112	113	+3½
*Studebaker Corp. pfd.	..	..	..
Swinehart Tire & Rubber Co.	..	87	..
United Motors Corp.	49¾	50¼	—9¾
*U. S. Rubber Co. com.	65½	65¾	—3¼
*U. S. Rubber Co. pfd.	111⅝	112	—1⅜
White Motor Co.	48½	49	—10½
*Willys-Overland Co. com.	36⅛	36½	—1⅛
*Willys-Overland Co. pfd.	98½	100	— ½

*At close Dec. 18, 1916. Listed New York Stock Exchange.
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	..	48	..
Chalmers Motor Co. com.	..	132	..
Chalmers Motor Co. pfd.	110	..	—2
Continental Motor Co. com.	44	44¾	—3½
Continental Motor Co. pfd.	9½	..	— ¼
Ford Motor Co. of Canada.	..	285	..
General Motors Co. com.	..	800	..
General Motors Co. pfd.	118½	121½	..
Maxwell Motor Co. com.	62	66	—11
Maxwell Motor Co. 1st pfd.	79	83	—2
Maxwell Motor Co. 2d pfd.	40	45	—9
Packard Motor Car Co. com.	..	175	..
Packard Motor Car Co. pfd.	..	102	..
Paige-Detroit Motor Car Co.	39	40½	—2¼
W. J. Prudden Co.	50	51¾	—3¾
Reo Motor Car Co.	42	42¼	—3¼
Studebaker Corp. com.	112	116	—7
Studebaker Corp. pfd.	107	..	..
C. M. Hall Lamp Co.	..	30½	..

INACTIVE STOCKS

Atlas Drop Forge Co.	30	34	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd.	25	30	..

ers of varied hue are to be used at the base of the giant marble columns on the main floor of the building. From the boxes will issue trailing vines which will reach to the top of the columns and twine about huge floral baskets of Roman type. A window frame of colonial design will be installed at each window on the main floor and behind the frame will be hung scenic paintings which will give the visitor the impression of looking outdoors. Dotting the walls between the windows will be installed a number of large mirrors and the reflection of the cars in these will add breadth to the interior. At the rear of the building huge draperies will hang, giving a rich background effect to the decorative plan.

The lobby to the Palace will be decorated with bay trees and flowers. Six large scenic paintings will be hung on the walls of the lobby.

The signs of the exhibitors will be made up of white letters on a red background in a gold border. The colors of the show will be white and green with red much in evidence.

—

Spark Plug Men Meet

DETROIT, Dec. 19—The fourth annual convention of Champion spark plug salesmen opened in Toledo yesterday, with visitors from all parts of the country. The convention will last for 4 days and the guests will include lectures, trips through the factory, luncheons and a huge banquet among their activities.

The company plans an output of 75,000 spark plugs per day during the next year and expects to instill highest efficiency selling principles in the salesmen to insure correct handling of such a large production.

—

Sparks-Withington Cleveland Branch

CLEVELAND, Dec. 18—The Sparks-Withington Co., Jackson, Mich., will maintain a branch office in Cleveland. A. A. O'Reilly will be in charge.

—

Nichoalds Branch in Indianapolis

DETROIT, Dec. 18—The Nichoalds Co., Detroit, retailer and jobber in motor car parts and accessories, will open a branch in Indianapolis Jan. 2. T. A. Nichoalds will be branch manager.

—

Renfro Sparks-Withington Sales Agent

JACKSON, MICH., Dec. 16—The Sparks-Withington Co., this city, has selected J. F. Renfro as Eastern Sales Agent, with offices at 1834 Broadway, New York, becoming effective Dec. 15. His territory comprises New York, Pennsylvania, New Jersey, Delaware, Maryland, Virginia and the District of Columbia. Mr. Renfro has been connected with the selling branch of the industry for a number of years.

Tire Prices Soon to Increase

—

20% Rise Expected, Due to Increased Cost of Materials and Manufacture

NEW YORK, Dec. 18—The rise in the prices of tires, threatened for the past few weeks, is not far off, according to the rubber trade in general. Prices are expected to go up at least 20 per cent. The material scarcity and their unprecedented prices have been the main reasons for the rise. Though rubber has not risen exorbitantly, the other materials which go into the makeup of tires have risen on an average about 20 per cent. For instance, tire fabric, one of the important parts of the tire, has risen in price about 100 per cent. Chemicals, cotton, labor, rent, shipping conditions, all have had their potent effect on prices.

Advise Immediate Purchase

A few of the tire companies are looking to the future by advising their dealers to get in their tires immediately. One prominent concern is taking no large orders, but advises its dealers to buy at present prices.

One of the largest companies is guaranteeing its prices for three months. Other concerns state that there is no logical reason why prices should not go up at the present time, that they are waiting for some company to take the initiative in the matter. And for that reason some of them are not accepting orders for future delivery at guaranteed prices.

The high cost of fabric has been largely responsible for the threatened rise. Tire fabric has gone up on account of the big scarcity of Egyptian and Sea Island cotton, two of the most popular grades used. Submarine warfare, weather conditions, and manipulation on the Alexandrian Exchange were responsible for a big rise in Egyptian cotton. Great Britain is largely in control of the Sea Island cotton, which is mainly contracted for before the American tire makers or duck makers have a chance to buy. These conditions, together with the cotton scarcity along the Atlantic Coast, naturally caused an increase. The cotton along the Atlantic Coast, in the Carolinas and Virginia, is the only grade in this country that is suited for tire manufacture.

—

Eleventh Edition National Used Car Report

CHICAGO, Dec. 18—The eleventh edition of the National Used Car Market Report has been issued by the Chicago Automobile Trade Association. Zone 11, centering in Dallas, is still missing.

New names in the list are: Arbenz, Biddle, Bour-Davis, Cameron, Daniels, Dispatch, Dixie, Elcar, Elgin, Hackett, Hollier, Jordan, Laurel, Madison, McIntyre, Monitor, Monroe, Owen Magnetic, Roamer, Singer, Spaulding, Sun and Woods Gas-Electric. There are 163 gasoline cars and 15 electrics listed, as compared with 139 gas and 14 electrics in the tenth addition. The pocket edition accompanies the larger edition, containing the data in abbreviated form.

—

National Rubber Co. Increases Mileage Guarantee

POTTSTOWN, PA., Dec. 16—For 1917 the National Rubber Co., this city, is placing on the market a new gray tread speedway tire which will be guaranteed on the basis of 5000 miles' service.

The list price of the new tire will be slightly higher than its ebony tread speedway, but because of the larger mileage guarantee the price of the new tire is actually less, when figured from the mileage viewpoint.

The company does not contemplate any increase in the price of its new gray tread tire.

—

Dunlop Originated Cycle Tire

NEW YORK, Dec. 14—The Michelin Tire Co. advises us that in an advertisement of theirs appearing in a recent issue of THE AUTOMOBILE, it was stated that Michelin invented the bicycle tire. This was a mistake. What should have been said was, the first detachable bicycle tire. The invention of the pneumatic tire dates back to the middle of the last century, and J. B. Dunlop originated the first successful pneumatic bicycle tire in Ireland in 1888.

—

Gerlinger Tractor Attachment for $275

TACOMA, WASH., Dec. 16—The Gerlinger Motor Car Co., Tacoma, has placed a tractor attachment on the market which may be attached to any small car. The price is $275. It is known as the Universal tractor attachment.

—

To Build Trucks in Cork

MANCHESTER, ENGLAND, Dec. 10—The city park of Cork, Ireland, is to be used for the manufacture of commercial vehicles. The Trafford Engineering Co., this city, has taken an option on that park upon which it will erect a plant to cost between $1,000,000 and $2,000,000. The company plans the manufacture of worm-drive trucks on a large scale. It will employ 2000 men.

—

J. W. Packard Presides Over Buffalo Co.

DETROIT, Dec. 16—J. W. Packard has been elected president of the Packard Buffalo Motor Co., Inc., which recently purchased the Buffalo interests of the Packard Motor Car Co., of New York.

Mr. Packard owned the small electrical shop at Warren, Ohio, where the first Packard car was made. He was the first president of the Packard Motor Car Co. and was later chairman of the board of directors. Four years ago he resigned and retired to Lakewood, N. J. The Packard Buffalo company is the result of financial aid from Mr. Packard and his brother, W. D. Packard. It will be managed by B. C. Day, who was formerly in charge of the Buffalo branch for the Packard Motor Car Co., of New York.

—

Hare Heads N. Y. Packard

NEW YORK, Dec. 16—Emlen S. Hare, formerly general manager of the New York branch of the Packard Motor Car Co., has been promoted to the head of that organization. L. J. Eastman has been elected as president and director of the Packard Motor Car Co. of Philadelphia.

—

Paige Distributers at Factory

DETROIT, Dec. 16—More than forty of the principal distributers of the Paige cars in the United States were visitors at the factory of the Paige-Detroit Motor Car Co. this past week. They witnessed the unveiling of the new models, listened to addresses made by Harry M. Jewett, president of the company, Henry Krohn, sales manager, and others, and spent a part of the time inspecting the factory, merchandising plans and efficiency and sales promotion work.

—

Not a Kent Representative

NEW YORK, Dec. 18.—Readers of THE AUTOMOBILE should beware of a man representing himself as the authorized agent of the Kent Motors Corp., to appoint territorial agents to whom a car was to be sent on consignment on payment of $5. The Kent corporation has no traveling representative. Before paying any money to so called agents of car manufacturers, it is best to communicate with the home office of the company on the matter.

—

Studebaker Dealers in Grand Rapids

DETROIT, Dec. 18—Forty-six Studebaker dealers from Western Michigan, units of the Becker Motor Car Co., Grand Rapids, met last week in that city, for a banquet and business discussion.

—

Herreshoff Co. in Bristol, R. I.

NEW YORK, Dec. 18—In THE AUTOMOBILE for Dec. 7, the location of the Herreshoff Mfg. Co., maker of the Novara car, was given as Bristol, Conn., whereas it should have been Bristol, R. I.

May Run 500-Mile at Cincinnati

—

Overcharging of Automobilists by Indianapolis Hotel Keepers May Cause Shift

INDIANAPOLIS, IND., Dec. 19—Carl G. Fisher, president of the Indianapolis Motor Speedway, announces he is considering plans for staging the annual 500-mile international sweepstakes race at the Cincinnati Motor Speedway on Memorial Day, because of the treatment accorded automobilists in Indianapolis by hotel keepers. Fisher is incensed because hotel owners have insisted on charging motorists who come here to attend the races as high as $25 a day for rooms for which the charge normally is from $2 to $4. He declared the speedway management can make as much if not more money by staging the race in Cincinnati. Fisher declared the attitude of Indianapolis hotel keepers has given the city a black eye with motorists throughout the entire country.

—

Indiana S. A. E. Talks Carburetion

(*Continued from page* 1037)

and 1600 r.p.m., with 100 lb. on the brake at full load.

We ran it with one-fourth load, one-half, three-quarters and full load. At each condition, say at 1300 revolutions, and 50 lb. brake load, we changed the mixture in the carbureter arbitrarily by changing the gasoline needle valve until the mixture was very lean, and kept increasing it until we got the engine running under the most powerful mixture—until we got to the point where the mixture would not increase the power of the motor at the same opening of the throttle.

After we got to 1300 revolutions and 50-lb. brake load we kept the throttle opening the same, and changed our brake load so as to hold the speed constant. We had the apparatus so arranged that we could weigh our gasoline to 1/100 part of an ounce. We metered the air and took the temperature into the meter and out. The vacuum was recorded and the humidity of the air was recorded, so we made an attempt to find out just how much dry air was used in each case. At the time it came to a balance it rang a gong and started a revolution counter on the end of the shaft, and then we took off the weights and set the switch again. Then, when it balanced again, it rang the gong, stopped the watch, and we knew the amount of air within 1 per cent, and knew the amount of gasoline to 1/100 part of an ounce. We recorded the amount of air, the temperature, pressure and humidity, the amount of gasoline used, and the power developed, and then we made a run.

We increased the mixture and got point No. 2, Fig. 1, and made a series of tests that way, increasing the gas in the mixture until the engine would no longer run. The curve, Fig. 1, shows the change in power due to the change in gasoline in the mixture; 0.05 of a pound of gasoline per pound of dry air, up to 16 hundredths pounds of gasoline per pound of dry air. We have very accurate figures. The perfect mixture is 0.0671 lb. gasoline to 1 lb. dry air.

The power is not quite maximum at the theoretically perfect mixture. For the range of mixtures you can get good power at 0.06 and still get good power at 0.12. You can double the amount of gasoline in the mixture and still carry almost full load, and I was unable to train myself so I could stand beside the engine and tell where in that range the motor was running. I could not tell by sound whether the engine was on the lean or the rich end.

The next point is the effect on efficiency. In all of these curves for all running conditions we have found the maximum efficiency seemed to be exactly at the point of the theoretically perfect mixture. Below perfect mixture the efficiency dropped off. If you increase above that your power drops off.

—

New Klaxon Three at $3

NEWARK, N. J., Nov. 6—The Klaxon Three, selling at $3, will be brought out Jan. 1 by the Klaxon Co., this city. It will operate on the push-from-behind principle. The push-from-the top principle which has heretofore been used in the Klaxon, has been abandoned in all models.

Upon the completion of a large addition now in process of construction, the Klaxon plant will be doubled in capacity. For 1917 the company announces a reduction in the number of models which it has made in the past. All facilities will be concentrated on a few standard models to be known as Klaxon 20, selling for $20; Klaxon 12, designed especially for use under the hood; Klaxon 6, a smaller electric horn for both outside and under-hood use at $6; and the new Klaxon Three.

—

Columbia Truck Increases Capital

PONTIAC, MICH., Dec. 19—The Columbia Motor Truck & Trailer Co., Pontiac, Mich., has increased its capital from $35,000 to $100,000. The additional stock was subscribed for by several private individuals. The company plans to erect another additional building.

—

Dickinson With Champion Motors

FULTON, ILL., Dec. 18—D. M. Dickinson has been appointed director of sales for the Champion Motors Co., Inc.

The Automobile

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Better Cars

IN summing up all the changes in engineering noted on the 1917 cars there is but a paltry total if the design changes of last year are compared with those of the present one. But design is only a part of the task of making good automobiles, and 1916 has been a banner year for the manufacturing side, which does work that is much less spectacular than that of the engineering departments.

There is no object in trying to blink the fact that some manufacturers have increased production at the expense of the quality of their cars, that some of the new systems and processes have exhibited troubles during the year, and that the vastly improved designs produced in 1915 have not always had the perfection of manufacture during 1916 of which they were worthy. But troubles as they arose have been caught in the early stages and the probability is that 1917 will be a year in which average workmanship will be improved very greatly, following the steady improvement that has been taking place throughout the year now drawing to a close.

When a huge new machine is set up—a big printing press, a large turbine, a ship's engines and so on—it is always some little time after first starting up that everything is running smoothly. Last year the automobile manufacturers re-created their factories, made bigger machines of them, and we have had the period of settling down to go through. We have now passed this period, or at least the worst of it, and can look forward confidently to better and even more economically made cars in 1917.

The Parking Problem

EVERY day in big cities the parking problem grows more acute. If it is bad to-day, and indeed it is so, what will be the situation in 3 years?

We are facing something which was never foreseen in the planning of our towns, a thing which has come upon us so swiftly that there has been no time to grasp the immensity of the problem till we are almost overcome by it.

At present we need some definite ideals to work for. The big cities are now trying to handle the matter by prohibiting parking in the main thoroughfares, but this is not a solution of the difficulty; it merely postpones the task of settling the thing properly and makes that settlement more difficult in the end.

One, almost ideal method is to have streets so wide that a central strip 30 to 40 ft. wide can be given over to parking, leaving enough road for traffic on either side, but obviously this can only be considered in very new towns with their future before them.

For existing big cities we have three schemes, large municipal garages, underground parking "cellars" and overhead roads. Of the three the first is not a good solution. To get the greatest benefit from the machine the automobile should be parked close to the place where its user is at the time. Very many scattered, small parking places are much better than a few immense garages.

There is one big opportunity for doing something with the huge garage and this is in the few biggest cities of all where transportation of all kinds is good. Here big garages just outside the congested area would be an immense advantage. In New York, for instance, they might be just off or just on Manhattan at the points where the main roads enter and link with the public service surface and subway systems.

The underground scheme has excessive cost against it, and also the need for perpetual artificial light and the probable difficulty of getting in and out. Yet, if we cannot widen our streets it seems the only other answer is to double then by going above or below. The elevated road would be costly, but it does seem to be the more plausible scheme.

The elevated road should be considered from the viewpoint of its advantage to through traffic. Take a city with a half dozen radial roads where it is necessary to cross town to get from one side to the other. In such places an elevated system would remove all through traffic from streets where the shopping and similar traffic abounds. Imagine Detroit with an overhead Woodward Avenue connecting to Jefferson and to several points on the Boulevard; an elevated road with no speed limit, solely for automobile traffic!

The subject needs much more discussion than it is getting. It cannot possibly be handled much longer by repressive legislation alone.

Austria-Hungary

By Edward Allen Langdon*

¶ All classes in Hungary have been enriched by the war, and when hostilities cease there will be a large demand for automobiles.

¶ Austria will need 150,000 passenger automobiles and 6000 trucks in the first 24 months following the close of the war.

¶ U. S. A. automobile firms will have to establish service stations in either Austria or Germany. They will have to be well stocked with spare parts.

¶ Hungary being primarily an agricultural country will need light automobiles and small farm tractors. Conditions are similar to that of the West and Middle West U. S. A.

¶ Austria-Hungary after the war will be on a basis of German efficiency.

So far as one can tell, by developments up to the present time, there will be hardly a country in Europe which will be so modernized by the war as Austria-Hungary. Already deep changes are noticeable, and no doubt this state will present, after the war, a set of conditions altogether different from what the dual monarchy was known as before 1914. Many of these changes are of very direct bearing on the question of Austria-Hungary as an automobile market, and the following remarks are devoted precisely to this question. If, after 2 years of warfare, the struggle is still going on unrelentingly, it seems nevertheless to most well-informed people not only in Central Europe, but also in the neutral countries of this continent that the end of the war is nearer than it would seem from its bitterness. For this reason, too much stress cannot be laid upon the advice to American manufacturers of automobiles, motor trucks, tires and accessories.

1500 People Per Car

The beginning of the war found Austria in the possession of perhaps 40,000 automobiles. Certainly, this was a small number for a nation of almost 60,000,000. But there was a reason, or rather, several good reasons; Austria-Hungary was, and still is, primarily an agricultural country, and in Europe this means a country none too progressive. Hence, modern machinery both in manufacture and transportation was introduced slowly. The horse played a very important rôle in the transportation of passengers and merchandise. The agricultural population, excepting the rich landowners, were partly not in a position to buy automobiles, and partly did they still mistrust this modern type of vehicle. The peasant in this country is much more conservative than the American farmer, or for that matter, the farming class of England and France. Hence, the rural sections were almost without motor vehicles, excepting where lumber mills and other large industrial undertakings utilized motor trucks.

Horses Are Fewer

All these conditions have changed. The supply of horses has been diminished, so that the importance of this factor in tractive work is much less than 3 years ago. In addition to this absolute decrease of importance, there must be considered the fact that the peasant class has more than any other class suffered from the troubles of war, is more than any other decimated and maimed and reduced in their ability to work. Hence, agriculture in the dual monarchy will *perforce* be put on a more modern basis of operation, wherein the work formerly done by two, three or four men will have to be done by one man, or a woman, for that matter; as women are now a factor of never before imagined importance in the life of Austria-Hungary.

So much for the need of small passenger automobiles, medium-sized trucks and tractors for the agricultural sections.

Government Provides Truck Subsidy

The industries of Austria began to take to automobiles even before the war, and this trend was enhanced by the policy of the government to subsidize purchasers of motor trucks made in Austria provided the trucks came up to certain governmental specifications so as to be useful in case of war. This policy will without a doubt be continued with increased energy when peace has been restored, and of course foreign-made automobiles (in all likelihood the subsidies will be extended to passenger cars also) will not receive the government support and therefore will have to compare favorably in price with the native product.

All the population has been educated in a broad way to modern appliances by the war. Soldiers, called from the farm, who never before had an opportunity to handle mechanical devices, have become interested and adept in the driving of automobiles. People have become accustomed, in this most comfortable country of Europe, to do their work on an

*Editor's Note—Edward Allen Langdon has for many months been in different parts of Europe studying automobile conditions in those countries. Mr. Langdon is a critical student of conditions. He is making a conservative study of trade and all his utterances savor of conservatism.

efficient-schedule basis, to be on time, to carry out their tasks with almost German or American precision. All these factors make for a psychologically better automobile market after the war.

Hungary Especially Important

Special attention should be given to Hungary. This part of the dual monarchy has very much increased in importance during the war and indeed is to-day more powerful than "the Kingdoms and Countries represented in Parliament," as the Austrian half of the realm is called officially. Hungary is primarily an agricultural country and fertile enough to feed all of Central Europe, with proper methods of distribution. But the country is also rich in mineral resources, and the past two decades have seen a rapid growth of industry there. The war is bound to accelerate this development, and as Hungary has been very much enriched, through all its classes, by the war, it ought to offer splendid opportunities to enterprising exporters of American cars.

Money Is Plentiful

The field here includes especially the very types of automobiles sought and bought by American farmers of the West and Middle West, also three-wheeled tractors suitable for connection to agricultural machines proper. It should also be noted that the end of the war will find money more plentiful in Hungary than in Austria.

It has been stated that women have become a highly important factor in social and economic life of Austria-Hungary. This means that cars hereafter will in many cases be operated by women, whereas before the war none except the ladies of the richest classes operated machines. It follows that, women being perhaps less ready to grasp mechanical details, the bulk of automobiles sold in Austria-Hungary will have to be fairly simple and yet reliable in construction.

Much Hill Work

Austria is to a very large extent mountainous, and passenger cars for touring purposes will have to be of a type suitable for alpine work, with good climbing ability, plenty of reserve power and fair fuel economy. The Austrian fuel, after the war, will be benzine—practically identical with American gasoline—although Germany will use alcohol and benzol extensively. Touring cars should be comfortable, strong and efficient, without being too heavy. The ideal type of Alpine car is the Austrian Daimler which in the last few Alpine tours made excellent showings; and by this standard Austrian tourists will measure the cars they buy. They will look for machines built along somewhat similar yet lighter lines, including the points aforementioned, and fitted if possible with large tires, as well as electric lighting and starting, all the necessary accessories and fixtures required for the particular class of touring.

Service Stations Are Essential

One point essential in selling cars in Austria-Hungary is that there must be a service station somewhere in Europe, capable of supplying within a few days any reserve parts needed. Very likely this service station will have to be located in either Austria or Germany, as it will be a long time until the Central European countries will forget the isolation created by the British blockade. This point of the necessity of a service station cannot be overemphasized.

The Road to the Orient

Another point is the knowledge of the native language by the salesman, and, of course, discretion and politeness, perhaps even diplomacy; for there are many people in Central Europe now who are anything but enthusiastic admirers of America.

If, as has been mentioned as probable, the end of the war is nearer than is generally supposed, then Austria-Hungary will take on importance in another new respect. At this writing there is practically an unbroken line of transit between Hamburg and Bagdad; and unless the fates of war change fundamentally in the future, Vienna will be the central point of the important bridge between industrial Germany and the progressing Near East. Austria-Hungary is bound, in such an evolution, to play an important role, and preparations are being made, financially and technically to fit her for playing it. This development alone, the rendering of the dual monarchy into a road to the Orient will necessarily lead to an increased prosperity of Austria-Hungary.

Industrial Efficiency to Grow

Judging by the degree to which Austrian affairs are now run, directly or indirectly, by Imperial German direction, it is very likely that Austria will rapidly advance to an industrial efficiency closely approaching that of Germany herself. In that case the prosperity of the rejuvenated dual monarchy will by far exceed the fairly conservative estimate given below. This estimate is for the automobile market's capacity, for the 24 months following the war, and presupposes a moderate regeneration which would be illustrated by an exchange rate on Austria of 15 to 16 cents for the Krone. From talks with members of the Austrian industries I should put the demand for the period mentioned at

150,000	passenger cars....	@ $ 700	$105,000,000
5,000	trucks	" 2,000	10,000,000
1,000	"	" 3,000	3,000,000
	Total		$118,000,000

Best Car-Marketing Plan

The prices marked would have to be f.o.b. New York, and wherever agencies are given to local dealers, transactions would have to be done on letter of credit for 4 months' sight. Automobiles would have to be guaranteed substantially.

As to the selling of cars in Austria-Hungary a few points have already been mentioned. The most advantageous method of utilizing the territory would be a central place in Vienna, and four or five branch salesrooms in Austria and one or two in Hungary. Perhaps the best plan would be for several makers to combine for the export of their products to Austria-Hungary so as to reduce the expense and use the saving for selling the machines at the best price possible.

Regarding the cost of such agencies, it is very difficult to lay down definite data, but a place in Vienna and moderate advertising can be had for $12,000 to $15,000 a year total expense. This makes possible a turnover of $60,000 to $80,000 for the same period.

U. S. A. Cars in Favor

Before the war, half a dozen or so of well-known medium-priced American cars were introduced very successfully in Austria-Hungary and while the supply of these cars was cut short by the outbreak of the war, many of these machines have rendered splendid service in the army and have served to create an excellent reputation for American cars regarding which many pople felt rather chary prior to the present calamity.

There has been a tariff on automobiles and it will very likely be continued after the war, perhaps even increased. If this is the case, the exporting to Austria-Hungary of automobile parts will pay even better than that of complete automobiles.

Good Tire and Accessory Field

There is also a splendid market for tires in this country, and while there are some Austrian and German makes on the market, American products, if properly handled, should be

able to replace them completely after the close of hostilities.

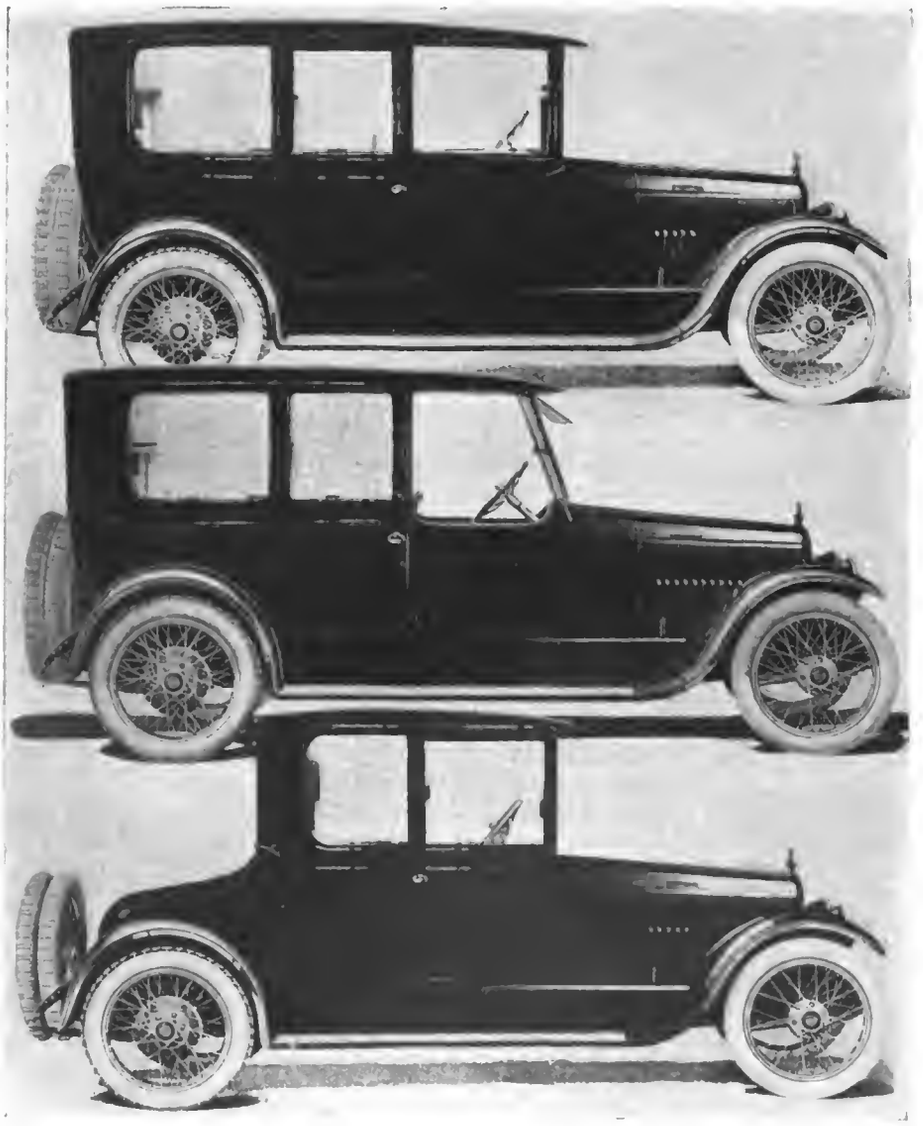
Likewise, accessories such as starters, speedometers, etc., are certain to find a good market in the dual monarchy after the war.

Must Begin Operations at Once

In every case where exporting is tried, the work can best be done by native Americans—except if an applicant for the position possesses unusually good connections in the country—who can speak the language fluently and who are possessed of some psychological instinct and natural tact. This point, however commonplace it may sound, is extremely important and can perhaps be fully appreciated only by those Americans who have spent the last 2½ years in Central Europe, during which time relations across the Atlantic became strained more than once. At the present time the feeling toward America is rather friendly, and, unless the situation is changed radically, will continue to be so to the end of and after the war.

At any rate, preparations for handling the Austro-Hungarian after-war business cannot be made too early. Not only because doing business in this country of many tongues and nations requires deft treatment, but also because Germany is certain to recover with great speed from the war. The German Empire, due to the preparations made for the days of peace even now, when supreme efforts are still being made for waging the war, will beyond a doubt be the first country of Europe to get over the effects of the war, and will do everything in its power to obtain a maximum share of the world's trade, and logically will begin with the places nearest home: Austria-Hungary, Scandinavia, Poland, Italy and the Near East. The export to all these territories, is therefore, really one great question, and will have to be handled as such. Unless American manufacturers realize this in time, they will lose the greatest chance of the after-war period; just as—according to many economists here—they have done themselves out of a good share of lasting international trade by devoting their energies chiefly to the destructive and very temporary business of supplying the European war.

Jordan Limousine, Luxury Sedan and Custom Style Coupé



Above is the new Jordan seven-passenger limousine which sells for $3,000 f.o.b. factory. It is mounted on the standard four-cylinder chassis with 127-in. wheelbase. There will be only twenty-five limousines provided. In the middle is the Luxury sedan which has a permanent top but is convertible so that it may be used open or closed for different seasons. It lists at $2,350 f.o.b. At the bottom is the four-passenger coupé which sells for $2,300

COMBINING selected materials with workmanship of a high standard, the closed line of the Jordan Motor Car Co., Cleveland, comprises a seven-passenger limousine, a seven-passenger sedan and a four-passenger coupé. All are of low design, in accordance with the latest dictates of body construction, and the spring suspension is adapted to each to meet all load and road conditions and are rigidly mounted on the chassis to eliminate all rattles and squeaks.

Only twenty-five limousines will be provided, insuring distinction to the purchasers. The color is an unusually attractive blue or green, upholstery in the rear compartment being French tapestry with the front seats in long-grained, hand-buffed leather. There are window lifts, silk curtains, auxiliary seats folding out of sight, dome, running-board and reading lights, etc., besides many small bits of equipment, such as a watch and dictagraph phone. The price is $3,000, f.o.b.

As in the limousine, comfort is a great feature of the Luxury sedan. This body is of the convertible, permanent-top style, with windows folding into the doors. A car heater is provided, and the equipment is complete to the smallest detail. The sedan lists at $2,350, f.o.b. factory.

The coupés will be limited in output and will be of the same general finish as the sedan, the seating arrangement, however, being staggered, two passengers sitting at the right about 16 in. to the rear of the driver. The rear compartment will hold two suitcases and a traveling bag. The coupé sells for $2,300.

All three bodies are mounted on the standard Jordan sixty chassis with 127-in. wheelbase.

Suggests a New Testing Method

Novel Way of Plotting Engine Characteristics Outlined in Paper Presented Before Mid-West Section S.A.E.

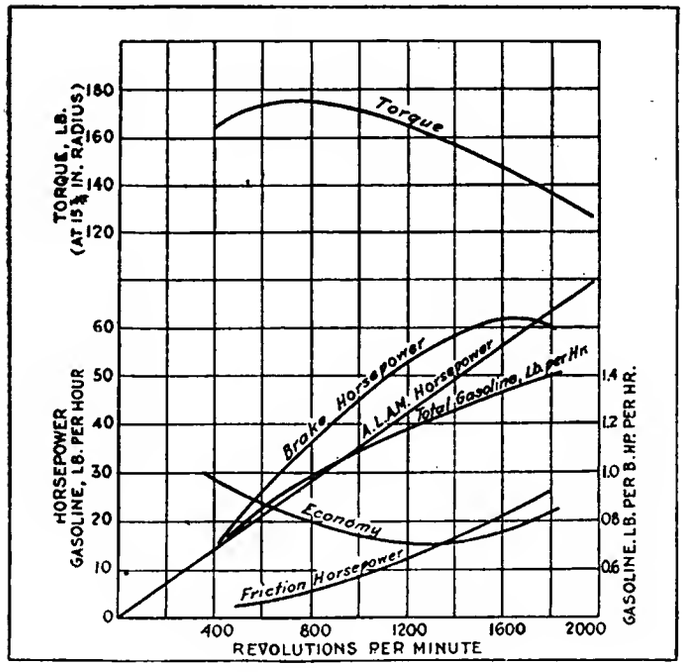
By Daniel Roesch

THE present method of testing variable-speed gas engines, as used in automobiles, motorcycles, marine craft or air craft, consists primarily of determining the *maximum* torque and horsepower at a number of different speeds. These results are plotted on co-ordinate paper; a smooth curve drawn through them represents the ultimate torque and horsepower characteristics for all speeds within the test range. The gasoline consumption is often taken simultaneously with these data. The gasoline consumption per hour or per brake horsepower per hour can then be plotted in the same way. These data are customarily taken under wide-open throttle conditions, the results being plotted with revolutions per minute as abscissas and the other variables as ordinates. These data and others less frequently taken during tests or derived from test results are:

1—Revolutions per minute of the engine.
2—Developed torque—average turning-moment developed.
3—Brake horsepower—calculated from 1 and 2.
4—Friction torque.
5—Friction horsepower.
6—Gasoline rate—preferably weight per unit of time.
7—Gasoline economy—weight per unit of power per unit of time, calculated from 6 and 3.
8—Jacket-water rate—preferably weight per unit of time.
9—Sensible heat in exhaust—by calorimeter.
10—Exhaust analysis—for incomplete combustion.
11—Radiation—preferably obtained by difference.
12—Air rate—weight per unit of time.
13—Mixture ratio—calculated from 6 and 12.
14—Depression in inlet manifold—indicating carbureter resistance.
15—Pressure in exhaust manifold—indicating exhaust-pipe resistance.
16—Spark advance.
17—Mean effective pressure, net—from 2, or 1 and 3.
18—Mean effective pressure, actual—from indicator card; from 1, from 3 and 5, or from 2 and 4.
19—Mechanical efficiency—from 2 and 4, from 3 and 5, or from 17 and 18.
20—Compression pressure—by indicator test.
21—Heat balance—percentage of heat supplied appearing as:

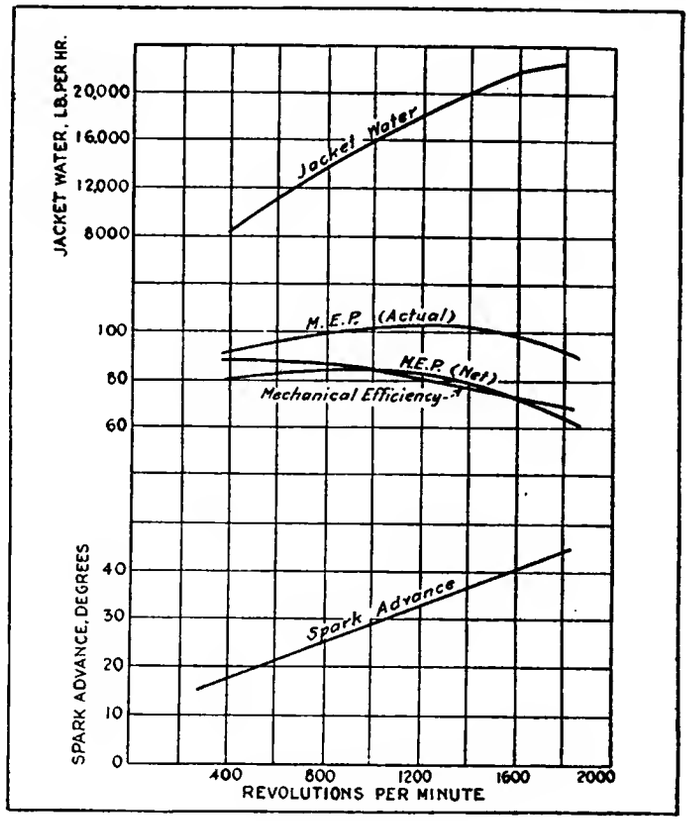
a Indicated horsepower.
  1. Brake horsepower.
  2. Friction horsepower.
b Jacket-water loss.
c Sensible heat of the exhaust.
d Incomplete combustion.
e Radiation.

These characteristics of a variable-speed engine show only its performance under wide-open throttle conditions—a condition often not maintained in use. It would follow then that an engine *A*, showing superior merits to an engine *B* under the usual test conditions, can have inferior



Above—Fig. 1—Torque, horsepower and fuel consumption curves

Right—Fig. 2—Curves for engine operating with wide open throttle



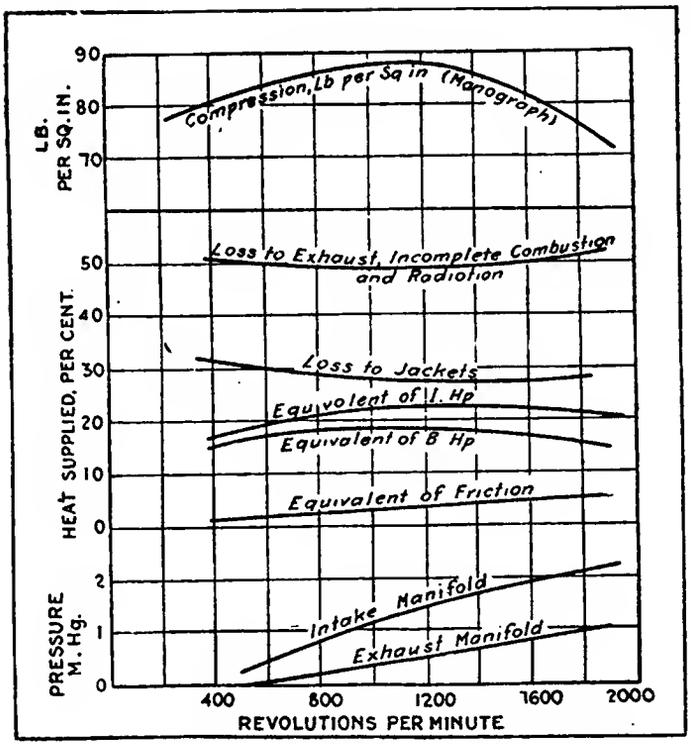


Fig. 3—Curves showing distribution of heat supplied to engine

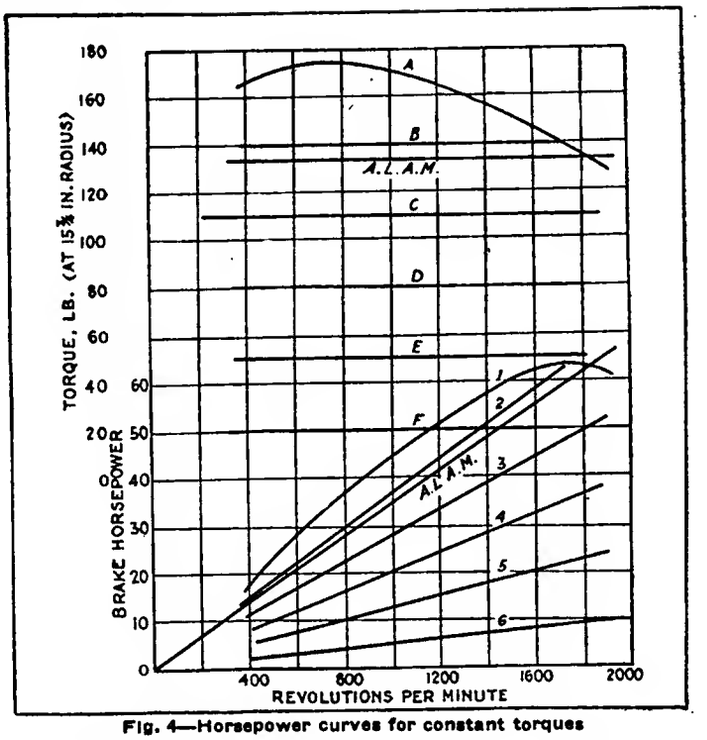


Fig. 4—Horsepower curves for constant torques

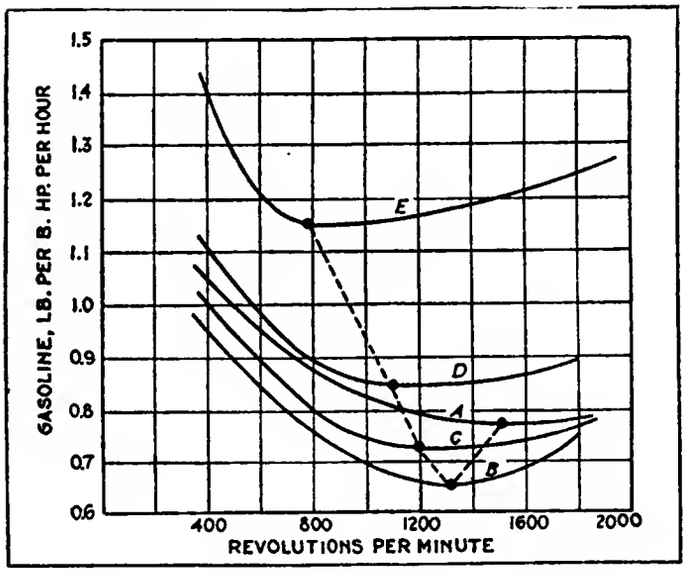


Fig. 6—Fuel consumption per brake hp. for constant torques

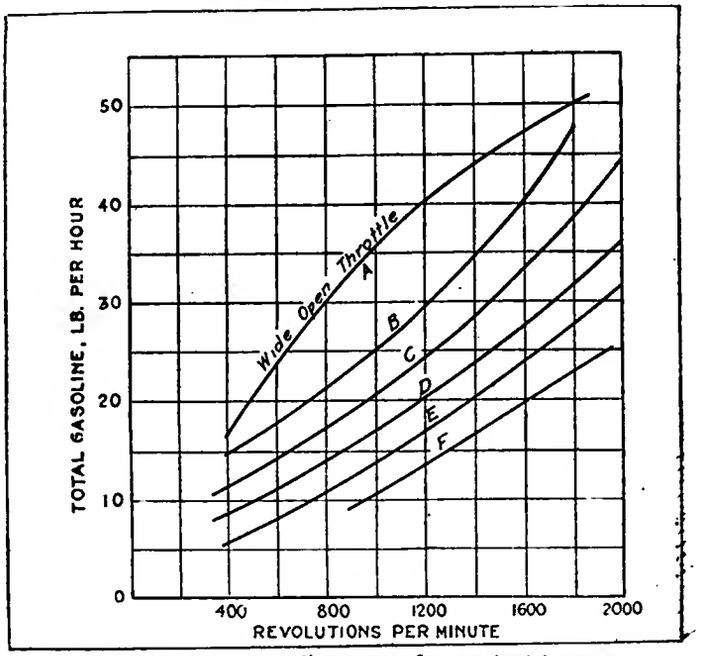


Fig. 5—Total fuel consumption curves for constant torques

merits when tested under partly-open throttle. This difference would have little moment where the engine operates largely at wide-open throttle, but might have a determining influence where the operation was chiefly at partly-open throttle, as in the automobile or motorcycle engine.

Preliminary Investigations

In order to investigate this question and develop a method of analysis for engines of this type the author suggested to Messrs. Cooban, Palmer and Stepanek, class of 1915, Armour Institute of Technology, that they conduct a preliminary investigation of this problem as a thesis. This investigation furnished the necessary data upon which the method was developed. Additional investigations utilizing and developing this method of testing are at present being conducted in the Armour Institute laboratories by Messrs. Fritze, King and White, class of 1917.

Electric-dynamometer tests were conducted on a high-class 4 by 5½-in. six-cylinder L-head engine built about June, 1914. The data were taken so as to cover all ranges of speed and load on the engine, whereas the customary method covers all ranges of speed at maximum load only. The engine was new, was fitted with stock pistons and had no extra provisions for lubrication. It was deemed therefore advisable not to operate at high speed or heavy loads more than 10 min. without decreasing the load. A run confined to this time limit gave accurate readings of power and economy with possibly questionable readings of jacket losses.

Since this paper deals with the method of obtaining new test data and not the actual figures obtainable, slight inaccuracies are of no particular consequence. The test data as replotted nevertheless represent performance characteristics in a new and broader way than heretofore observed. While the 1915 preliminary thesis established that such a method gave the desired information, it was considered more cumbersome than the one here described.

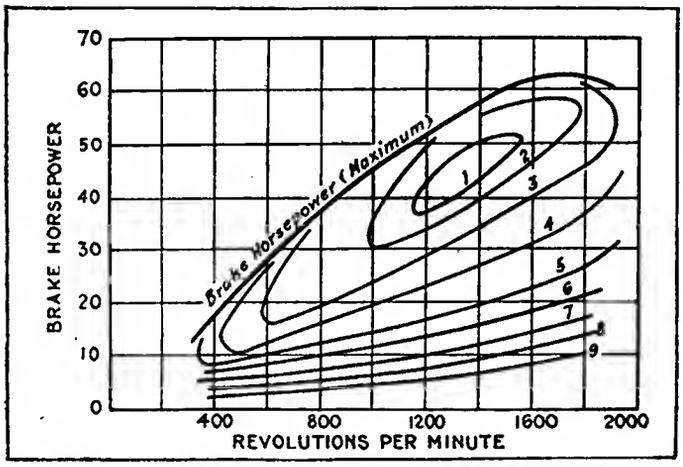


Fig 7—Lines of equal thermal efficiency

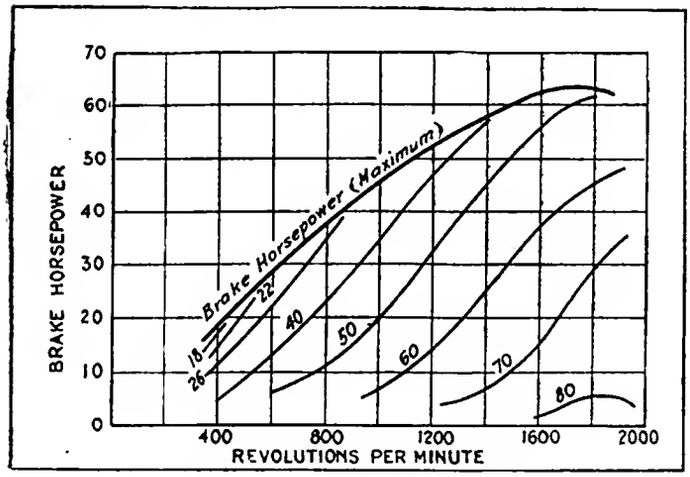


Fig. 8—Lines of equal spark advance

If data enumerated under items 1 to 21, inclusive, were taken during a test of an engine the resultant curves might be conventionally shown as in Figs. 1 to 3, inclusive. It is to be again noted, however, that only wide-open throttle conditions of operation are represented by these curves.

Methods of Complete Analysis

The complete analysis of an engine of the type considered can be determined from data taken in the following manner:

Tests are first made in the conventional way at various speeds with wide-open throttle. Whatever data are desired are then taken at each test speed and the customary characteristic curves plotted. One of these will be the torque curve, which is frequently taken as the pull in pounds at a 15¾-in. radius. This characteristic is represented by *A*, Fig. 4. The corresponding horsepower curve is represented by 1, Fig. 4, and shows the maximum power developed at any speed. If now a constant torque of, say, 140 lb. at 15¾-in. radius be maintained and the test conducted as before, we can obtain torque curve *B*, Fig. 4, and the corresponding horsepower curve 2. Similarly the curves *C*, *D*, *E* and *F*, and their respective horsepower curves 3, 4 5 and 6, are obtained for various constant values of torque.

Whenever the torque line is horizontal a constant mean effective-pressure, net, has been maintained by the engine; also the horsepower increases directly with the speed. This is similar to the N. A. A. M. horsepower rating and its corresponding mean effective-pressure, net. These lines are added to Fig. 4 for comparison. Since the horsepower of all but the first series of tests is proportional to the speed these curves will be straight lines and pass through the intersection of the axes.

Instead of selecting constant even-value torques for lines *B*, *C*, *D*, *E* and *F*, an alternative method would be to obtain these curves so that they would correspond to 67.3 lb. m.e.p., net, and, say, 15, 30, 45, 60, 75 and 90 lb. m.e.p., net. The advantage would be in subjecting various engines to like net mean effective pressures for each series of tests. This would facilitate comparison of performances. The disadvantage lies in having an odd value for the torque, which may be confusing during testing.

While this analysis can be applied to all of the data enumerated at the beginning of this paper, the factors of fuel consumption, mechanical efficiency and spark advance are probably the most important. The method of determining these and other characteristics under all conditions of load and speed will be indicated.

Obtaining Contour Lines

The total fuel-consumption curves for conditions as indicated, curves *A*, *B*, *C*, *D*, *E* and *F*, Fig. 4, are shown by curves similarly marked in Fig. 5. The gasoline consumption in pounds per brake horsepower per hour for each load condition was also computed and plotted in Fig. 6. These curves then furnish the necessary data to establish the load and speed for any particular gasoline consumption. A set of interpolation curves was then constructed for 400, 600, 800, 1000, 1200, 1400, 1600 and 1800 r.p.m. with brake horsepower as abscissas and gasoline consumption in pounds per brake horsepower per hour as ordinates. The data for these curves were taken from the curves in Fig. 6. These interpolation curves furnished sufficient points for, say, 0.7 lb. per brake horsepower per hour, to locate properly this contour line in Fig. 7. The other lines of equal thermal efficiency were plotted in a similar manner from the same in-

Line No.	1	2	3	4	5	6	7	8	9
Gasoline, lb. per B. Hp. per hour	0.66	0.7	0.8	0.9	1.0	1.25	1.5	2.0	2.5
Thermal efficiency on B. Hp.....	19.3	18.2	15.9	14.1	12.7	10.2	8.5	6.4	5.1

terpolation curves. Lines of equal gasoline consumption were thus established from these test data, as shown in Fig. 7. Lines of equal spark advance, Fig. 8, have been determined in a similar manner. Lines of equal mechanical efficiency, Fig. 9, have been determined by the conventional electric dynamometer method. There appears to be no reason why any of the other test data ever taken could not be graphically shown in a similar manner.

Summary

The chief advantage of the data presented graphically in the manner indicated is that they show concisely and clearly the performance of the engine under every possible condition of load and speed. Academically the method has already been found valuable in disclosing completely the various engine characteristics. Commercially the determination of cer-

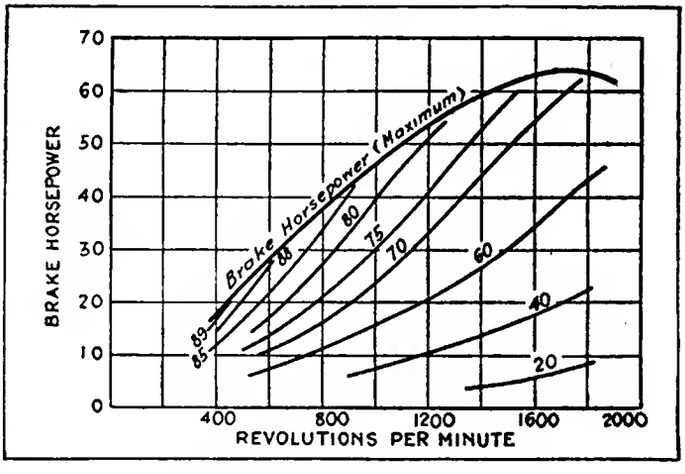


Fig. 9—Lines of equal mechanical efficiency

tain of the contour lines has been found valuable in design study of the engine features affecting them.

The gasoline-economy contour curves of various carbureters on the same engine should be of particular value for purposes of comparison. The same curves from different engines would be of value in more closely predicting car mileage per unit of fuel consumption.

The data on sensible heat in the exhaust should be of value in the design of kerosene carbureting devices, with which considerable heat is required for fuel and air preheating.

The jacket-water rate and loss should be of value in pump and radiator design.

The spark-advance contour curves are valuable in design of automatic spark-advance mechanisms, which advance correctly the spark for load and speed variations.

May Develop Other Methods

No doubt many other applications of test data recorded as indicated will become apparent upon study by the automobile-design specialist. It is hoped that the presentation of this paper will develop discussion showing: 1, The weak spots in the method and means of remedying them; 2, benefits to be derived from data thus presented; and, 3, other methods for ascertaining similar results.

Studebaker Dealers and Sub-Dealers in South America Meet in Buenos Aires

BUENOS AIRES, ARGENTINA, Nov. 4—The annual meeting of Studebaker dealers and sub-dealers in South America was instituted in this city during the past fall, when D. B. Richardson, manager of the Studebaker interests in South America entertained all of the dealers and sub-dealers at a banquet as well as a trip through the city park system.

The meeting of dealers in a conference of this kind is unusual in Argentina. The city of Buenos Aires has not its association of automobile dealers as have the cities in North America. Here there has never been any getting together of dealers handling rival makes of cars. Since the war it would be practically impossible to get around the same banquet table dealers representing English, German, French and Italian cars. It is this fact that Buenos Aires dealers handle cars made by rival countries that has held back cooperation of Buenos Aires dealers. Unquestionably this movement by the Studebaker organization will have its influence, and manager Richardson has made up his mind to have started in this city an organization of automobile dealers such as exists in so many cities in the United States.

The illustration shows a typical Buenos Aires scene with the parade of Studebaker cars filling the street. It is a park drive in the Palermo Park, which is one of the show points of Buenos Aires.

The rapid increase in the number of U. S. A. cars exported to Argentina is an indication of the development which may be expected in the automobile business in this country.

A vista down one of the drivas in the Palermo Park in Buenos Aires, showing the parade of Studebaker cars held at the time of the dealers' convention. Palermo Park is one of the show placas of the city, noted for the beauty of its parks and boulevards

Studebaker dealers and sub-dealers in South America at the banquet held during their recent convention in Buenos Aires

Care of Batteries on Stored Cars

75% of Battery Troubles Are Due to Neglect of Dealers To See That Cars Are Turned Over to Buyers with Battery Fully Charged

EDITOR'S NOTE:—From a paper presented by H. S. Bentley, of the Willard Storage Battery Co. before the Indiana Automobile Service Managers' Assn. Dec. 9

BECAUSE of the failure of motor car dealers to give the storage battery a proper chance for its life, by neglecting to turn it over to a customer with a full charge, at least 75 per cent of all future storage battery troubles and dissatisfaction are born. If he knows the battery is half or more discharged, he quiets his conscience by thinking that the generator will build it up to a condition of full charge. This may happen in a few cases, but in most cases the current produced by the generator will not be sufficient to any more than replace the current used for everyday lighting and cranking. Consequently, the battery continues in a more or less starved condition for several weeks or months, and ultimately goes dead. Reforming may restore it to serviceable condition, or new insulation may be necessary. In either case the owner expresses dissatisfaction with the battery, which dissatisfaction, if properly placed, should be directed toward the dealer who neglected to furnish a new car with a battery in proper condition for service.

Half-Starved Batteries Cause Trouble

Battery trouble develops in other directions from half starved batteries on new cars. If the battery and car have been in transit or in stock for a considerable period, the discharged condition of the plates may make them so hard that great resistance to the charging current is set up and the plates are severely overheated on the first long run on a warm day. The normal generator output which would not injuriously affect a healthy battery will produce this result in a neglected and discharged battery.

We have already shown that it is always of very great importance to the life and service obtained from a battery, that the dealer should have it charged upon receipt, if necessary, and thereafter keep it in a fully charged or nearly fully charged condition until the car is sold. Naturally, this is of much greater importance with respect to batteries received on stock cars to be held during winter months. This is true, because the storage period is ordinarily much longer than the period during which any cars are kept in stock during the selling season.

We come then to the question of the means which a dealer should take to preserve these batteries from deterioration, so far as possible.

Ship Dry Batteries for Winter Stock

First of all, manufacturers should arrange with their dealers to ship them "export" or "dry" batteries with all cars to be stocked during the winter season. These batteries are prepared without electrolyte, and if kept in a moderate temperature of from 35 to 60 degrees will need no further attention, and will not suffer deterioration to any degree until they are needed for service. A few days before they are to be used for service they must be filled with electrolyte of the proper strength and given a reforming charge until gravity and cadmium tests show that the plates are in a fully charged condition.

Must Take Precautions

Manufacturers who ship batteries for winter storage in the dry condition should take the precaution to paste a seal over the filling aperture of the gasoline tank, calling attention to the fact that the battery on the car is without electrolyte, and must be properly filled and charged before the car is used. If this precaution is not taken, it would be possible, through carelessness, for batteries to be charged while dry, and consequently ruined. If batteries are received in the regular way with electrolyte, they should be fully charged upon receipt, and given sufficient charging every 2 weeks thereafter to keep them in a fully charged condition. Due to the chemical action, there will be more deterioration during the storage period than would be the case if they were prepared and stored in the dry or export condition.

Shipping Cars Without Batteries

It has been proposed as a possibility that manufacturers ship cars for winter storage without batteries, and some provision be made for supply batteries in proper condition for service when the cars are sold in the spring. It is manifestly impossible for a storage battery manufacturer to undertake to make deliveries on manufacturers' orders through their retail selling organization. The difficulties of making proper shipment to proper points, and of handling the billing and other details would make such a plan prohibitive.

Value of Service Stations

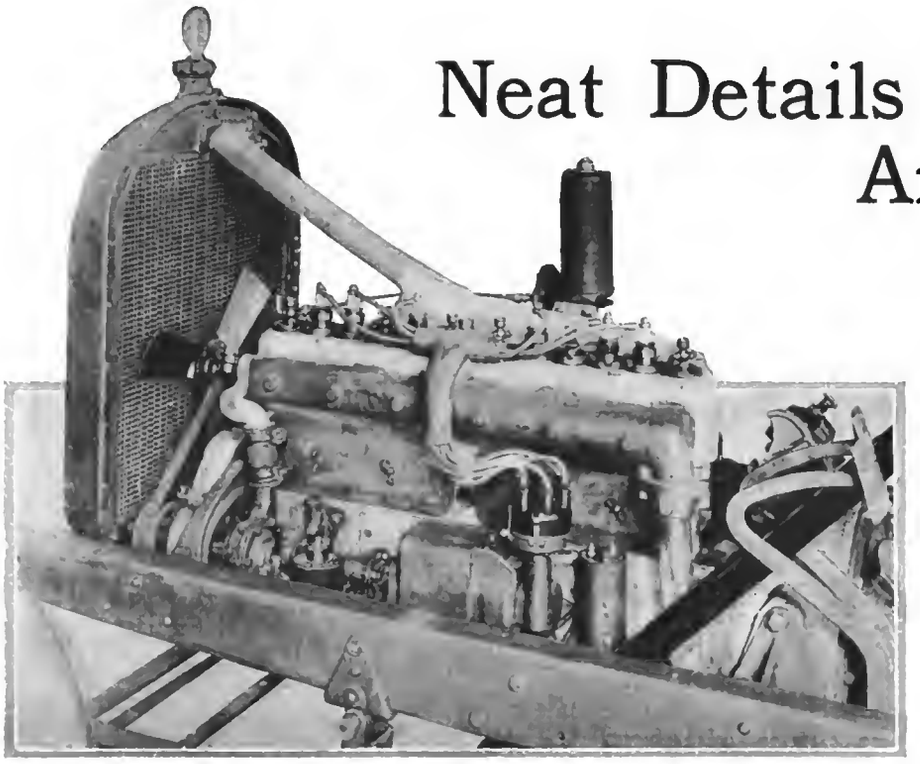
It must be recognized, however, that the dealer seldom has the equipment or skilled employees necessary either to prepare dry batteries for service, or to properly care for wet batteries economically. Careless or inexpert garage employees already have to their discredit the absolute ruin of hundreds of batteries, either through overcharging or charging in reverse. So far as the Willard company and Willard batteries are concerned, competent battery service stations have been provided at over 800 points in the United States and Canada, in whose hands either wet or dry batteries may be placed for storage and preparation with absolute confidence. Dealers may, therefore, unload on the Willard service organization all worries and cares in connection with batteries received with winter stock cars. The cost of this service will be reasonable in every case, but will necessarily be governed to some extent by local conditions in the various territories. For example, a service station at Buffalo may pay only 1½ cents per kw. for electric current, 4 cents per lb. for electrolyte, and 30 cents per hr. for labor. At Butte, Montana, electric current may cost 12 cents per kw., electrolyte 10 cents per lb., and union labor may be at the rate of 75 cents per hr.

Make Dealers Responsible

Considering the conditions as outlined, we believe that the best interests of the motor car manufacturer, storage battery manufacturer, motor car dealer, and ultimate car owner, demand that every motor car manufacturer put up to his dealers their responsibility for the condition of these batteries and recommend in the strongest possible way that the dealer place all such batteries as soon as received in the hands of the local service station of the storage battery manufacturer.

Neat Details Features of American Six

New Design by Louis Chevrolet—Full of Character — Lubrication by Unusual System



Mounting of Carter tank and Gray and Davis starting motor on American Six engine. Note the bracket on the bell housing carrying the accelerator pedal and starter switch

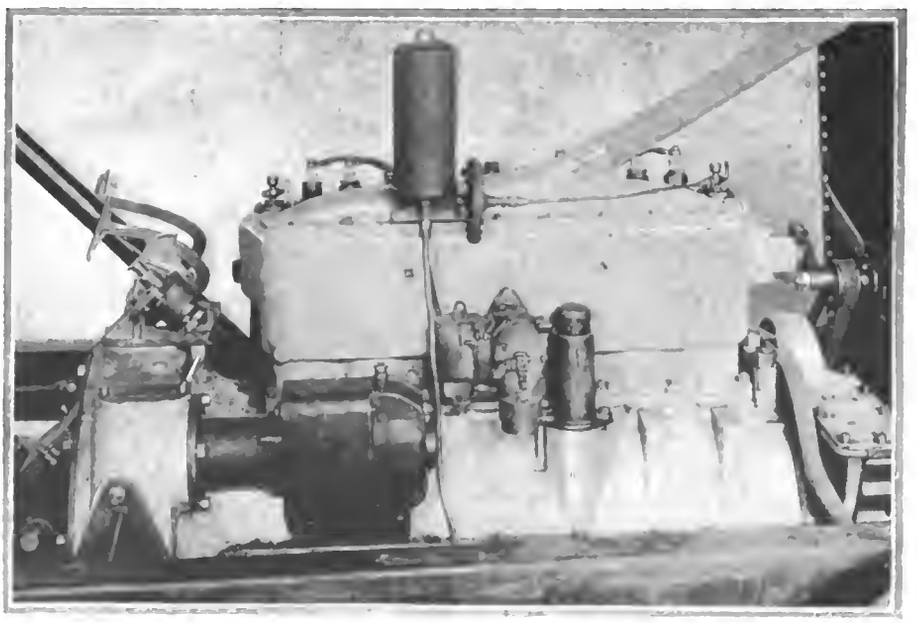
THE American Six, made by the American Motors Corp., Plainfield, N. J., while in no respect unconventional in a general way has many points which make it a distinctive car. With the exception of engine and frame it is assembled from well known units, but the detail has been worked out with great care, the engineer's particular aim being to produce a car which will have no petty weakness. After completing the design and preparing for manufacture the price has been set at $1,285 with five-passenger body, this being a little more than the original idea but necessary to maintain the standard of quality.

An almost unique feature of the American Six is that the chassis is complete in itself and is drivable without the body, all wiring and everything except the actual instrument panel being a chassis attachment. In the illustrations it can be seen that there is a light steel frame bolted to the top of the bell housing. This holds the accelerator pedal and the starting switch and also has a clip incorporated which takes the unit assembly of all the wires that have to go to the cowlboard. All the instruments are mounted on a plate that sets in the center of the cowlboard, so that there is only the atachment of this to be performed after the body is put on the chassis. On a chain assembly line this is an immense advantage, for it means that there are no awkward, half concealed things to get at. In connection with the panel assembly for the instruments there is a novelty which should appeal to the owner, this being the location of the single main fuse directly beneath the panel light and on the front of the panel. This makes the replacement of a blown fuse ideally simple and also allows the fuse to be used as a plug switch; since removing it prevents flow of current in any circuit.

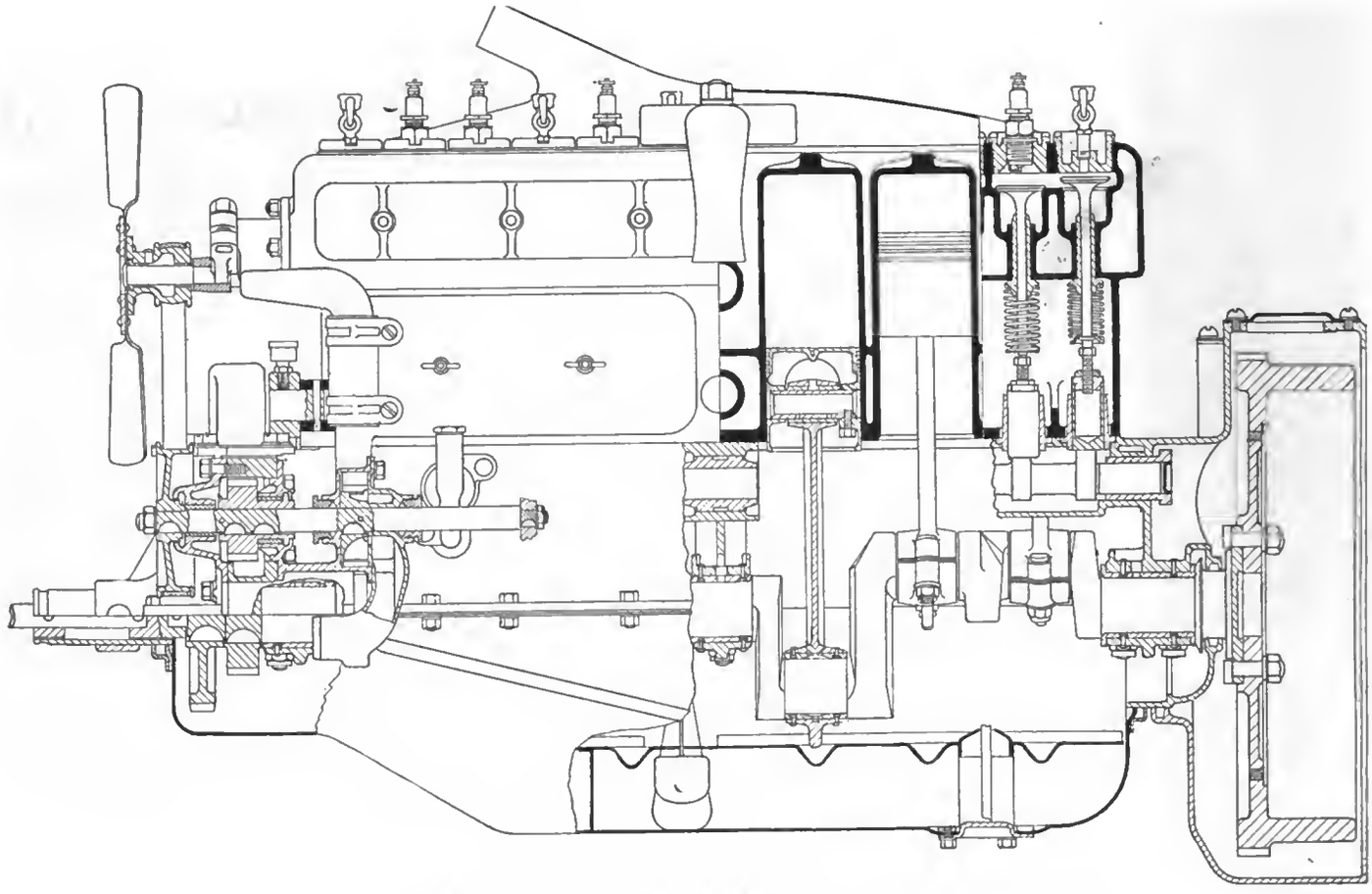
Engine Is Own Design

The 3 by 5-in. six-cylinder engine is not a stock article, but is made specially in a plant associated with the American Motors Co. Broadly it is of conventional design, but it has several points of novelty. The cylinders are an L-head block without a detachable head, the crankcase being aluminum throughout. To obtain quietness the camshaft lubrication has been studied and the shaft is inclosed in a tunnel to which oil is fed by a gear pump. This keeps the tunnel so nearly full that the tappets dip in the oil and the cams are entirely submerged. From this tunnel the overflow fills dip troughs beneath the connecting-rods and the oil splashed thence collects in deep gutters cast on the webs of the crankcase that conduct the lubricant to the three main bearings.

In the sectional view of the engine a neat point that should be noticed is the attachment of the water pump. As this delivers to the front end of the cylinders the outlet pipe has been ingeniously combined with the fan support, making a slight saving in weight by the combined functions. The at-



Generator and ignition unit with coil alongside mounted so as not to interfere with valve accessibility



Section of American Six engine. Observe ample water spaces round valves and cylinders

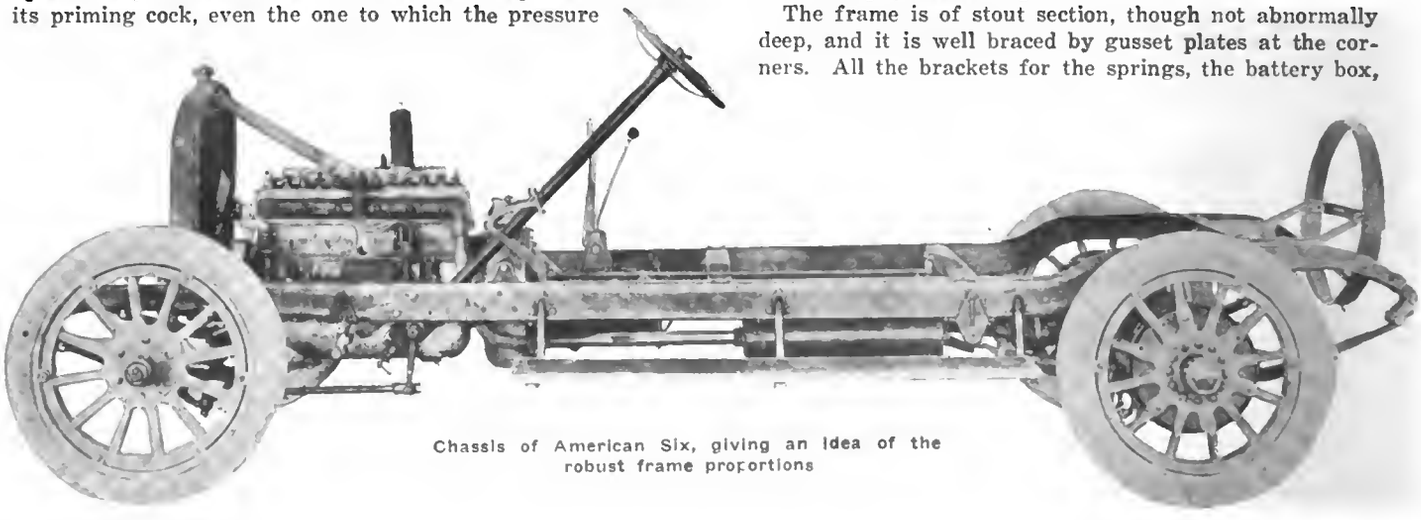
tachment of the pump to the crankcase so as to insure alignment can also be seen in the drawing.

Light cast iron pistons are used and the crankshaft is 1¾ in. diameter with webs big enough to reduce the tendency to distortion to vanishing point at all usual speeds. Care is to be observed in the layout of the electrical accessories, which are all of Gray & Davis manufacture. With the generator the closed circuit ignition distributer is combined, and the coil is mounted alongside the generator on the same crankcase platform. The starting motor is on the upper side of the crankcase, where it is out of reach of the worst of mud and water, and both generator and motor are perfectly accessible. In all, the tappets, electrical units and the pump gland are just about as accessible as they well could be, while the Zenith carbureter bolting directly to the cylinders is high up and easy to reach. Each exhaust valve cap bears its priming cock, even the one to which the pressure line for the Carter fuel feed is attached, and the Carter tank is clipped to the cylinders where it requires the minimum length of pressure piping.

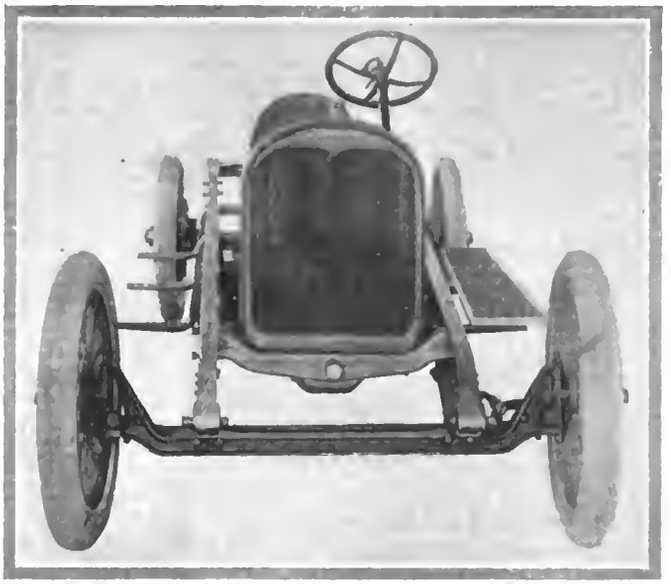
Strong, Simple Frame.

A three-speed Mechanics Machine Co. transmission is attached by a bell housing to the engine, and the clutch used is a Borg and Beck dry disk. In the housing are the necessary cover plates for giving access to the clutch adjustment. These are made more than usually easy to get at because the toe board has nothing fixed in it, the bracket mounting for the starting switch and accelerator allowing the toe board to come away without trouble. The clutch has a very light pedal action and the gear lever is set in a convenient position, so that gear shifting is easy even for a woman possessed of little physical strength.

The frame is of stout section, though not abnormally deep, and it is well braced by gusset plates at the corners. All the brackets for the springs, the battery box,



Chassis of American Six, giving an idea of the robust frame proportions



Distinctive radiator of American Six. A mudguard extension is fitted beneath the radiator, though not shown here

Above — Instrument board with unit assembly of all switches and gages in a central panel

Right—Lamp bracket and fender support, showing method of wiring for headlamps

etc., are massive, the idea being to provide a frame which will retain its original rigidity. The springs are all semi-elliptic, the rear ones being underslung, and Hotchkiss drive is employed.

Salisbury Rear Axle Used

A Salisbury rear axle is used with a gear ratio of 4 5/12 to 1, and the brake equalizers are mounted directly upon the axle housing. This allows a single rod to be run from the hand lever to the axle, and the pedal has one rod going to a short lever attached to a pivot on the middle cross member of the frame, a second rod going from the same lever to the rear axle equalizer bar. The intermediate lever brings the center of oscillation of the brake system near to that of the axle due to the Hotchkiss drive. The wheelbase is 122 in., and the tires 32 by 4 in.

Lavigne Steering Gear

For the steering gear a Lavigne has been chosen, this being a type with an easy action and provision for adjustment to take up slack. The front axle, which is a conventional forging, is set with a 5-deg. rake so as to provide a caster action, giving just enough natural return to the straight position of the wheels after making a turn to provide a "feel".

Only a five-passenger body will be made, at least at first, and the long wheelbase allows this to have plenty of room especially in front, the driver's compartment being well above the average standard of comfort. A narrow center cowl is used, this having polished wood at the back giving a nice finish to the tonneau. Leather upholstery is included and the color is a dark blue. In attaching the fenders rigidity is the feature most sought and the lamp brackets are utilized to assist this. A matter of detail is again apparent here, for the wires to the headlamps are taken up inside the mudguard, of course inclosed metallically, and led through beside the bracket, this reducing the length of the wire which is exposed to a minimum.

Olympian Car To Replace Pontiac Chassis

Olympian clover-leaf model mounted on the standard four-cylinder chassis to be manufactured by the Olympian Motors Co., Pontiac, Mich. This concern recently took over the Pontiac chassis. The new cars are going through production and test models are on the road

THE Olympian Motors Co., Pontiac, Mich., which recently took over the Pontiac chassis, will discontinue the manufacture of the latter after existing contracts have been filled. The new car which the Olympian company is manufacturing will soon be going through regular production and the trial cars are now on the road.

The chassis is very much the same as the Pontiac chassis except that it is 2 in. longer in wheelbase. The body is an original design and the complete car will be shown at the Sherman House in Chicago during show week. The car has a Golden, Belknap & Swartz unit power-plant with block 3¾ by 4¼-in. engine. Starting and lighting are by the Auto-Lite system.

Car Builders Can Co-operate with Electric Device Makers

Increasing Demands on Generator Make More Room in Mounting Necessary—Best Speed Ratio Should Be Determined—Co-operation on Battery Ignition Possible—Engineering Facilities Little Used

EDITOR'S NOTE—*From a paper presented by J. B. Replogle, director of research of the Remy Electric Co. before the Cleveland section of the S. A. E. on Friday, Dec.* 15.

THERE was a time in the history of the automobile art when the entire electrical equipment of a car consisted of a magneto to ignite the fuel in the cylinders and a pocket flash lamp to observe the fuel in the tank. As a conventional magneto gives two impulses per revolution, it was found necessary to drive the magneto shaft at engine speed, if the engine was a four-cylinder one, and at one and a half times engine speed if the engine had six cylinders.

Later it was observed that it was exceedingly difficult and inconvenient to light a lamp with a match in the rain and wind and that it was a laborious and sometimes dangerous task to crank a motor, so electric lights and cranking motors were installed, the source of the electric energy for these being a storage battery and a generator to keep the storage battery charged.

Later still, when it was learned how easy it is to transform electricity from one form to another, many men came to the conclusion that one generator of electricity on a car is sufficient, and in such cases, battery ignition displaced the magneto, and the generator was driven from the shaft that formerly drove the magneto and at one time it was an almost universal practice to drive generators on four-cylinder engines at engine speed and on six-cylinder engines at one and a half times engine speed. Of cars that we have listed, nearly 65 per cent are designed with the generator running either at engine speed or one and one-half times that speed. In many cases, no doubt, this is a very good ratio, particularly the one and one-half ratio, but it seems to indicate to me that the automobile designer has not given very much thought to the question of what is the best ratio.

Determining Best Speed Ratio

So the first way in which the automobile manufacturer can co-operate with the electrical accessories manufacturer is a careful consideration of the best speed ratio of generator to engine. The best speed ratio is a matter of gearing. It is the highest ratio that will permit of quiet gear operation and sufficient clearance space for the generator.

A very much larger proportion of the operation of machines is below 15 m.p.h. than formerly. This is largely due to the congestion of the streets and roadways. Touring around our large cities on a clear Sunday or other holiday has almost evolved into a slow parade. The cement and brick roadways are rather narrow and do not permit safe driving with more than two machines abreast and, as the parade is a double one, passing in both directions, it is usually quite hazardous to attempt to pass the machine in front. As a consequence, each line of the parade moves at a speed controlled by the wish of its most leisurely driver. Not only from this cause, but also from the number of children, motor trucks and day-dreaming pedestrians on the streets, a very large percentage of machines are being driven at low speeds a large proportion of the time. Notwithstanding this, the driver feels he has a real grievance if his battery is not kept charged.

It is a fact well known to electrical designers, and also to engine designers, that size can be traded for speed, and there is no doubt that generators can be and often are made large enough to supply the necessary charge to the battery even under these adverse conditions, but that adds weight and expense and is undesirable.

Should Avoid Causing Noise

But in the attempt to secure a high ratio, there are several limiting features of gear design that must not be overlooked. In the desire to run the generator at a high speed relative to the engine, many designers have made the mistake of having the gearing so designed that there are insufficient teeth in the pinion on the generator shaft to permit smooth and noiseless operation and a disagreeable howl has resulted at speeds where the generator is carrying its maximum load.

I cannot emphasize too strongly here the need of first-class gear making when high generator ratios are used as the presence of the teeth in the generator armature causes the load on the gears to vary harmonically and an unpleasantly loud sound will result unless the gears fit and mesh nicely.

A further difficulty occasionally met with in designing for high ratios is that the generator drive pinion is of such small diameter that insufficient clearance between generator shaft and crank case results and a more or less freaky type of machine must be designed to fit in.

While the application of electrical apparatus to automobiles is comparatively new, it must not be overlooked that the electrical art of itself is relatively mature and standardization has been carried much further than in the automobile art. During the period of its evolution very many forms of generators were developed, tried out and abandoned until to all intents and purposes but one form remains, namely the round or cylindrical type. You are using generators and motors in large quantities in your several plants and you will find that almost without exception they approximate the cylindrical form. This accumulated experience of an older art, when applied with common sense and judgment is of more value than any possible amount of theorizing on the subject, and the round type generator stands to-day the result of all the electrical brains that have made up electrical history. Therefore when you are designing your engine you can co-operate with the electrical accessories manufacturer by keeping in mind the desirability of applying standard generator frames and by adopting as high a generator gear ratio as you can without sacrificing smooth, quiet operation or necessitating the adoption of other than standard forms of machines. I might note here that to date, this highest gear ratio has not usually exceeded two to one.

Space for the Generator

That brings us naturally to the second item where the automobile manufacturer can co-operate, namely in designing so as to permit comfortable space for the generator. This statement will immediately provoke a reply that there is not

comfortable space in an automobile for anything except the passengers—but, notwithstanding this fact, I hope to show you where it will be to your advantage to allot a larger space for the generator.

As noted previously, the use of electricity was limited at first to igniting the charge in the cylinders. Next it was used for lighting the roadway and the tail lights. Then to illuminate the instruments on the cowlboard. In a limousine it is used to show forth the splendor of milady on her procession to the opera. It is used to crank the motor and blow the horn. It is used further to warm your fingers in the steering wheel. To heat the rechristened kerosene in the carbureter. To shift the gears and to play a fan on our overheated countenances. It can be used to apply the brakes and inflate the tires. In addition to all of this, the market offers quite a number of devices that purport to permit operation of the headlights at full brilliancy without conflict with the authorities or danger to other people and that takes more electricity.

Then we have the ubiquitous dirigible searchlight which also takes more electricity and all of this must be supplied by the generator. The first thing you know you will be overwhelmed with complaints that the electrical systems are not working right; the lights are dim; the starting motor will not crank the engine as it should; the batteries will sulphate and a host of other troubles will follow because you are using electricity faster than you are generating it. The space you allotted for the generator was sufficient when it only had to supply current for the starting motor during the summer months when the engine is not stiff and when the lights were few in number and operated but a short time in the later summer evenings. But with all of the accessories we now have demanding their share of current and with cars operated the year around and standing for hours at the curb with the lights burning during the long winter evenings, to satisfy the police authorities (although in a brilliantly illuminated space where you cannot avoid seeing them without shutting your eyes), then cranking a cold, stiff motor, the space allotted for the generator is insufficient. Several companies have developed a profitable business supplying extra equipment to garages for recharging batteries because the generators on the cars have insufficient capacity. In my estimation the time has come when you must be more liberal with the space allotted for generator and must demand and be willing to pay for a larger generator for the car or you will soon be swamped with complaints. That is the second item where you can co-operate with the electrical accessories manufacturer.

Difference Between Seasonal Demands

It might be advisable, before abandoning this phase of the subject, to note that the extreme difference between the electrical demand in mid-summer and in mid-winter has presented quite a problem to the electrical accessories manufacturer, owing to the peculiarities of a storage battery. In hot weather a storage battery of given rating can only receive a limited amount of current input without distress, due to rapid evaporation of the electrolyte and heating and buckling of the plates, and shedding of active material therefrom. But providentially, the electrical demand adapts itself to temperature conditions in such a way as to co-ordinate with the limitations of the battery, provided the generator output is made to co-ordinate with the electrical demand. That is to say, a battery cannot stand a large charge rate in warm weather for a long period, but it does not need a large charge rate in warm weather because the demand in warm weather is relatively low. But in cold weather the battery can stand for a much greater charge rate, the demand is much greater, and therefore the generator can and should be designed to give a greater average charge rate in cold weather than in warm. Heretofore this has been accomplished occasionally by hand-operated adjustment of the generator, but the company with which I am associated has evolved and is now commercially producing generators which automatically accomplish this by means of thermostatic control.

Need Substantial Starting Motor

There is opportunity for co-operation with regard to the starting motor also, although the situation there is not so acute as with the generator. The principal items are to have a very low resistance connection between the battery and the starting motor and to be willing to pay for a good husky motor. Let us consider each of these items briefly. Under the most favorable circumstances only about half of the energy used in breaking away a stiff engine ever gets to the starting motor. The remainder is lost in the battery, leads, connections and switches. Therefore, it is very important that you keep these low, either by placing the battery close to the motor or by using large cable to make the connections. Also to be sure that the kind of switches you use and the connections you apply are of high conductivity.

As regards the size of starting motor, here again the widespread use of cars throughout the winter has altered the situation markedly. The factor of safety of starting motors is just barely sufficient, in many cases, to take care of stiff, newly adjusted engines which have stood all night in a cold garage, and I believe a small additional amount spent for more power in the motor, and more ability to spin it when cold could well be withdrawn from selling expense because of the user's satisfaction in his equipment.

There are two kinds of strong motors, wastefully strong and efficiently strong. The torque of a motor is due to current, copper and steel. If you do not care how much current you use to crank the engine, you can economize on copper and steel, but if you want a thoroughly satisfactory equipment it must be an efficient one and that requires copper and steel and sufficient space in which to mount it.

Co-operation on Battery Ignition

In the consideration of co-operation of the automobile manufacturer with the electrical manufacturer in the matter of ignition, I will confine my comments to battery ignition, as that forms such a large proportion of ignition in this country. There are four prominent operating principles in battery ignition, namely, maximum speed at which ignition sparks will be supplied, minimum voltage at which ignition can be accomplshed, amount of current required at average driving speeds, and the energy contained in the spark for ignition. An ideal ignition system would be one that could fire an engine at 10,000 r.p.m. would operate perfectly with 1 volt, would require but a tenth of an ampere at 12 m.p.h. and would have so much heat in the spark you would not require any gasoline.

We cannot make such an ideal system, and you wouldn't buy it if we could because of prohibitive cost, but you sometimes ask for a system that comes unnecessarily near this ideal in some one characteristic and I am going to try and show you how you cannot eat your ignition cake and have it, too. To do this, I shall be compelled to discuss some elementary ignition principles and, if I repeat some things you already know, you will please bear with me, as I may hereby bring out a mite of information that is new to you.

A spark ignites the compressed charge because of its heat. This heat results from the dissipation of energy. This energy we get from breaking down the magnetism in a bundle of iron surrounded by two coils of wire. We build up the magnetism by sending electrical energy into the coarse primary winding and we carry a part of the energy to the spark by means of the secondary winding when we break down the magnetism. Now the electrical energy we send into the primary winding is in two parts. One part merely heats the coil and is wasted. The other part is stored in the coil in

the form of magnetic kinetic energy and this is the part we use to ignite our charge. The volume of this useful part depends upon two things, the current we send into the primary and the inductance which is a peculiar property of every electro-magnetic circuit. I am not going to take the time to try to show you what the inductance is, although it is probably the one most important characteristic of a coil, but I am merely going to tell you that this inductance has two effects that are of interest to us.

As noted before, it is absolutely essential that it be present to permit the storing of useful energy in the coil, and on the other hand, it tends to reduce the speed at which useful energy can be stored in the coil. So you see if we want a very high speed coil, we cannot have very much inductance. If we do not have much inductance, we must use a very large amount of current at running speeds or we will not have a desirably hot spark, and we cannot get sufficient current at very low voltages to produce an operating spark.

Speed and Power Requirements

If a customer asks us for a system that will fire his engine at 5000 r.p.m. we can easily give it to him, provided he does not object to using several amperes at running speeds and will guarantee his battery will never be below 4 volts. But if his engine will never run faster than 2000 r.p.m. he is buying something that is unnecessarily expensive for his needs, not necessarily more expensive in money, but in current consumption or satisfactory starting in cold weather with low battery. If your ultimate customer will never want to drive his machine so his engine is turning over at a greater speed than 2000 r.p.m. do not insist that we furnish you with ignition equipment that will show a bench test of 3500 r.p.m. because it will be necessary to sacrifice either current economy or heat of spark or low voltage operation to do so, one is practically as easy and inexpensive to make as the other, but you cannot have both without abrogation of the laws of nature.

So you can co-operate with the electrical accessories manufacturer by asking for what you need to use in the way of speed and not for what you want to show on a bench. Special equipment for stunt tests can be supplied without interfering with the efficiency of the general production.

Finally, you can co-operate with the electrical accessories manufacturer by making more use of his training and equipment. The accessories manufacturer is of the opinion that you cannot possibly know as much about the electrical equipment of an automobile as he, or are you nearly as well prepared to carry on experiments concerning the electrical equipment. He believes the time has come when it is decidedly expedient if not necessary for you to enter more freely into conference and discussion with him and to bring your electrical problems to him spontaneously so that he can render you real service in doing investigation and development work that he is best qualified to perform. He has complete and well organized laboratories and engineering staffs at your disposal that you are not making most efficient use of. He wants you to consider them your property, organized for the express purpose of giving you service at the time when it will do you the most good, namely in the period of design.

He is making an earnest effort to comprehend your problems and to formulate a solution for them. He has bought your cars and is driving them under all imaginable conditions in the endeavor to foresee future problems the solution of which will be of incalculable benefit to you. You and he are both trying to peer into the dim and misty obscurity of future trend of the art and he feels that if you and he travel together, he may often aid you in keeping to the road and occasionally your private road map may point out a way for him when no way is visible. Let us get together.

Reducing Waste Labor By Showing Results

WHEN a worker turns out a large percentage of defective parts in the course of his labor, he wastes time, effort and money, both for himself and his employer, besides endangering the quality of the product. To eliminate waste labor, reduce the loss of time and money, and to improve the quality of their product, S. F. Bowser & Co., Inc., Fort Wayne, Ind., have installed a plan of displaying damaged and spoiled parts in bins to their employees.

Factory meetings, which are held at indefinite periods but occur about once a month, witness the gathering of all shop employees. Addresses are made either by officials of the company or by outsiders on different subjects calculated to promote efficiency. In recent addresses, the bins filled with damaged parts are wheeled in before the men and lectures have been given calling attention to the methods of increasing production through intelligent, efficient work rather than by hurried, careless labor.

The company states, to its employees, that it is better business for them and consequently for the workers, to do a normal amount of work which results in perfect product rather than to produce a great quantity some of which must be scrapped because of defective workmanship.

The psychology of the sight of the damaged parts in connection with the address has been taken into account and the company believes that the plan will result in a better quantity of work and greater co-operation among the men. The idea is practically a new one and definite results regarding the merits of the plan cannot be stated at this time.

It is readily possible that further developments of the psychological principle embodied in the plan can be worked out to the mutual benefit of employer and employee. The various departments could be brought into a state of friendly rivalry as to which showed the best record as revealed by the size of the display of spoiled and damaged parts standing against it. Also the pride of the men in their work could be capitalized to the extent of rendering them ashamed of contributing through carelessness or poor workmanship to the pile of evidence arrayed against their respective departments. Other variations of the idea in accordance with the requirements of the plant to which it is applied could be devised.

Damaged parts on display at the plant of S. F. Bowser & Co., Inc., Fort Wayne, Ind.

Kent four-cylinder, five-passenger touring car selling for $985

Individuality in Kent Four

New Car Has 3¾ By 5-In. Engine and 116-In. Wheelbase — Standard Units Used Throughout Chassis—Body Lines Up to Date

INDIVIDUALITY of design, combined with the use of very high-grade units in the chassis, renders the four-cylinder Kent, produced by the Kent Motors Cerp., with factory at Bellleville, N. J., and offices in New York City, a very substantial and attractive car, especially when its price of $985 is considered.

Unusual Magneto Mounting

The compact unit power plant, which is illustrated herewith, employs a 3¾ by 5-in. Continental engine that is stated to develop 40 hp., an output which is amply sufficient for the car, the weight being given as about 2500 lb., fitted with either the five-passenger touring body or four-passenger club roadster design. A two-unit Bosch electrical system is used for starting and lighting, ignition being by Bosch magneto. An unusual feature in the mounting of the units is that the generator is driven directly from a gear meshing with the crankshaft and the magneto is placed toward the rear so that it takes its drive from the generator. This arrangement is well illustrated in the accompanying view of the exhaust side of the power plant mounted in the chassis. Carburetion is by a 1¼-in. Zenith instrument of a special type fitted with spray adjustment. Fuel feed is by the Stewart vacuum system from a 15-gal. tank suspended at the rear of the chassis.

A disk-type clutch situated in the flywheel transmits the drive from this clutch through a three-speed and reverse selective gearset. The gears employed in this unit are of nickel-steel, heat-treated and chamfered for silent engagement, an example of the thorough way in which the little details which make for comfort of the passengers and silent operation of the car are worked out in the entire construction. The drive to the differential is by shaft in the conventional manner through two substantial universal joints.

Both axles are of Timken manufacture, the front being an I-beam type made of 0.20-0.30 carbon steel, and the rear axle has helical bevel gears, heat-treated and ground, the driving shafts of the axle being forged from chrome nickel-steel to insure the maximum of tensile strength and resiliency under driving stresses.

Brakes are provided in two sets, in conformity with general practice, the emergency set being of the internal-expanding type and the service brakes of external-contracting construction.

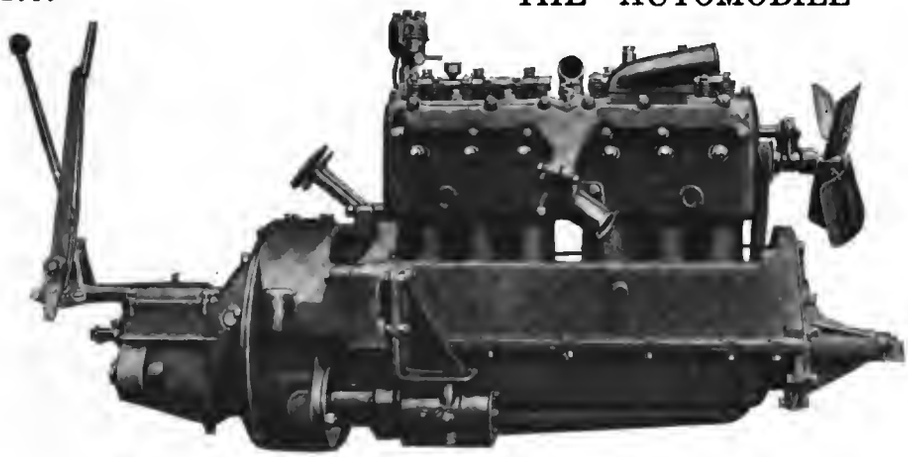
The frame, that unit of the chassis assembly which has been so often referred to as the backbone of the car, is typical of the strong though light-weight character of the construction. It is of pressed-steel channel section and made of 0.20-0.25 carbon steel, a 3½-in. kick-up at the rear insuring ample clearance over the rear axle on rebounds. To secure positive frame rigidity there are three cross-members, which are reinforced with gusset plates at the corners, all members in the assembly being hot-riveted. Springs are special alloy steel, heat-treated. Front springs are semi-elliptic and 36 in. long, and rear three-quarter-elliptic and 50 in. long. All are 2 in. wide and designed to insure comfortable riding for the passengers under all sorts of load conditions.

A wheelbase of 116 in. and 32 by 4-in. tires all around are additional factors which tend to give the Kent car its long, low, rakish appearance. The hood is high and the radiator is narrow, in keeping with the general lines of the design, and the low mounting of the body, in conjunction with the slanted windshield and raked steering wheel, impart an extremely smart appearance, an effect further accentuated by the double cowl and the horizontal placing of the top.

Equipment is very complete, some of the features which may be mentioned being top, slanting windshield, Stewart speedometer, 8-day clock and full kit of tools.

F. H. Clarke is president of the company and associated with him as directors are men prominent in the automobile, banking and other fields. As announced in THE AUTOMOBILE for Oct. 19, the Kent corporation plans to establish a plant in Belleville, a suburb of Newark, costing more than $500,000, and having potential capacity for 50,000 cars a year. The company occupied the first completed unit on Dec. 2.

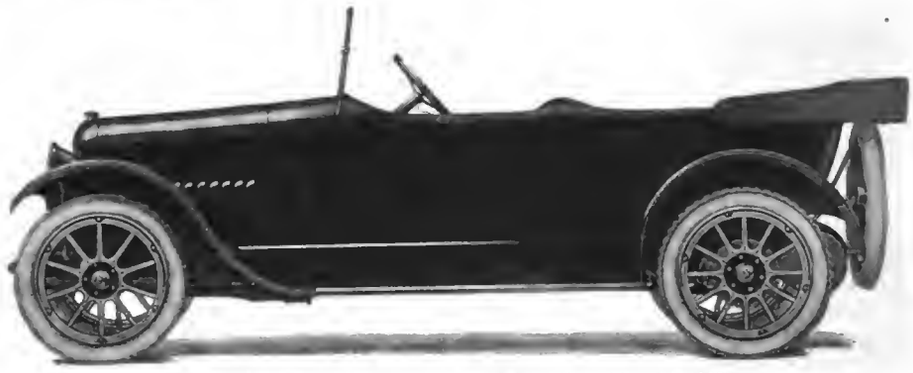
Kent power plant, showing magneto drive from generator



Falls six 3 by 4¼-in. engine used in Elgin. Note starting motor mounting

Better Springs on Elgin

New Model Improved—Heavier Frame Adopted



Four-passenger Elgin. A new model at the old price, $985

THE new Elgin six, made by the Elgin Motor Car Co., Chicago, is an improved edition of its immediate predecessor. The wheelbase is 116 instead of 114 in., and a much heavier frame is being used of the straight taper type. The springs have also had attention and the present layout is said to be extremely satisfactory. It will be noticed that the springs are mounted directly beneath the frame, and that they are practically flat, a characteristic which assists to eliminate roll. Also the springs are wider apart at the axle end than at the front end, since they follow the taper of the frame, and this certainly is a factor in their action on the road. The rigid frame, relieving the body of all stress, is contributory to the easy-riding qualities.

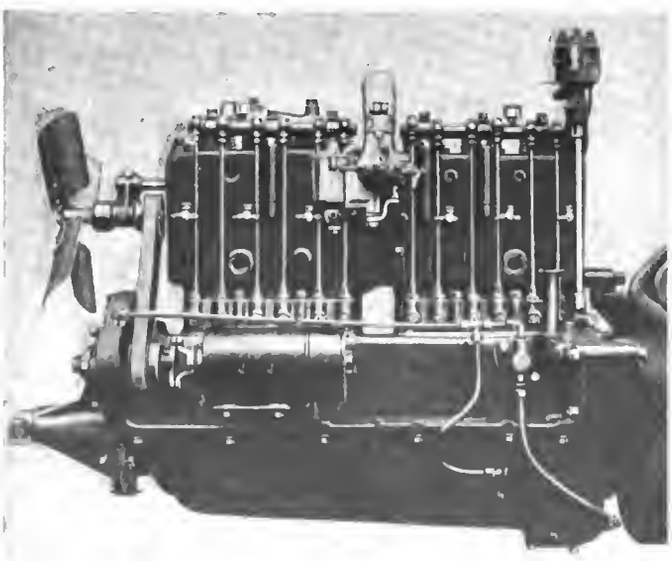
Overhead Valve Engine

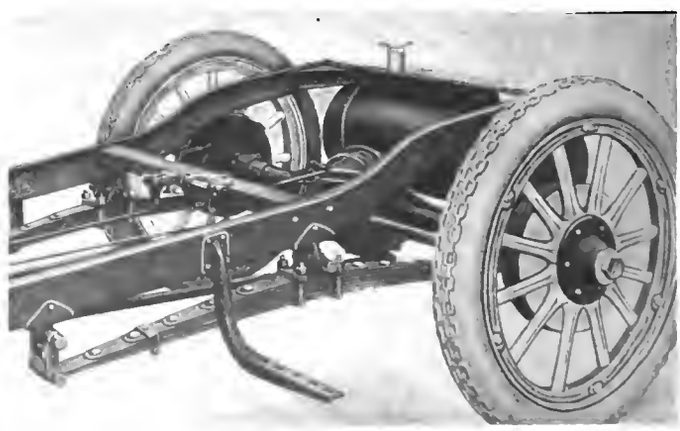
The power plant consists of a Falls engine with six cylinders 3 by 4¼ in., a Borg & Beck clutch and a three-speed gearset. The clutch is new to Elgin practice, and the ignition has also been changed to a Remy equipment with vertically mounted distributer. Wagner now supplies the generator and starting motor, the latter having Bendix flywheel engagement.

As shown in the illustrations, the engine has overhead valves operated from the camshaft by long push rods, and the valves come away together with the cylinder head. Lubrication is by combined pressure and splash and cooling is by thermo-syphon circulation.

The rear springs being cantilever a torque arm is, of course, used. The rear axle is full floating with a pressed steel housing and the complete differential with the spiral bevel gear can be removed without taking off the wheels.

The touring body seats five passengers and has a center cowl. It is upholstered in leather and the color is dark blue. The running gear is black but the wheels are painted light cream, with black striping. A new body is a four-passenger with divided front seats. This is finished in gray and has a rear deck underneath which there is plenty of luggage space. In a general way, the lines of the two bodies are strongly similar. For both cars the equipment is the same, including Jiffy curtains, Stewart speedometer, a motor-driven horn, and extra rim for the 33 by 4 tires. The price continues $985.





Above is the rear of the Elgin six-cylinder chassis, showing cantilever springs attached directly beneath the frame member. They are practically flat, which aids to eliminate roll. Note fuel tank mounting

At the left is the intake and valve side of the Falls six engine used in the Elgin, showing valve action and generator mounting

Otis Axles for 3½ and 5-Ton Trucks

Both Models Floating—Casing a Single Steel Casting —Straight Overhead Worm Used in Unit Assembly with Gear—Cast Steel Wheels Also Manufactured

THE latest addition to the ranks of manufacturers of truck axles is the Otis Elevator Co., New York, which has, of course, many years' experience in the production of worm gearing.

The Otis axles are at present being made for 3½ and 5-ton trucks, and are both of the floating type with a single cast-steel casing extending from hub to hub. This casting is made from electric steel in the Otis company's own foundries, and the manufacturers state that particular care is taken in the annealing process. Chrome-nickel steel tubes are forced into the casing at either end to carry the wheel bearings, a pressure of 20,000 lb. being used. The worm and gear are mounted as a unit assembly on a plate which bolts to the main casing, this assembly being spigoted in the case both above and below, so as to obtain a proper register and insure correct alignment. The worm itself is of the straight type, the manufacturers saying that this has been preferred because with it adjustment is unimportant except in a direction at right angles to the axis of the worm.

Timken Bearings Employed

Either Timken roller or ball bearings are used, at the choice of the purchaser. When the roller bearing is used this is mounted in such a way that expansion of the worm shaft tends to loosen the bearing. With ball bearings, one end of the worm shaft is supported in an annular bearing and the other end as a double thrust bearing.

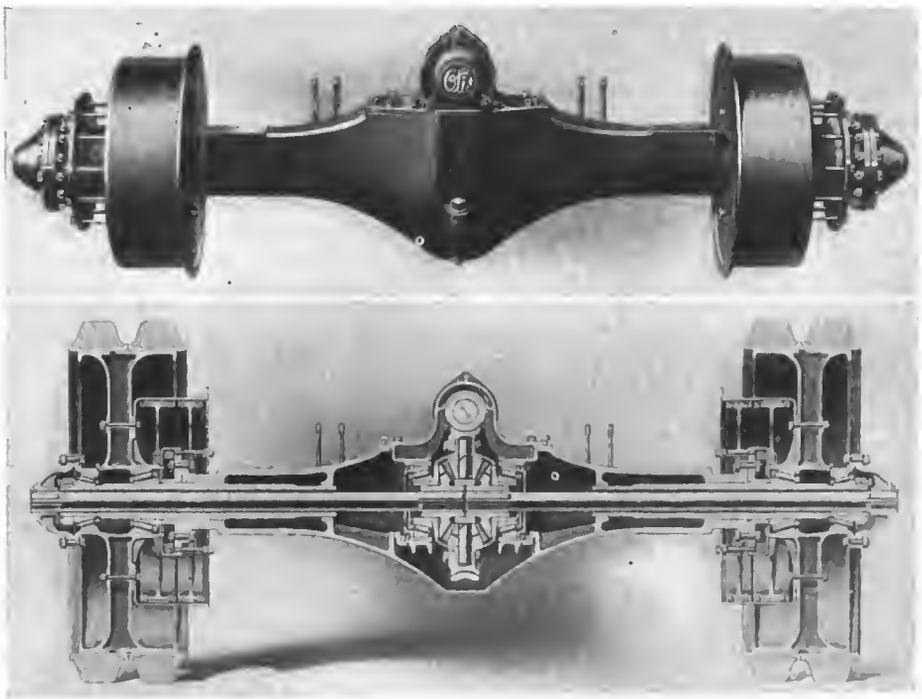
For the worm wheel bronze is, of course, the material employed, this being attached to an electric steel differential casing carrying the bevel pinion spider. The side gears of the differential are splined so that the drive-shafts are removable from the hub end of the axle, and it is noteworthy that an ample counter bore is used so as to make the engagement of the shafts easy when they are being put in place. In place of the bevel differential, one with spiral gears can be fitted if desired.

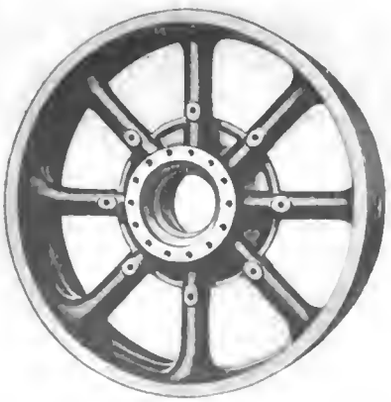
Both the brakes are internal, the drums being steel deeply flanged to prevent distortion. It is stated that the brake surface provided is exceptionally large and the way in which each brake shoe is mounted on a separate pin is of assistance both in smoothing the action of the brake and making the wear even. Great care has been taken with the detail of the brake work, the expanding cams and all other parts being hardened on their wearing surfaces.

Oiling Level Positive

For the road wheels, Timken roller bearings are used, the wheel hub having a plug for the insertion of lubricants. Oil for the worm is inserted through the filling plug at the center of the casing, and this is at such a height that only just the right amount of oil can be put in.

The Otis company is also making electric cast-steel wheels of European type, and announces that it is able to undertake large orders for these at the present time.





Above are illustrated exterior and section through the floating rear axle design produced by the Otis Elevator Co. for 3½ and 5-ton trucks. The casing is a single electric steel casting from hub to hub and the straight type worm is mounted in a unit assembly with the gear on a plate which bolts to the main casing. Chrome-nickel steel tubes are forced into each end of the casing under 20,000 lb. pressure to carry the wheel bearings. At the right are two examples of the steel wheels produced by the Otis concern, these being commercial vehicle types. They are of electric steel and are of cast construction

Six Johns-Manville Speedometers

Five Are New Models—Season Odometer 10,000 Miles—Trip Reset Improved

Special design to be standard equipment on 1917 Dodge Bros. cars

New model with flush ring for mounting on instrument boards

Combination instrument board and speedometer for Ford 1916 and 1917 cars

SEVERAL improvements in design and construction will be features of the speedometers to be produced for 1917 by the H. W. Johns-Manville Co., New York. The line consists of six models, five of which are new. There is a special design, which will be regular equipment on Dodge Bros. cars during 1917 with fittings as heretofore for transmission drive; a standard model for flush mounting; and a standard model for bracket mounting suitable for all makes of cars; a combination instrument board and speedometer for 1916 and 1917 Ford cars; another model for Fords, which is flush mounted in a suspension plate and attaches to the windshield strip; also a continuation of last year's bracket-mounted type for Ford cars. All models have 3¼-in. dials with 60-mile speed scale.

The chief difference in construction for 1917, in addition to the standardization of dials to 3¼ in., is the use of a new 10,000-mile season odometer movement instead of the 100,000-mile movement previously used. This change permits of making the odometer mileage figures larger, so that they may be more easily read. The previously used trip odometer reset mechanism, comprising a knurled wheel, projecting through a slot in the flush mounting ring in conjunction with a pressure button for engaging the reset wheel with the interior mechanism of the odometer, which construction necessitated the use of two hands when operating it, has been eliminated.

In place of this a new reset mechanism, simpler in construction, neater in appearance and much more rapid in operation and necessitating the use of only one hand to manipulate, has been adopted.

A simple knurled stem, projecting through a flush ring, operates the trip reset mechanism by merely pushing in and turning the knurled stem. With this construction the trip odometer is reset 2 or 3 miles with every turn of the stem, while with the previously used construction, the resetting process was very slow, as the odometer could only be set back a few tenths of a mile with each manipulation of the knurled wheel.

The Johns-Manville company finds that the trend in speedometer dial finish is toward the use of a black dial with white figures. For 1917 the company is prepared to furnish dials in this finish, as well as in the silver finish with black figures, which have been previously used to a large extent. All Johns-Manville instruments for the coming year will be externally finished in black and nickel and will embody a 60-mile speed scale, 10,000-mile season odometer and 100-mile trip with tenth figures in red.

The operating mechanism is unchanged from previous practice, being of the centrifugal governor type and using three accurately balanced brass weights, fastened with links to brass spiders, one of which is slidably mounted on the governor shaft, making a unit assembly of the governor mechanism with the driving spindle. The weights are controlled by a suitable spring and are caused to extend or dilate by centrifugal force, when the shaft carrying these weights is revolved through the medium of a flexible shaft and gears, connected to the road wheel. The spring is so calibrated in relation to the weights that they will diverge approximately in proportion to increases in speed and through the medium of suitable leverages or cams. This divergence is translated into miles per hour speed indication on a graduated dial.

Odometer drive is by worm and gear.

The entire interior mechanism is assembled as a unit on the cast frame before being put in the shell or casing. This unit can be lifted out of the shell, allowing of easy inspection.

The interior mechanism of all Johns-Manville speedometers is thoroughly lubricated when assembled, which lubrication is sufficient to last during the life of the instrument. The main points lubricated are the ball bearings at the top and bottom of the driving spindle, the gear and worm shaft, and the sliding sleeve on the driving spindle.

The special type speedometer for Dodge Bros. cars is called model 113H and is mounted flush in the dash without the aid of the usual flush ring, being held in place by three oval-head countersunk machine screws, which pass through the dash and enter nuts, permanently secured to three metal supporting clips, attached to the instrument case. The trip reset stem on this model projects through the dash at the right of the speedometer. The dial is black with white figures, graduations and speed indicator hand.

Model 101H is similar to that already described, except that it is provided with a special flush ring to make it suitable for flush mounting on various types of instrument boards. The type of reset on this instrument

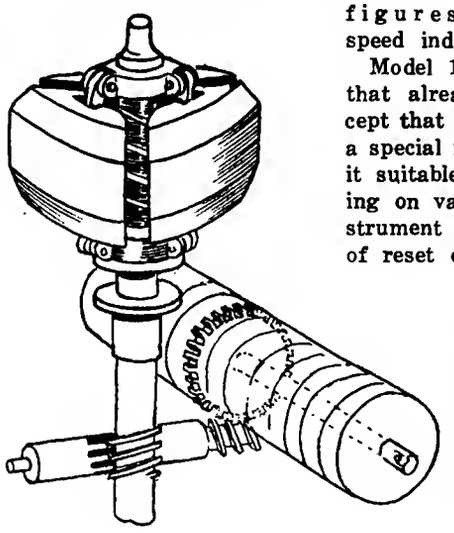


Diagram of centrifugal governor, shaft and gears used in the Johns-Manville speedometer. The cross shaft which transmits the drive from the vertical spindle to the odometer gears is also shown

is the same as on model 113H, except that it projects through a hole in the side of the flush ring to the right of the speedometer. The list price on model 101H, including fittings for front wheel drive, is $25.

The only difference between model 101H and model 101AA is that the latter is provided with either a rigid or adjustable type of dash bracket for mounting in any position desired to suit the car owner. In this instrument the trip reset stem projects from the right side of the case. Furnished complete with fittings for front wheel drive, this model sells for $25.

Special fittings can he provided to drive any of the three instruments mentioned from the transmission or universal joint, in addition to the front wheel drive.

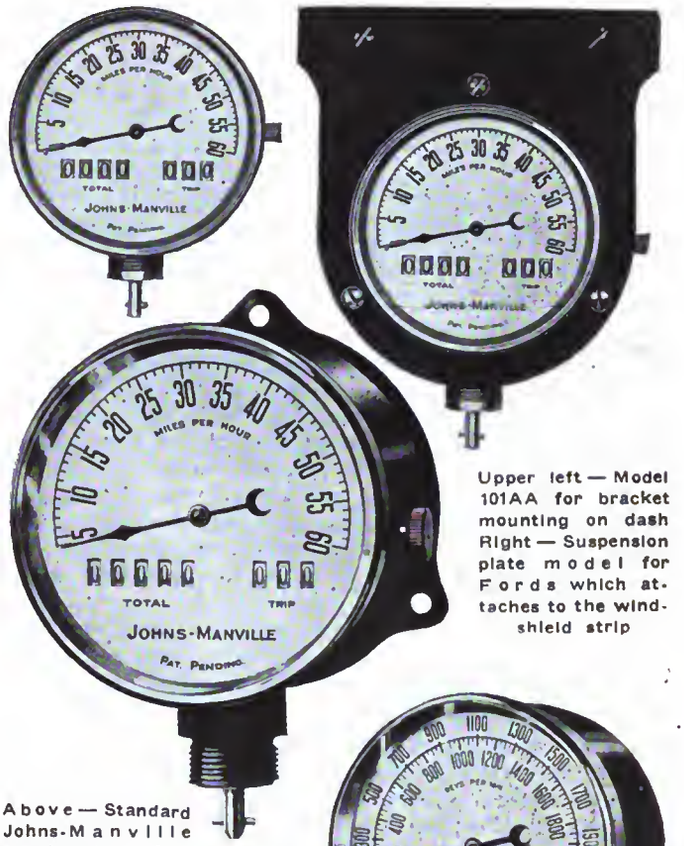
The Ford car model especially featured is the combination instrument hoard and speedometer, the two heing sold only together and called model 3009. The board is of maple, finished in dull black, to prevent any reflection of light rays into the face of the driver, and to match the Ford body. Adjustable metal and brackets are provided to compensate for variations in the width of Ford bodies. The instrument hoard also permits of mounting other instruments, such as clocks, starter switches, carbureter controls, etc. On this model the trip reset stem is hehind the instrument board, and is readily accessihle for operation. The speedometer is fiush-mounted on the hoard and is finished in black and nickel, with a hlack dial, white figures, graduations, and speed indicator hand. Instrument board speedometer and fittings complete list at $11.25.

Another new speedometer for Ford cars is the suspension plate model, which emhodies an instrument as previously described, except that the instrument is mounted flush on a hlack finished metal plate, which permits attaching the instrument to or from the windshield strip, thus mounting in a position where the speed of the car or the number of miles traveled can he easily read.

The trip odometer resetting stem projects from the right hand side of the speedometer case, and is readily accessihle for operation. This consists simply of pushing in the knurled reset stem and revolving same until the desired mileage figure is attained. Price, complete with all fittings, $11.

The other instrument for Fords, known as model 3000, is a continuation of last year's model 2001D, and has the dash bracket riveted to the back of the case. This instrument continues the use of the 100,000-mile season odometer, and is finished in black and hrass, having a white dial with black figures, graduation and speed indicator hand. It also differs from the other models in that it uses a larger knurled trip reset stem. With all fittings this model sells for $10.

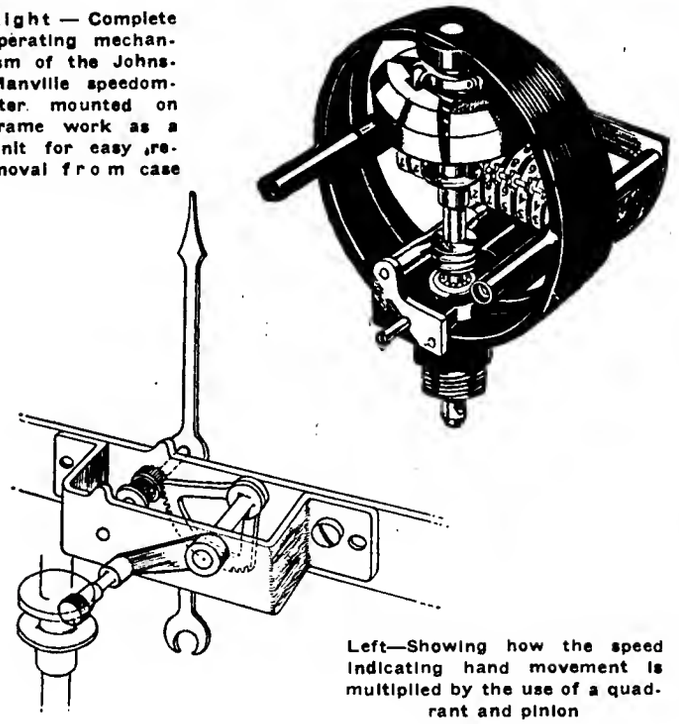
All three instruments for Ford cars can be furnished with straight or spiral swivel drive gear sections.



Upper left — Model 101AA for bracket mounting on dash Right — Suspension plate model for Fords which attaches to the windshield strip

Above — Standard Johns-Manville speedometer for Fords with dash bracket and continuing the 100,000-mile odometer

Above — Tachometer for measuring crankshaft r.p.m. Made in four styles Left—Hub odometer for trucks



Right — Complete operating mechanism of the Johns-Manville speedometer mounted on frame work as a unit for easy removal from case

Left—Showing how the speed indicating hand movement is multiplied by the use of a quadrant and pinion

Huh Odometer and Tachometer Continued

The company is continuing the manufacture of the Jones hub odometer, which will be known as Johns-Manville in the future. The hub odometer is designed for truck use and has a 100,000-mile odometer movement. Prices are: Larger model, $20; type for Ford commercial vehicles, $15.

The tachometer is made in four models to show r. p. m. of engine shafts from 50 to 4000. The instrument is of practically the same construction as the speedometers except that the odometer movement is omitted, and the calibration and dial are different. Price, $30 in a 3¼-in. size and $40 in the 4-in. model.

Many Unique Points in Harroun

Lubrication System Includes Oil Radiator—Frame Is Particularly Rigid—Stroke to Bore Ratio 1.63—Cantilever Rear Springs With Inclosed Propeller Shaft

THE Harroun Motor Co., Detroit, Mich., a concern whose entrance into the manufacturing field has been awaited with so much interest, is about to produce a car selling for $595 possessing a number of striking engineering features. Dealing first with the specification, the engine is a four 3¼ by 5¼ in., and with overhead valves. The three-speed transmission and cone clutch are combined with the engine in a unit; the rear springs are cantilever; the bodies include a five-passenger and a three-passenger roadster at $595 and a sedan for $850, the wheelbase being 107 in. in each case.

Valves at an Angle

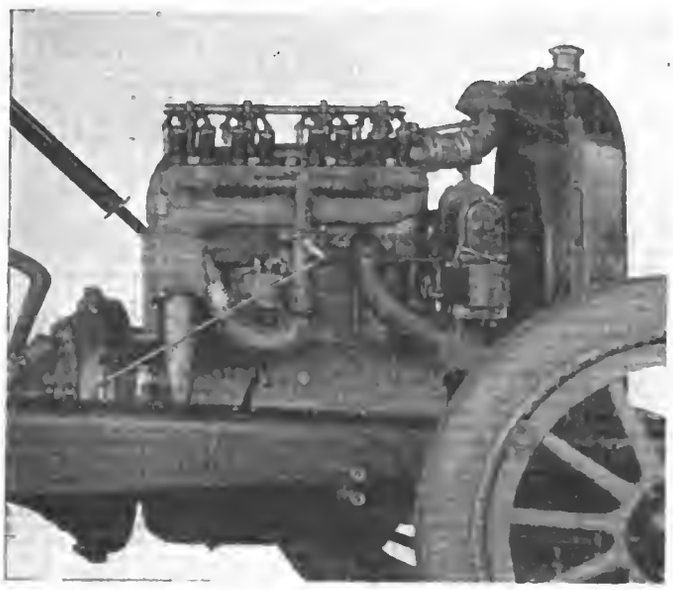
The cylinders have a detachable head and the valves are set directly in it, but an unusual feature is that they are at an angle instead of having their stems vertical. This allows the sparking plugs to be placed symmetrically with the valves, also in the head, thus following racing practice, such as might have been expected from Ray Harroun. The camshaft is in the conventional position in the crankcase, which is integral with the cylinders, and the valves are operated by push-rods and rockers. The camshaft is on the left side of the cylinders and the valves on the right, so the rockers are of considerable length. They are fulcrumed on a longitudinal shaft mounted above the cylinder outlet water header, and in this respect the engine is unique, there being no other like it in America or in any other country.

Exhaust gases go direct from the valve ports to the four-flange manifold, and a two-flange intake manifold is bolted to the cylinder head immediately above the exhaust branch, where it receives plenty of heat. The carbureter is a vertical Bell instrument, and there is a short length of vertical pipe leading to the horizontal portion that connects the two cylinder-head orifices. As shown in the illustration, the exhaust pipe has combined with it the stove providing hot air for the carbureter, and the instrument itself is so located that it will be kept fairly warm in its entirety.

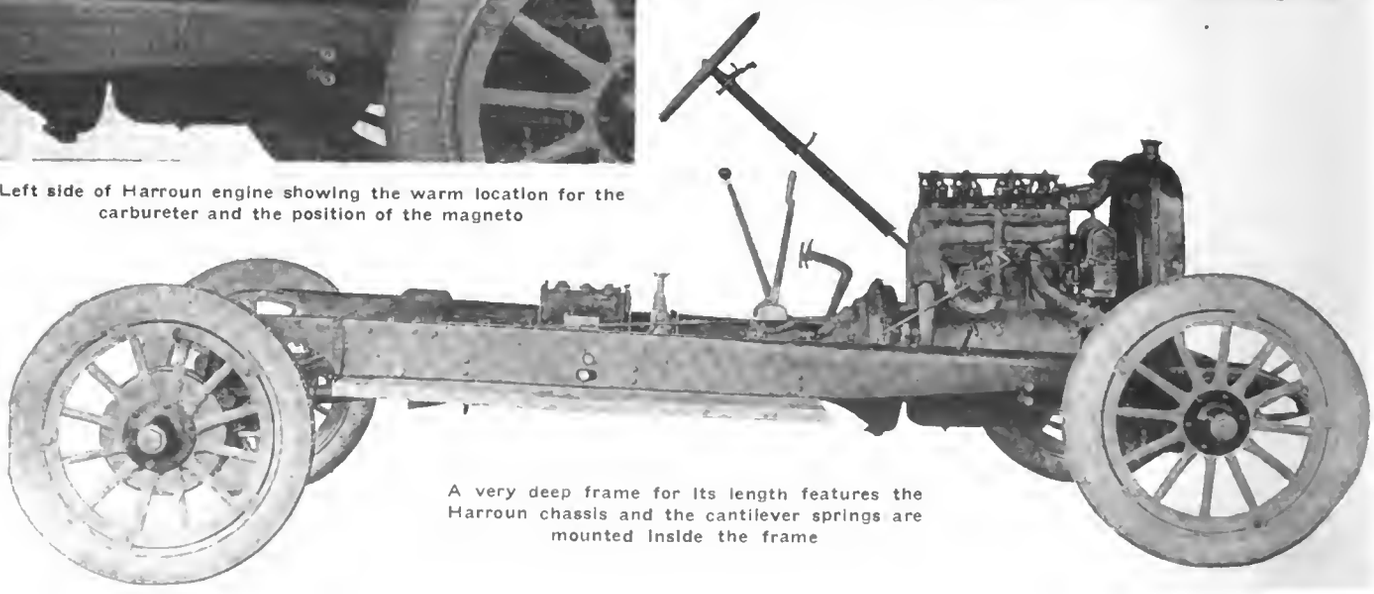
In the same illustration of the engine it can be seen that the thermo-syphon circulation is arranged so that the cool water enters just below the valves, so that the main flow is around the valve seats, where it is most required. On this side of the engine there is nothing except the carbureter, which is thus rendered ideally accessible. The end of the magneto shown in the carbureter side picture is that farthest from the wiring and contact breaker.

Ignition and generator current for battery charging are provided by a new Bosch instrument which has a magneto of the usual sort combined in one unit with a permanent magnet generator. This is mounted transversely at the front of the engine and its shaft is driven by a helical gear which meshes with the large timing gear, but in a plane at right angles to the latter. In other words the helical gearing acts as skew gearing also.

Lubrication is complete, there being a pump which supplies the main bearings by direct feeds that keep filled large cups above each bearing. Separate supplies are also taken to the camshaft and to the dip troughs beneath the connecting-rods.



Left side of Harroun engine showing the warm location for the carbureter and the position of the magneto



A very deep frame for its length features the Harroun chassis and the cantilever springs are mounted inside the frame

As it comes from the sump the oil is sucked through a long, cast pipe, located on the side of the crankcase and having fins on its exterior, this being the oil cooling device. The pump is a plunger type and is driven direct off the camshaft, but it is operated by a proper eccentric and strap instead of by a cam and a spring in the conventional way.

The crankshaft is unusual also, as the middle bearing is about a half inch bigger than either of the end bearings. It is a narrow bearing and this coupled with the large diameter should make the shaft about as rigid as it well could be. The engine is a remarkably easy assembly proposition. It should be noted that the pistons at the top of the stroke come level with the top of the cylinder block, which means that all the combustion spaces are machined out of the head casting. Care is taken to have the spaces of exact size, so that compression in one cylinder is the same as in any other.

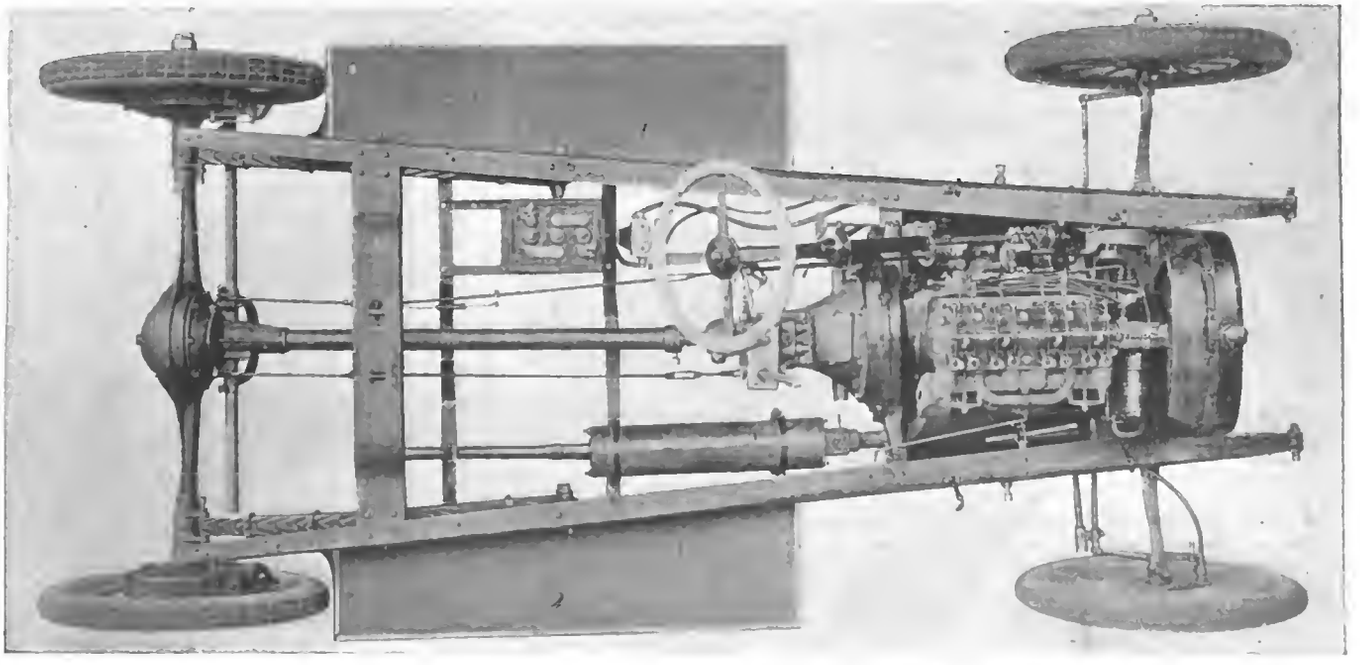
Five-passenger Harroun Four with standard equipment

About the pressed steel cone clutch and the three speed gearset there is nothing very remarkable, save, perhaps, that compactness in design is exhibited to an advanced degree. Behind the gearset there is a single universal, and then a torque tube to the pressed steel rear axle housing. This torque tube ends just behind the universal and has no frame connection whatever. There is an interesting detail of the brakework than can be seen in the chassis plan. The hand lever operates a solid shaft running from brake to brake right across the axle. So the hand brake mechanism is reduced to a simple pull rod and a plain cross shaft with one little lever on it. The foot brake is operated by tubes outside the shaft just mentioned, and there are two levers, one on each tube at the inner ends. These two levers are linked together by a yoke, seen in the chassis plan, which solidly connects the two tubes. It will thus be seen that there is no equalization in the brakes, many parts and a good deal of weight being saved in this elimination.

Of course, one of the features of the car is the frame which is so deep that the running board bolts right up against it without any sheet metal shields. The running board irons go right across the frame from side to side, thus acting as cross members and stiffening the frame very greatly. It is one of the most tapering taper frames ever built, and the way in which the cantilever springs are mounted inside the frame sections is also novel. These springs are also given a "spread" at the rear, and this is claimed to aid the spring action by damping out side stresses.

Yet another departure from conventional design is found in the steering. First, the steering gear is bolted to the crankcase, instead of to the frame, and the connecting-rod works across the frame instead of fore and aft. This allows the gear to be placed far forward, giving the column a good rake. The wheel itself has leaf springs as spokes, these being claimed to damp vibration and to make the wheel pleasant to hold for long periods. Furthermore the steering gear can readily be mounted on either the right or left side, the whole car being designed so that it can be made either way without special parts.

In the body a conventional outward form has been adhered to, and the finish is a green with which the khaki top contrasts. The driver and front passenger have not been neglected for the sake of the tonneau occupants, so that any one of the five seats is as good as another. All the usual things come with the car, but the inclusion of both a clock and a speedometer is not conventional on so low-priced a vehicle.



Plan of Harroun Four chassis, showing cross member step irons and wide flare on taper frame

King Adds Four-Passenger Model

Foursome Is Development of Club Car Idea—Is Mounted on Standard Eight-Cylinder Chassis Which Is Altered Only By Refinements—Touring, Roadster and Sedan Are Improved

UNDER the model number EE the King Motor Car Co. has continued with refinements the No. E eight made last season. One addition has been made to the line in the shape of a new body of four-passenger capacity. Other than this the changes in the King cars are chiefly in minor refinements of a mechanical nature and slight alterations in body detail.

The new four-passenger King is a development of the club car idea, with the objectionable points removed. The body provides plenty of room in the rear compartment, giving all the advantages of the close-coupled touring design with the lines of the roadster preserved. The other three bodies on this chassis, the seven-passenger touring car, three-passenger roadster, and seven-passenger sedan, have also been refined in construction and appearance in bringing the models up to the standard set for the 1917 season.

No Radical Changes

Mechanically, there are no changes which rank as important or radical. The brakes have been improved, there is a new gasoline system, the Stewart vacuum, the radiator is larger and better shaped, the tie rod yoke has been redesigned and there are one or two small alterations in the crankshaft.

The brake changes affect both the service and the hand brake, the latter being mounted as in previous King models on the end of the transmission shaft. The change is the insertion of a spring link in the line, so that any desired tension can be placed upon the brake linkage, thus tightening the brake as firmly as desired and allowing the car to be left safely upon any gradient without danger of rolling. On tightening the brake it is possible to set the brake as it would be with the ordinary type of linkage and then upon further pull on the hand lever, the brake can be tightened four more notches on the brake quadrant.

On the foot brake the change is in the insertion of an equalizing mechanism at the rear, it was formerly solid from the pedal all the way back to the brake levers on the rear axle.

On the engine there has been two slight alterations in the crankshaft. These are in the increase of the thrust flange area at the center bearing and in the use of a crab for holding the valve tappet guide in place. The shaft has a diameter of 1 13/16 at the center bearing and the flange originally had a diameter of 2⅝ in. The diameter is now 3½ in. This about doubles the area of the thrust surface on the center bearing. This is a three-bearing shaft with side by side connecting-rods.

The use of the crab instead of the plate formerly used has the advantage of not tending to bind the guide for the tappet. Another change which is rather part of the oiling system than of the crankshaft is the installation of an oil throw-off at the rear bearing. This is in the form of two grooves, and after the oil is thrown from the shaft it drains back to the crankcase and joins the other circulating oil. There are no other changes in the oiling system.

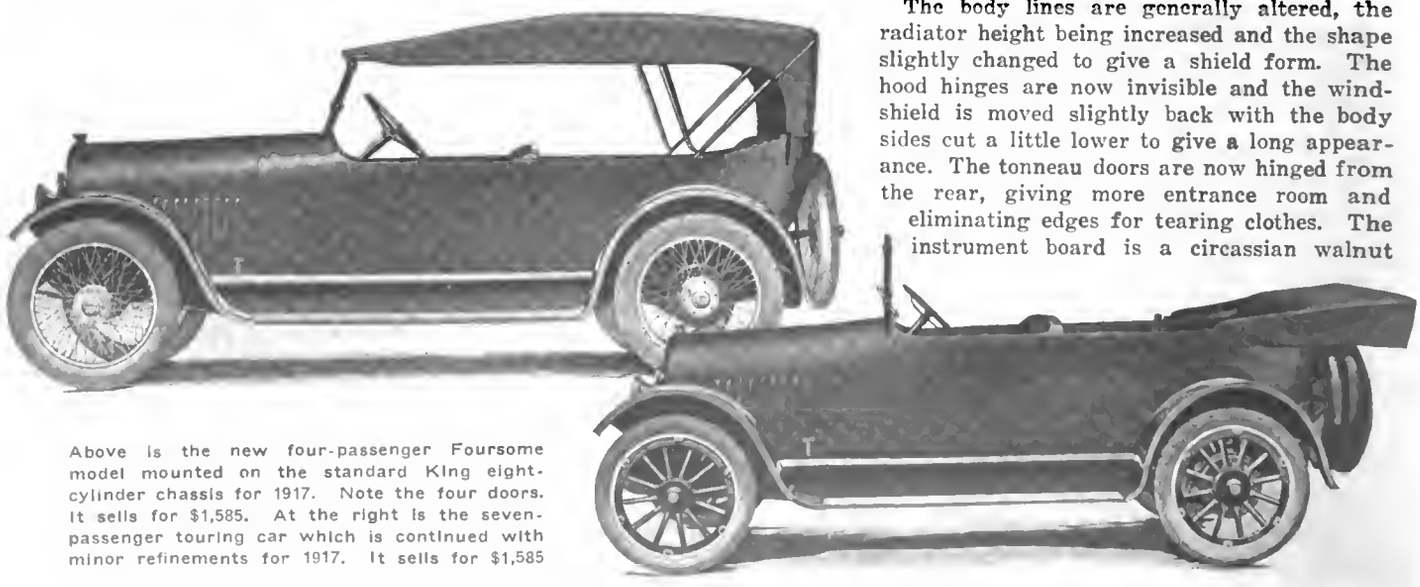
One of the alterations of detail which represents a valuable addition to the safety of the car is in the connection of the tie rod end to the steering arm. This is now a forked yoke connection with a bearing both above and below. In addition to the larger bearing space provided, the yoke connection is better connected to the cross arm by means of two clamp bolts instead of one.

A minor detail which is illustrative of the care taken to prevent rattles is in the use of a full length steering column sleeve which now extends from the wheel to the steering gear housing whereas it formerly only went down as far as the dash.

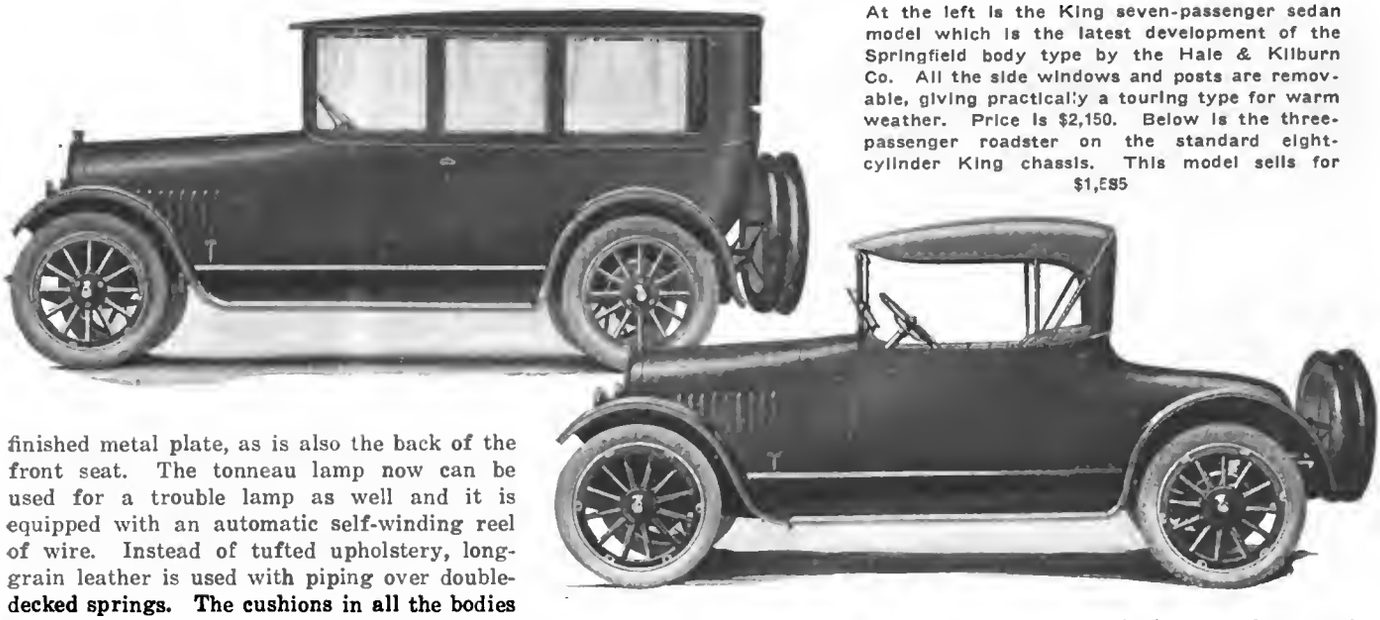
Line Now Complete

In putting the four-body line upon the single chassis, a complete range of cars is given. The price is $1,585 for the seven-passenger touring, four-passenger foursome and three-passenger roadster and $2,150 for the sedan.

The body lines are generally altered, the radiator height being increased and the shape slightly changed to give a shield form. The hood hinges are now invisible and the windshield is moved slightly back with the body sides cut a little lower to give a long appearance. The tonneau doors are now hinged from the rear, giving more entrance room and eliminating edges for tearing clothes. The instrument board is a circassian walnut



Above is the new four-passenger Foursome model mounted on the standard King eight-cylinder chassis for 1917. Note the four doors. It sells for $1,585. At the right is the seven-passenger touring car which is continued with minor refinements for 1917. It sells for $1,585



At the left is the King seven-passenger sedan model which is the latest development of the Springfield body type by the Hale & Kilburn Co. All the side windows and posts are removable, giving practically a touring type for warm weather. Price is $2,150. Below is the three-passenger roadster on the standard eight-cylinder King chassis. This model sells for $1,595

finished metal plate, as is also the back of the front seat. The tonneau lamp now can be used for a trouble lamp as well and it is equipped with an automatic self-winding reel of wire. Instead of tufted upholstery, long-grain leather is used with piping over double-decked springs. The cushions in all the bodies are 10 in. in thickness, this making for extreme comfort.

Just inside the windshield there are placed louvres for ventilation in warm weather. The top is better finished with a German silver binding at the front and rear. The top now fastens to the windshield with an automatic catch and the top material is the De Luxe Neverleak.

In the Foursome body, the four-passenger roadster idea is departed from in that there are four doors. Everything has been done to get low rakish lines, the windshield, for example, being sloped to an angle of 20 deg.

The Seven-Passenger Sedan

The seven-passenger sedan is the latest improvement of the Springfield type, manufactured by Hale & Kilburn Co. All the side windows are removable as well as the posts, giving practically a touring car with top up when desired for warmer weather. The seating arrangements are the same as for the seven-passenger touring car with the exception of the front seats, which are divided.

The chassis remains essentially the same. The unit power plant includes a V-type 3 by 5-in. eight, fitted with Atwater Kent ignition, Ball & Ball carbureter and Ward Leonard lighting and starting, with Willard 6-80 battery. The tire equipment is 34 by 4 with non-skid rear and wire wheels optional at $100 extra. The wheelbase is 120 in.

A plate clutch is used transmitting the drive through a three-speed gearbox, two Spicer joints and propeller shaft to a floating axle. The drive is taken through the 48-in. rear cantilever, but the torque is taken through a separate member of triangular design.

Using Old Tires

By Charles Vivier

JUST as the best chain fails at its weakest link so does the best tire fail at its weakest spot. It seems that in the majority of tires the carcass is much weaker than the tread; as a matter of fact, a casing subjected to ordinary touring use blows up within 25 to 30 per cent of its ultimate possible mileage, when a few thousand miles of perfectly good rubber still remain unused. Through neglect or accident, the blow-out occurs much sooner. Among the chief causes which are conducive to premature blow-outs, touring conditions considered, are under-inflation of casing when new and over-inflation when old, glass cuts, stone bruises and also tangential nail punctures. The modern pneumatic tire possesses remarkable wearing qualities which are unfortunately equalled by the high cost of the finished product. With the present price of gasoline, motoring costs about as much for tires as for fuel and oil; therefore, it behooves the motorist to save on tires as well as on fuel; to get the largest tire mileage with the least cost.

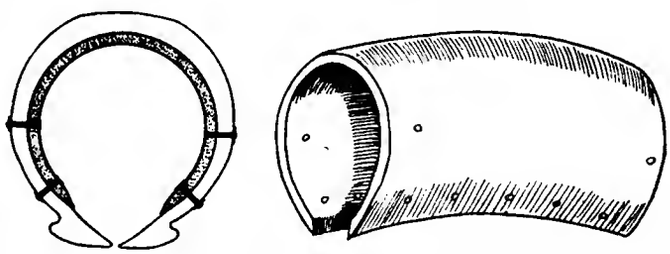
Repair Is Cheap

A blow-up casing can be efficiently and inexpensively repaired by riveting on the inside a patch (made from an old tire of the same size), covering the injured part. All the tools necessary consist of a hammer, a riveting tool and a leather punch; the material; some copper rivets and patches, according to the size of the casing to be repaired. Of course, such a riveting task is not very easy, especially for large size tires, but any one who has elementary notions about riveting leather can do a neat and dependable job, proceeding as follows:

Simple Materials

For a 4½-in. tire, for instance, get 1-in. copper rivets and burrs; hammer the ends of the rivets to a sharp point. For the inside patch, get a sufficiently large section (with the bead and rubber removed) from a discarded 4½-in. tire. Punch a few ⅛-in. holes, for the easy insertion and driving of rivets, about 2½ in. apart on each edge of patch, as per illustration. Then hammer or force the rivets into a riveting position, taking care that the patch is not too loose nor too tight when the tire assumes its normal curve.

This method can take care of a fairly serious blow-out, no matter if the wound is near the bead or across the tire. As 15 to 20 cents' worth of rivets are sufficient to repair an ordinary blow-out on a 4½-in. tire, the riveting process compares most favorably with the more expensive jobs of vulcanizing or of sewing two old casings together, in the approved manner.



Simple method for using up old tires described by Chas. Vivier

Maxwell Adds 1-Ton Truck To Line

25,000 To Be Built on Standardized Production Plan—Three Body Models To Meet All Requirements

ALL the manufacturing facilities of the Maxwell Motor Co., embracing the three plants at Detroit, Dayton, Ohio, and New Castle, Ind., will concentrate on the new 1-ton Maxwell truck as well as on the passenger car. A manufacturing program of 25,000 trucks has been embarked upon, and the distribution will be taken care of through the regular Maxwell channels.

Three standard body models will be mounted on the 1-ton chassis, designed to meet the needs of practically any line of business. The field which it is intended to serve includes such trades as the grocers, dry goods, meat dealers, laundries, bakeries, baggage and transfer companies, hardware dealers, painters, hauling contractors, builders, lumber dealers, and a wide variety of other vocations where a 1-ton truck will be suitable.

Coincident with the manufacturing plan, an elaborate service scheme has been laid out so that in all parts of the country owners will be able to get repair parts on short notice. The Maxwell organization of 3000 dealers and branches will maintain service stations for Maxwell trucks as well as for the passenger cars, and they will be at all times required to keep a supply of spare parts on hand. The warehouse system will also be used, so that regardless of the location of the dealer he will be able to be supplied with spare parts on 12 hr. notice.

Chassis Parts Like Passenger Car's

A standardized production scheme which fits in well with the Maxwell quantity production methods can readily be used in connection with the truck and passenger car, as the majority of the chassis parts are the same. In fact, the design is similar to the passenger cars throughout, except for the rear end. The truck has a 124-in. wheelbase and is so arranged that the major part of the load falls on the rear axle. The chassis frame work and rear end are strongly constructed for heavy-duty work. The wheels are 32 by 3, equipped with solid tires, in front, and 32 by 3½, with solid tires, in the rear. The body platform is 8½ ft. long.

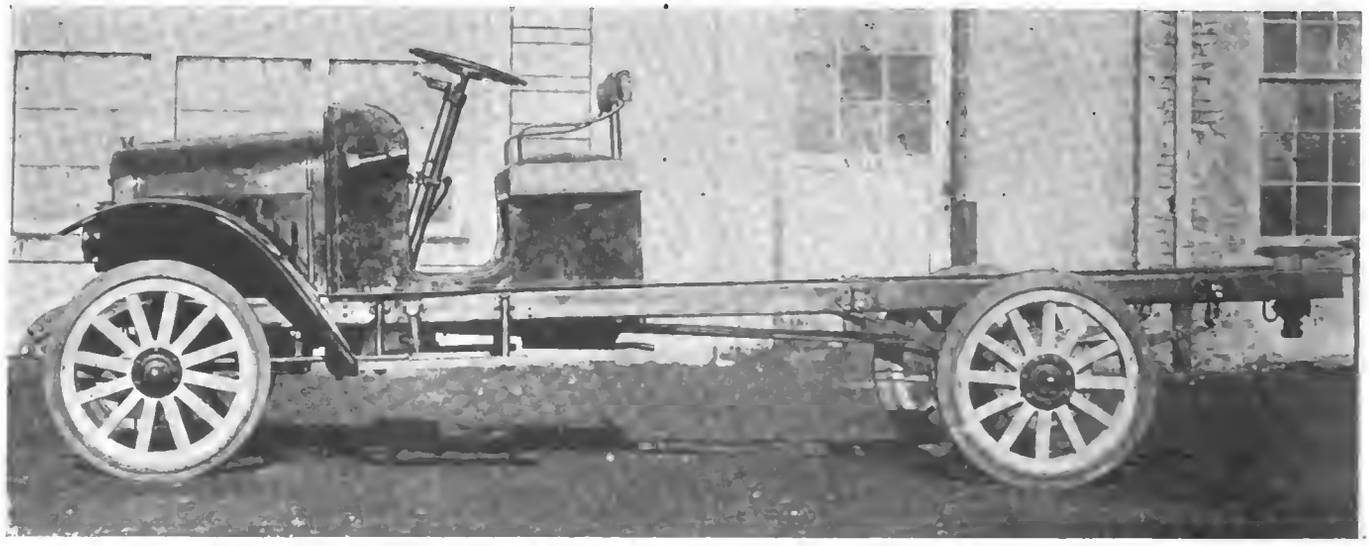
Worm drive is used for the rear transmission in connection with a three-quarter-floating axle housed in an exceptionally rigid malleable-steel housing. Heavy artillery truck wheels are used and circled by steel rims and carried upon heavy-duty roller bearings. Another feature of the chassis, which shows the care used in securing the greatest possible strength and rigidity, is the heavy cross-members which are riveted and strongly bracketed to the side channel members of the frame. Semi-elliptic springs front and rear also are of special design to take the particular stresses which will fall upon a truck of this size subjected to continual running over all sorts of road conditions and at speeds in excess of what is general practice in truck usage.

The Three Body Styles

The three body lines are regulation box style, an open express and a screened express. The same style of chassis and cab is used for all three, and, if need be for certain lines of business, more than one body can be had for a chassis, thus giving an opportunity to use the particular style of body desired with the work in hand. The open express lists at $805; the screened express, equipped with a roof and side screens, at $845, and the regulation box, provided with a continuous roof, at $840. The chassis sells for $760.

The same power plant used in the Maxwell passenger car is employed. It retains its bore of 3⅝ in., with a stroke of 4½ in., and has a formula rating of 21.1 hp. and a displacement of 185.8 cu. in. The cylinders and the upper half of the crankcase are cast integrally. The valves and manifolds are on the right, along with the Sims high-tension magneto.

The crankshaft is carried on two bearings, each 1⅞ in. in diameter, the front being 2½ and the rear 2 13/16 in. long. The lower rod bearing is 1⅞ by 1½. The camshaft diameter is 1¼ in., the front and rear bearing lengths being respectively 1 13/16 and 1⅜ in. The cams act directly upon flat mushroom-type followers which operate the 1 9/16-in. valve. Throughout the entire engine conventional practice rules, with all dimensions on the safe side. The cast-iron pistons



Maxwell 1-ton truck chassis, showing the substantial simplicity of the design, which is to be produced on a standardized production plan

Two types of body on Maxwell 1-ton chassis, giving a good idea of the ample length

have two rings above the wrist-pin and a scraper ring below. The piston pin is locked in the boss on each side of the upper connecting-rod bearing. The rods are I-beam sections.

Oiling is by splash, with supply carried in the pressed-steel bottom pan which when removed leaves the entire interior free for inspection. The oil is circulated by a camshaft-driven pump, being circulated directly to leads beneath the rod bearings, from where it is splashed to all parts of the engine. There is an oil-level indicator on the crankcase.

One of the features of the power plant which will be appreciated in truck usage is its accessibility. By removing the stud bolts in the head the entire top of the engine can be taken off, along with the spark plugs, exposing the valves and combustion chambers. For valve grinding and carbon removing the time spent in reaching the desired parts has been minimized. To reach the other units it is necessary to drop the engine pan, which allows the repairmen to reach the lower rod bearings or the main bearings. To remove the piston and rod assemblies the lower rod bolts can be removed by dropping the bottom of the crankcase, and the pistons can then be taken out of the top when the head is off the block.

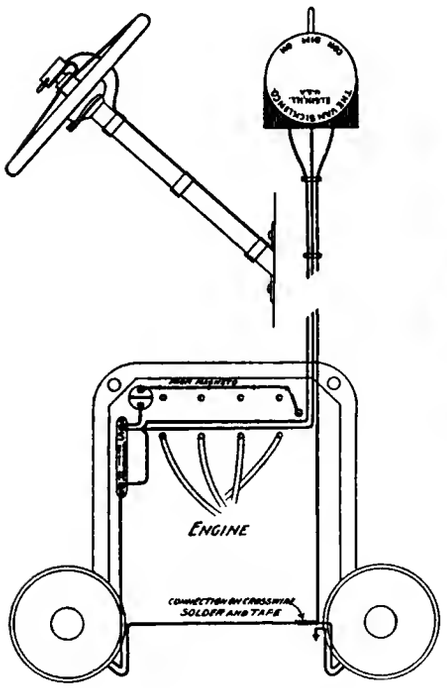
The Maxwell clutch and three-speed gearbox have been retained as used in the passenger car. The clutch is a cone, with a woven asbestos face which is oilproof. The clutch is completely housed with the flywheel in the unit plant, and operates in oil.

From the gearset to the rear wheels the propulsive units are altogether different from the passenger car. The propeller shaft, instead of being considerably longer for the 124-in. chassis, has been made more rigid by dividing its length. The drive is carried in two sections. The first member reaches a point between the axle and the gearbox, where it is supported by one of the cross-members of the frame. From this point a universal joint transmits the drive to another length of shaft which reaches the rear axle. This style of divided drive eliminates the tendency to whipping and also gives a maximum of flexibilty. It is expected by Maxwell engineers that this will prolong the life of the axle bearings, due to a reduction of the stresses ordinarily caused by the whipping tendency.

The Hotchkiss drive is used, and has been found to work out to particular advantage in connection with the divided propeller shaft and heavy truck springs.

For some time there has been considerable discussion regarding the possibility of a light vehicle which will take the place of a one-horse wagon or, to even better advantage, a number of one-horse wagons. The range of a light truck in miles per day is much greater than that of a horse vehicle, and therefore, to take advantage of this range and at the same time have the truck operate economically, it is necessary that the capacity shall balance the distance which it is able to travel.

Van Sicklen Lighting System for Fords at $4



Above — Van Sicklen dimmer and intensifier switch, showing attachment for top of Ford steering column

Above at left—Headlight switch, showing simple method of attaching. Note convenient location of headlight control within thumb-reach of the driving hand

At left—Wiring diagram of the Van Sicklen headlight dimmer and intensifier equipment, showing method of installation

COMPOSED of but three parts and so simple that it can be installed in 3 min. without interfering with the regular wiring in any way, the Van Sicklen Headlight Dimmer and Intensifier equipment for Ford cars has been perfected by the Van Sicklen Co., Elgin, Ill., and is marketed by the Beckley, Ralston Co., of Chicago. This device, which is illustrated herewith, is claimed to furnish a uniform light under all conditions, a flip of the switch to Int. giving a clear penetrating light, turning it to Dim softens it to a mellow glow which complies with all police requirements, and for ordinary conditions when the normal light produced by the Ford lighting system is desired, flipping the switch to On restores it.

Easily Attached

The addition of three short wires and the switch, which is mounted on the top of the steering column, comprise the installation, which does not require further attention when once mounted. The device sells for $4 complete.

The FORVM

Overloading and Rating of Trucks

By Edward T. Birdsall, M. E.

CAUSES—The practice of loading trucks beyond their rated capacities by owners and users has been the subject of many articles in the business press, and productive of many plans by the manufacturers of both trucks and components for its elimination, but all without substantial results.

The difficulties of regulating the abuse are many and most of them quite beyond the power of the manufacturers to cope with.

Among the principal causes of overloading are—

1—Lack of supervision on the part of the owner over the employees loading and handling the truck.

2—Lack of appreciation, or indifference, of the owner as to the evils of overloading.

3—Ignorance of the owner and employees as to the weights of the materials or items composing the load.

4—Exigencies of trade which make occasional overloading at any cost unavoidable. A few instances of this sort not followed by immediate breakage engenders confidence in the minds of the owner and employees that the truck is capable of carrying a load in excess of its rated capacity without injury.

5—Observation of instances of overloading, without apparent bad results, on the part of other users.

6—Ability of the power plant to pull the overload.

7—Statements of over zealous or mercenary truck salesmen that the truck will stand up under excess loading.

8—Fitting of oversize tires. This may have primarily been done to increase the tire life, but with an extra tire load capacity overloading of the truck soon follows as a natural sequence.

9—Natural growth of a business to a volume too great for the truck equipment, and reluctance of the owner to purchase additional units in advance of absolute necessity.

10—Willful overloading. In a few cases owners have argued that the aggregate value of overload ton miles carried, plus the sale value of the wreck, will in a year amount to a sum more than sufficient to pay for a new truck.

Requirements Vary With Trade

In addition to the above, every trade using trucks will be found to have special requirements or conditions peculiar to itself that will lead to occasional or more or less continual overloading.

Cause No. 3 is regarded by the writer as the most prolific cause of overloading.

Remedies—Much thought has been expended on plans, devices and what for a better name might be called subterfuges to remedy the evil. Prominent among these are:

a—Cancellation of the guarantee when overloading is discovered or persisted in.

b—The education of owners and users by published articles, pamphlets, advertisements, arguments and thinly veiled threats.

c—Bonus payments to drivers for maximum mileage coupled with minimum repairs.

d—Grading the springs so that by observation or effect an overload is made evident.

e—The employment of an expert to supervise the service. This, of course, is only possible where fleets are operated.

f—Indicating alarm or recording devices.

g—Use of a motor too small to pull the overload.

Of the above remedies, the use of a motor too small to pull the load is obviously impracticable.

Recording and alarm devices are soon neglected except by the manager of a fleet, in which case they only act as checks to other methods.

The bonus system to drivers I believe is good under all conditions, but must be impartially and systematically kept up. It is in the same class as "piece work rates" and must not be handled so as to bring discredit to the plan.

The springs are to a certain extent visible scales weighing the load, and can be used as rough indicators of overload.

The scheme of having the projecting body touch the tires under overload is impracticable as expensive injuries to the tires will occur, which no owner would tolerate.

The best suggestion in this line that has come to the writer's attention is to so proportion the springs that they are exactly straight or flat under the normal loads, but reversed under overloads.

Inspection Shows Condition

A mere inspection of the truck, even when in motion, at once discloses the condition of the loading. This plan to be of real value, however, necessitates the installing of special springs to fit all conditions arising from the different weights of bodies. Four or five sizes would probably cover most cases.

The writer believes that only the education of the owner and user will accomplish the end desired, and this will take a considerable time to fully accomplish. There will always be a minority of owners who will be indifferent to their welfare and impervious to argument. But the truck industry will soon be so large that the bad effect of this small class will not be felt by the industry at large. These are the same people who to-day are overloading their horse teams but obviously without the slightest effect upon the sales of the horse and wagon dealers or upon more sane owners.

It is a question whether the industry at the present time is in a strong enough position to take any drastic action in the matter. It seems that a persuasive yet forceful educational campaign which would hold a dollar bill constantly before the eyes of the owner is about all that can be done at present. The arguments against overloading should submit definite figures and not mere platitudes. They should give concrete facts and not a series of "Don'ts."

The campaign would be best inaugurated by an association of truck manufacturers, and not by individual builders, as it would thus have more weight and would eliminate the personal self-interest factor. It would also divide the burden of cost so that even an extensive and prolonged campaign would not be a hardship on any individual maker.

Rating Important

Closely allied to the question of overloading is the subject of truck load ratings. An investigation of the ratings of the various manufacturers at once discloses wide differences in the sizes and apparent strengths of the various parts on which the load rating must be based. The two components that have the most influence on the rating are the axles and the tires. The tire makers are now fairly well agreed as to the proper sizes of tires for various loads, but the axle manufacturers do not seem to be in very close agree-

ment. The tendency of the last 2 or 3 years has been to rate axles with an excessive factor of safety, if good roads and normal speeds are factors of the rating. They evidently rate them for rough roads, overloads and excessive speeds. This of course is a safety-first play for the axle maker, but works a hardship on the truck manufacturer as to costs, as the principal makers of axles refuse to sell or deliver if the advertised truck load rating is higher than their axle rating.

As the surface on which the truck travels is just as much a part of the transportation mechanism as the truck itself, it seems only logical and fair that it should be considered as one of the factors in the rating. This, however, at once raises a host of problems and complications of manufacture, selling and use that run hopelessly counter to design, production and profit.

For example: A given truck, with suitable minor changes in detail, might economically carry 4 tons at 10 m.p.h. on very good roads, but only be good for 2 tons on bad roads at 6 m.p.h. The possibilities of the truck industry when the owner's education has reached an elevation that would permit the truck builder with safety to meet such a condition, is beyond conjecture, and I fear far in the future. An examination of the trucks on the market shows clearly that some have their ratings based on good roads, have a resultant low price, and seem to be "getting away with it." Others are evidently rated for the worst roads, have a resultant high price and smaller production.

Decision Is Difficult

It is difficult, under present conditions, to decide which is right. It is comparatively easy to select and recommend a suitable truck for a particular set of conditions of operation and use, and all will be well as long as the truck is confined to its original location and use. When, however, for any reason, the truck is transferred to a new owner, location and use, then in a majority of cases trouble will develop, which under present conditions will reflect unfavorably on the manufacturer.

It would seem, therefore, that the education of the present owners and users, and the future truck-owning portion of the public, in the correct use of power vehicles is the first step to be taken.

The logical body to carry on the work of evolving a new rating is the standards committee of the S. A. E. The committee should be composed of truck makers and the findings of the committee should have the approval of at least 75 per cent of the manufacturers before making its report at the summer meeting of 1920.

Tires Pumped Too Hard

By O. B. Parkinson

MOST tires have lettered upon them the legend: "Inflate to — lbs.," inserting the figures 70, 80, 90 or 100, according to the size of the tire, and the ideas of the maker. It will be found that upon inflating a tire to the full pressure stated, that the tire becomes practically a solid tire. Many drivers when inflating their tires at a garage where air pressure is obtained, inflate their tires 10 lb. or more higher than the maker specifies, with the idea that it will save pumping again for a longer time.

Why is a pneumatic tire used? It was found that with the earlier types of cars having an extreme speed limit of not over 20 m.p.h. the solid tires with which these cars were equipped were the cause of excessive vibration which crystallized the steel of the car, shook loose the nuts and bearings, broke springs, and made the vehicle a most uncomfortable conveyance. Then came the pneumatic tire with its almost universal adoption, it being unanimously agreed that "riding on air" was much more comfortable than "riding on iron." In other words, the springing up and down of the air cushion would materially lessen the vibration, tend to eliminate crystallization, broken springs and loose nuts, and secure much more comfort for the passengers.

The Danger of Skidding

I know of no more senseless proceeding than to put a set of pneumatic tires on a car with the idea of securing ease of riding, and then to put a volume of compressed air in them to the extent that makes solid tires of them. Practically the same results follow as did with the old cars except that, by reason of better steels being used, the metal parts do not so readily crystallize and, by reason of better springs, the springs are not so often broken; but on account of the high rate of speed at which most motorists drive, there is a danger which was unknown in the early days, that of skidding, either in turning corners, or on roads where there is a slight roughness, such as an oiled macadam or asphalt road which has become "wavy." Very few accidents are the result of skidding on wet roads, as compared with those upon dry roads, as nearly all drivers proceed with extreme caution over wet, slippery pavements.

Now, anyone can easily prove to his own satisfaction, by trying it, that a car with tires inflated to 90 lb., which will skid over the dry roads as above indicated, will not skid over the same roads at the same speed, with the tires inflated to 60 lb. A machine which will not travel through sand at 90 lb. will do so at 60 lb.; likewise, a hill which it will not climb with 90 lb., it will climb with a 60-lb. pressure, Again, with a 90-lb. pressure, it is almost certain that early in the career of the tire the inner tube will be "pinched" either by being forced between the edges of the casing on the inside, or forced entirely under the casing.

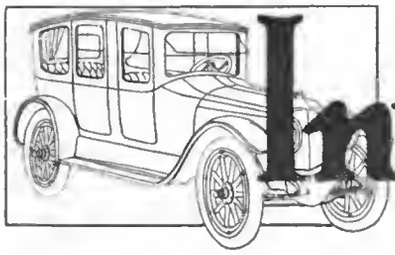
Rim Cutting Not Likely

The only apparently valid reason given for inflating tires until they resemble solid tires, is that the tires will not be rim-cut, and therefore, last longer. This is not correct. In good tires attached to rims which are now designed so that no sharp edges press against the wall of the tire, there is no rim cutting, unless the tire is run flat; and if a slightly larger mileage is obtained by pumping the tire hard, it is much more than offset in actual dollars by the cost of vulcanizing and replacing inner tubes, to say nothing of the annoyance, loss of time and energy expended in changing tires; add to this the elimination of the skidding danger, the elimination of loose nuts, bolts, and broken springs, as well as crystallization, and beyond all, for the average person, the luxurious ease of riding, and you have an array of reasons why a tire should not be over-inflated.

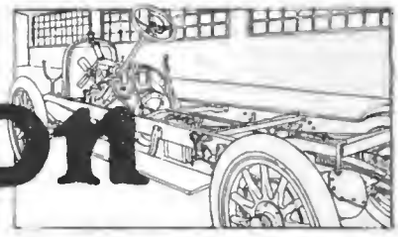
There may be some exceptions to this. There are certain tires which have been on the market but a comparatively short time, which are known generally as cord tires, on which the inflation pressure is marked at much lower figures than on the tires made in the standard fashion, and in the literature of some of these makes, it is stated that by reason of requiring less pressure, the car is easier riding, which is perfectly true.

Lower Pressure Practical

As a general rule, subject to some variations, and excepting as to cord tires, the tire should be pumped at least 20 lb. less than the maker advises. Some drivers get excellent satisfaction from rear tires inflated 20 lb. less, and front tires 30 lb. less than the maker advises. Personally, I have used a set of 4-in. tires (marked "inflate to 80 lb.") on a 3000-lb. car through mountains and over rough roads, with tires carrying not more than 30 lb. in front, and 50 lb. in the rear, and with exceptional ease of riding, the best of traction on hills and in sand and positively without any rim cutting or other injury to the tires except the ordinary abrasion of the tread.



Information



¶ With this issue of THE AUTOMOBILE the Rostrum, as a department devoted to answering the questions of readers and to publishing communications of general interest, gives way to Information. In the new form a higher efficiency is aimed at by economy of space and a method of direct reply.

QUERY—Description of Claudel carbureter. 2—Total weight and chassis weight of 16-hp. and 20-hp. four-cylinder Sunbeam touring cars, 1915 model. 3—Meaning of term "cracking of the fuel" as found in article in THE AUTOMOBILE for Sept. 14. 4—Reason for small use of overhead camshaft of the Stutz and Mercedes type for stock car valve-in-head type engines. 5—Suitability of 2-in. clear opening valve for stock car when engine is designed to peak at 2500 r.p.m.

(1) Beemer, Neb. G. S.

—Fig. 1 is one of the latest Claudel carbureter designs. The section of the jet shows that both air and fuel are drawn through it, and in practice it is a kind of froth which leaves the nozzle. In the barrel throttle is a peculiarly shaped opening, and this acts as the choke, the area of air opening around the nozzle thus increasing as the throttle is opened. To set the "shut" position of the throttle there is a screw, and there is also a secondary fuel feed up a small pipe and past another screw which supplies a little fuel through a hole in the side of the throttle chamber. This by-pass supplies practically all the fuel for slow running, and some of the fuel all the time. Adjustment has to be made on both screws, that controlling the shut position of the throttle also affects the area of opening at all stages, it is really a choke adjustment throughout the full range, and the other screw controls the size of the by-pass orifice only.

The carbureter has to be chosen carefully to suit any particular size and sort of engine, and original adjustments are made by altering the proportions of the parts in the main nozzle, especially by varying the size and number of the little air holes in the outside sleeve of the nozzle. It is intended for gasoline.

2—The total weight of the 16-20-hp. four-cylinder Sunbeam car is between 3000 and 3400 lb. The manufacture of this car will be discontinued and the firm intends in the future to specialize on six cylinders; at least this is the latest advice from England.

3—When gasoline or kerosene is heated too strongly it breaks up into its constituent parts which consist of very light oils and very heavy ones, together with some actual solids. If cracking takes place in an intake manifold it will make tar-like deposits in the cylinders and valve chambers.

4—Because it is very expensive and it is far from easy to obtain quiet drive from an overhead camshaft. And furthermore, the overhead camshaft has no advantages for anything except racing or aviation engines.

5—This depends entirely on the size of the engine. A 2-in. clear opening is large enough for a cylinder of 4-in. bore.

? ? ?

Query—Solution for cleaning out radiator. 2—Cause of backfiring. 3—Advantage in substituting 100-amp. hr. for 80-amp. hr. storage battery.

(2) Mt. Vernon, N. Y. M. C.

—A solution of about 1 lb. of caustic soda in hot water is sufficient to fill the water system of an ordinary car. The water should be drained, the hot solution poured in, the engine run for 10 min. to thoroughly circulate the solution which should then be drained out and a continuous stream of water run in at the radiator cap and out at the drain for another 10 min. It is very important that all traces of solution should be removed, since otherwise it will damage the radiator.

2—The engine backfires, or turns in the wrong direction, when an attempt is being made to start it because the spark occurs when the piston is on the compression stroke and before it has reached the top dead center.

3—Yes. The 100-amp. hr. battery would have a longer life.

? ? ?

Query—Where to obtain equipment for wheels of Metz roadster, 1914 model, for running on railroad tracks.

(3) Glen Jean, West Va. C. P. C.

—You will have to have these wheels made specially. Probably you could make or have made rims which would clip on outside the present one. You need not be afraid to make these considerably larger than the old pneumatic tires, since, having no hills to climb, the car will bear a higher gear ratio.

? ? ?

Query—Diameter of exhaust pipe on 1915 model Fairfield Paige. Size and best position for hole for fitting cutout. Method of making hole without removing pipe. 2—Method of attachment of spotlight to windshield and wiring connections for spotlight.

(4) Newark, N. J. A. J. H.

—The diameter of the exhaust pipe on this model is 2¼ in.

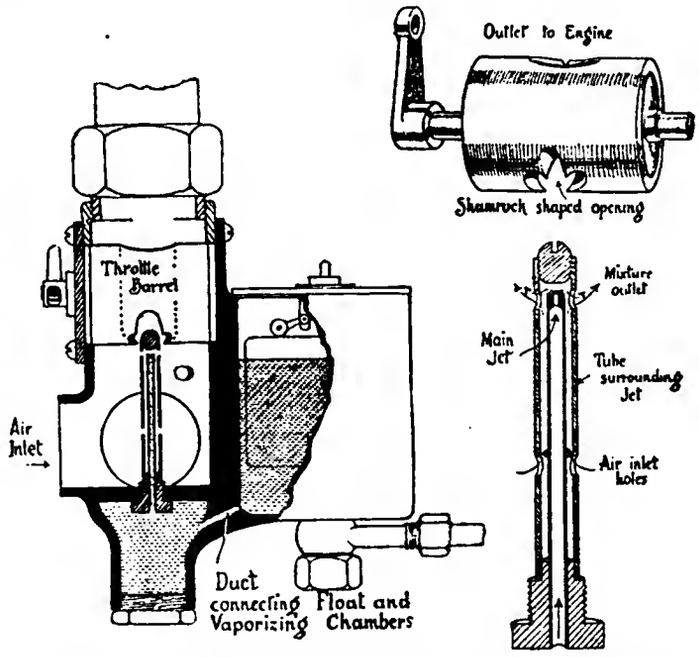


Fig. 1—Claudel carbureter of recent design, showing the action of the jet, which produces a sort of froth as the mixture leaves the nozzle

The best place to install a cutout is directly back of the bend in the pipe near the muffler. The size of the hole does not make much difference and we would suggest cutting this about 2 in. square. This can be accomplished by cutting across the pipe with a hack saw and cutting lengthwise with a cold-chisel. This is not a very easy job for an amateur unskilled in the use of a cold-chisel, but it is quite a cheap job at a repair shop.

Spotlights on the windshield are usually fitted with a plug which is attached to the dash light socket, although an extra switch can be installed on the dash and a wire run direct to the switch junction box. If the lamp should be single wire grounded type it will be necessary to run but one wire to the junction box, this to be attached to the top terminal. Should the lamp be a double wire type the two wires can be run to the top two terminals.

? ? ?

Query—Necessity for hydrogen flame in burning lead connections on batteries. 2—Possibility of using oxy-acetylene welding outfit for this work. 3—Best process. 4—Construction of hydrogen generator.

(5) Plaquemine, La. T. B.

? ? ?

—It is not essential, but it is much better to have a hydrogen flame.

2—A blow torch has to be used with great care since it is not very hot and there is a risk that too much of the lead will be heated up before it is melted at the small point where you desire to burn it. An oxy-acetylene welding outfit will give entirely too hot a flame.

3—A hydrogen generator is not a thing you can readily construct for yourself. Hydrogen is obtained in compressed form in steel bottles.

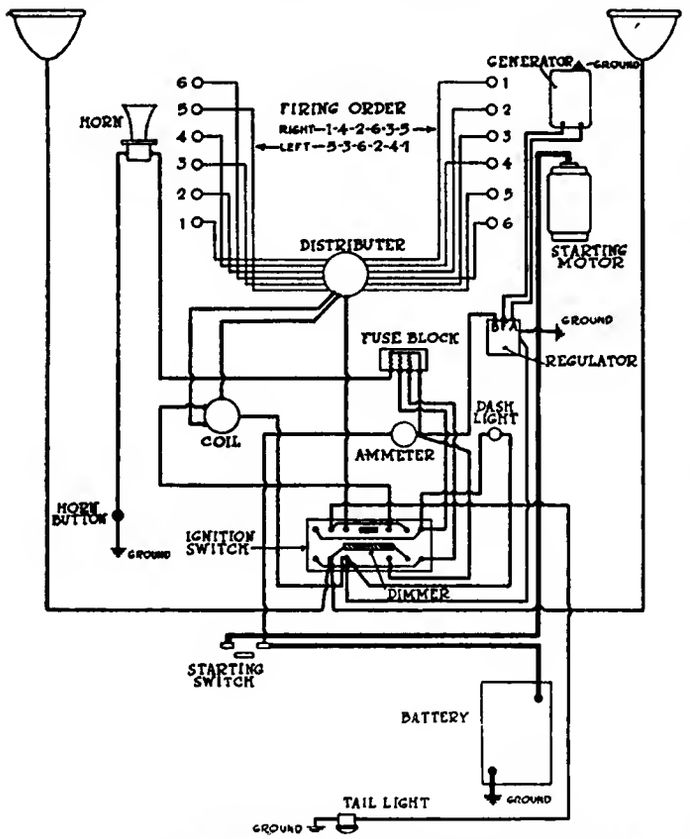


Fig. 3—Wiring diagram of starting, lighting and ignition system on the Hal car, showing connections to battery, switches, etc., and giving the firing order of the twelve cylinders

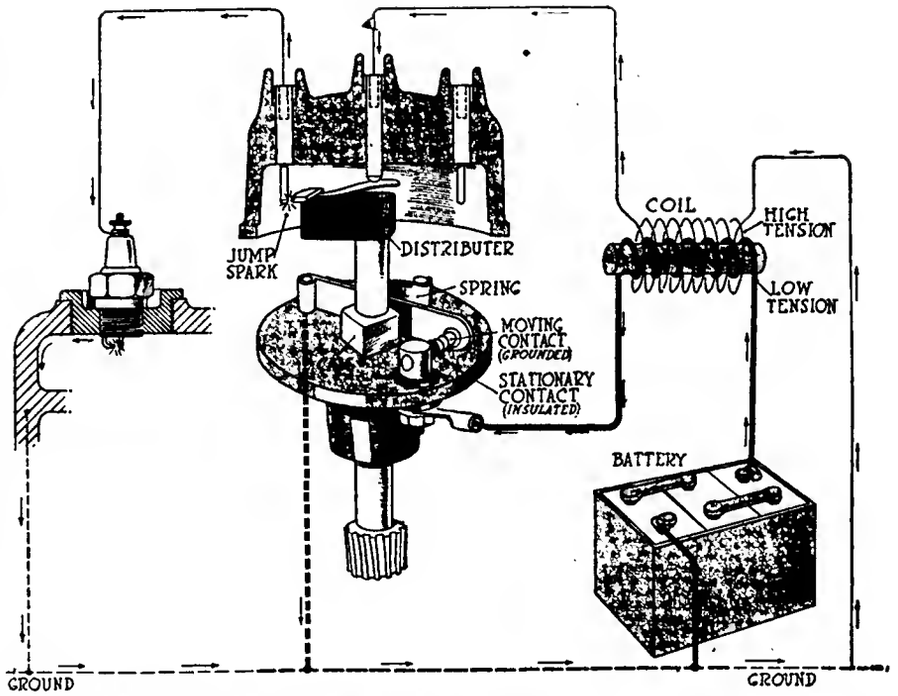


Fig. 2—Diagram illustrating the theory upon which battery ignition systems operate and showing the primary and secondary circuits

? ? ?

Query—Diagram showing theory of battery ignition systems in general, primary and secondary circuits.

(6) Brooklyn, N. Y. L. M. H.

—Diagram you request appears in Fig. 2.

? ? ?

Query—Cause of right-hand wheel of Buick model 10 locking after running about 10 ft. Brakes seem O. K., but housing gets warm. 2—Way of telling when axle is bent without taking it out of the housing. 3—Wiring diagram of starting, lighting and ignition on Hal.

(7) Bronx, N. Y. W. R. C.

—If you are certain that neither brake is binding, the axle should be taken to pieces and examined.

2—No certain way.

3—Diagram requested is illustrated in Fig. 3.

? ? ?

Query—Relative importance of the time used for combustion of the charge and of electrical lag within the ignition system in determining spark advance.

(8) Wellsboro, Pa. D. E. D.

—Spark advance is necessary almost entirely to make up for the time used in combustion. There is practically no electrical lag in modern ignition systems.

? ? ?

Query—Are steel cylinders of one piece construction with two inlet and two exhaust valves, similar to those used on the Mercedes aviation motor, made in this country?

(9) New York City. J. T.

—Several experimental engines have been built in this way, notably the Martin aviation engine in which a large number of stamped steel parts are welded together in a very ingenious way giving a cylinder with almost perfectly even thickness at every section.

Industrial Miscellany

Factory

Durston Gear Co., Syracuse, N. Y., will build a one-story, 50 by 108 ft. addition.

E. H. Sprague Mfg. Co., Omaha, Neb., has been formed to manufacture automobile accessories and is occupying the plant of the Standard Foundry Co.

Myers Rubber Co., has broken ground in Massillon, Ohio, upon which it will build a plant.

C. E. Hosbach Co., Baltimore, Md., maker of automobile tops and wagons, will build a one-story machine shop, 34 by 69 ft.

Continental Motor Truck Co., Superior, Wis., has completed work on its new factory and machine shop and is now erecting and equipping a power house.

A. Z. Metal Works, Thiensville, Wis., specializing in automobile and tractor radiators, lost its entire plant by fire. It is probable that a new factory will be erected.

Stungo-Radium Rubber Co., Pittsburgh, Pa., capitalized at $3,000,000 to manufacture automobile tires, has purchased the former Croxton Motor Co. Plant in Washington, Pa.

Piedmont Motor Co., Lynchburg, Va., is receiving bids on automobile manufacturing machinery and first installment for assembling.

National Welding Co., Newark, N. J., specializing in automobile repair work, has broken ground for a brick addition to its building. The new addition will be for the machine shop and welding department, and for handling smashed touring cars. The present building will be for commercial vehicles of every description.

Electric Tool & Appliance Co., organized recently at Milwaukee by Oscar Werwath, president of the Milwaukee School of Engineering, will erect a plant in the spring for the manufacture of patent box cutters and scientific laboratory apparatus. Temporary quarters will be obtained at once.

Aluminum Goods Mfg Co., Manitowoc, Wis., has purchased a group insurance policy in the Aetna Life covering all employes of the three big plants, at Manitowoc and Two Rivers, Wis., and New ark, N. J. The policy amounts to about $1,000,000 and the maximum sum on each employe is $1,000. It was purchased as a Christmas gift for employes.

General Bakelite Co., New York, has moved to 2 Rector Street. This company produces Bakelite, the heat-resisting, molded insulation.

Willys-Overland Co., Toledo, will establish a factory branch in Winnipeg, Man., to be a distributing point for the Province of Manitoba. This is the third branch to be opened by this company, the others being in Montreal and Regina.

Iowa Rubber Tire Co., has purchased the plant of the American Can Co., Davenport, Ill., for $70,000.

Reliable Auto Heater Co., Cleveland, has leased a plant formerly occupied by the Ashtabula Mfg. Co., on east side of city. This plant will be known as the Vesuvian Auto Heater Works. S. T. Campbell is in charge at this plant.

Stegeman Motor Car Co., Milwaukee, a manufacturer of trucks, will build a factory addition, 79 by 190 feet, adjoining the present plant at Woodworth and Linus Streets. The building will be of fireproof construction, and cost about $50,000 complete. It will be devoted principally for assembling purposes, and the space thus released from the present shops will be equipped with machinery and tools to provide the new shop with a largely increased output of parts.

The Automobile Calendar

ASSOCIATIONS

Jan. 6-13—New York, Mid-Winter Meeting of Society of Automobile Engineers, Engineering Society Bldg.
Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.
Jan. 9-11—New York City, Society of Automobile Engineers' Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.
Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.
Jan. 24-26—Chicago, Second Annual Meeting National Assn. of Automobile Accessory Jobbers. Congress Hotel.

CONTESTS
1917

April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 14 — Des Moines, Iowa, Speedway Race, Championship.
July 4—Tacoma, Wash., Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15 — Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race, Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13—Chicago Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Dec. 9-16—Akron, Ohio, Show for Passenger Cars Only, Market Street Gardens, Akron Automobile Dealers' Show Assn.
Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel, I. R. Gates, Mgr.
Dec. 26-27—Olean, N. Y., Show, Armory Hall.
Dec. 30-Jan. 6—Cleveland Automobile Accessory Show, Dreamland Auditorium.
Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.
Jan. 6-11—Milwaukee Auditorium, Milwaukee Automobile Dealers.
Jan. 6-13 — New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 12-20—Philadelphia, Show, Philadelphia Automobile Trade Assn.
Jan. 9-10 — Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.
Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.
Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 22-27—Manchester, N. H., Academy.
Jan. 22-27—Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jan. 23-27 — Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 25-27—Asheville, N. C., Show, Asheville Automobile Trade Assn.
Jan. 27-Feb. 3—Columbus, Ohio, Show, Memorial Hall, Columbus Dealers' Assn.
Jan. 27-Feb. 8, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Jan. 27-Feb. 5—York, Pa., Show, York Automobile Dealers' Assn.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Jan. 28-Feb. 3—Wilmington, Del., Show, Hotel duPont.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 5-9—Boston, 8th National Good Roads Show, Mechanics' Bldg.
Feb. 5-10—Bangor, Me., Bangor Automobile Assn., Auditorium.
Feb. 10-17 — Hartford, Conn., Show, State Armory, First Infantry.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 12 - 17 — Louisville, Ky., Show, First Regiment Armory, Louisville Automobile Dealers' Assn.
Feb. 12-19—Indianapolis, Ind., Show, Steinhart Bldg., Indianapolis Automobile Trade Assn
Feb. 17-24 — Newark, N. J., Show, First Regiment Armory.
Feb. 19-24—Grand Rapids, Mich., Show, Automobile Business Assn. of Grand Rapids.
Feb. 14-17—Peoria, Ill., Coliseum, Automobile and Accessory Dealers' Assn.
Feb. 18 - 25 — St. Louis, Mo., Show, Automobile Manufacturers' and Dealers' Assn.
Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.
Feb. 19 - 24 — Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.
Feb. 19-24—Bridgeport, Conn., Show, Armory, Coast Artillery Corps.
Feb. 19-24—St. Louis, Overland Bldg., St. Louis Auto. Dealers' Assn.
Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.
Feb. 24 - March 3 — Brooklyn, Show, 23rd Regiment Armory.
Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.
Feb. 27-March 4—Atlanta, Ga., Show, Auditorium, Atlanta Auto Trades and Accessory Assn.
March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co. Armory of the University of Ill.
March 3 - 10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 14-17—Davenport, Iowa, Show, Coliseum Bldg., Tri-City Automobile Trade.
March 18-23—Cedar Rapids, Ia., Cedar Rapids Automobile Trades Assn.
April—Calumet, Mich., Show, Coliseum, Frank Ketchell, Mgr.

The AUTOMOBILE

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No. 26

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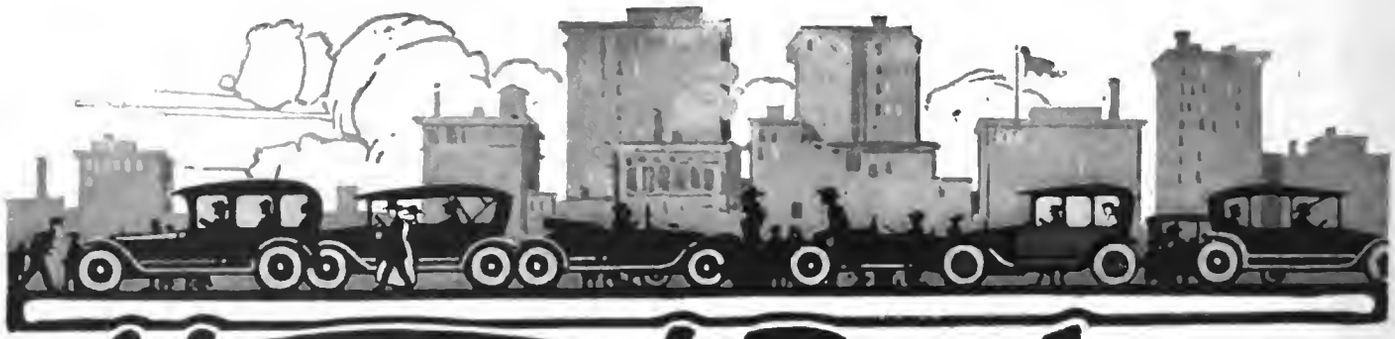

Stewart Products

$50

Warner
Auto-Meter

$25

Stewart
Speedometer

Progressive Dealers Know It Pays to Sell Leaders Only

Live dealers everywhere—men who do a big business and are making big money—know by experience that it pays to sell *Leaders Only*. They stock, sell and feature Stewart Products. The wide demand for Stewart Products is extremely significant to the wise dealer. It points out to him the unmistakable trend of public opinion—the tremendous demand for the best known and most widely advertised automobile accessories on the market.

The dealer who has achieved really big success does not waste his time, energy and money in trying to "put across" unknown accessories. He banks on a steady, consistent "turnover." He handles the one established line—the one that is universally accepted as standard. He carries a complete stock of Stewart Products.

Stewart Products offer you a steady source of income all year 'round—not only in Summer, but also in Winter, when you need it most. Determine right now to sell nothing but Leaders. Concentrate on, "boost," feature and sell Stewart Products—the fastest-selling and easiest-to-sell of all automobile accessories.

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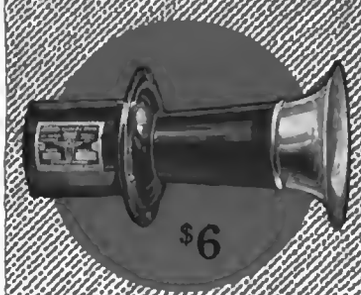
Chicago, U. S. A.



$6

Stewart
Motor Driven
Warning Signals

$3.50

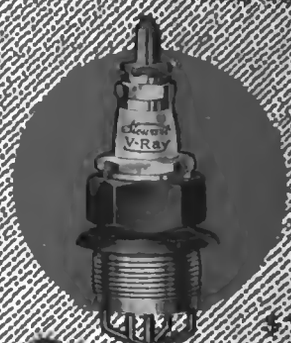
Stewart
Hood Ornament
Warning Signal

$10

Stewart Speedometer
Fly Leads

Stewart
PRODUCTS

PRESTIGE
QUALITY
SERVICE
SATISFACTION
MADE IN U.S.A.



$1

Stewart V-Ray
Spark Plug

$10

Stewart
Vacuum System

$12

Stewart
Fire Pump

The Automobile

Vol. XXXV New York—Thursday, December 28, 1916—Chicago No. 26

$1,900,000 for Buick Additions

Pres. Chrysler Receives Funds from General Motors Co. for Expansion

Flint, Mich., Dec. 27—The General Motors Co. has turned $1,900,000 over to W. P. Chrysler, president of the Buick Motor Co., to provide for expansion of the Buick manufacturing facilities, the method of investment being left to Mr. Chrysler's discretion. Plans for a new office building for the company to cost $225,000 are under way.

—

Lewis Goodyear Consulting Chemist

Boston, Dec. 26—Dr. Warren K. Lewis, professor of chemical engineering at the Massachusetts Institute of Technology, has been appointed consulting chemist for the Goodyear Tire & Rubber Co.

—

Form Britton Carburetor Mfg. Co.

Cleveland, Dec. 26—The Britton Carburetor Mfg. Co., this city, has been incorporated with a capital of $50,000, to manufacture carbureters. The incorporators are L. M. Diehl, A. C. Diehl, P. C. Jobes, C. F. Schultz and G. C. Middleton.

—

Dayton Wire Wheel Co. Formed

Dayton, Ohio, Dec. 26—The Dayton Wire Wheel Co., this city has been incorporated with a capital of $250,000, to manufacture wire wheels for automobiles. The incorporators are A. N. Wilcox, L. H. Roggs, L. W. James, J. B. Coolidge and B. D. Moore.

—

Bonus for Employees

Detroit, Dec. 26—The General Aluminum & Brass Mfg. Co. will pay a service bonus for the year ending Dec. 1, 1916, to all employees who are not stockholders. Under the plan adopted, employees who have been in the service of the company for 4 years or longer will receive 10 per cent of their wages for the year. Those with 3 years of service will receive 7½ per cent of their annual pay. Those with 2 years get 5 per cent. Those with 1 year's service secure 2½ per cent, and those with less than 1 year's service will receive one-half of 1 per cent.

—

Causan, French Engineer, Joins Chalmers

Detroit, Dec. 27—Nemorin Causan of the Paris branch has joined the engineering staff of the Chalmers Motor Co. Mr. Causan, who has been investigating automobile conditions in Detroit for the past 7 months, was formerly connected with Delage, Bayard-Clement and Panhard & Levassor and was the designer of several victorious French racing cars.

—

A New Scripps-Booth Four

Detroit, Dec. 27—In line with new models to be shown at the coming New York show will be the new four-cylinder Scripps-Booth, just announced. This car will be known as Model G and will have a 3 11/16 by 4-in. Brush design of overhead-valve engine. Other features will include a Zenith carbureter, Remy 6-volt lighting and starting, a cone clutch, 30 by 3½-in. wheels, semi-elliptic front springs with cantilever springs on the rear.

There will be two body types, a three-passenger roadster selling at $930, and a coupé at $1,450. Both will have wheelbases of 110 in.

—

Chamberlain Heads Packard Truck Sales

Detroit, Dec. 26—R. E. Chamberlain, truck sales manager of the Packard Motor Car Co. of New York, has been promoted to the position of truck sales manager of the Packard Motor Car Co. of Detroit.

India Bars Motor Imports

All Vehicles Using Gasoline Are Affected—Gasoline Shortage Is Acute

New York, Dec. 27—The gasoline shortage in India has become so serious that the government there has prohibited for an indefinite time the importation of automobiles, trucks, motorcycles, and all vehicles using gasoline, according to cable dispatches received by Dodge & Seymour, Ltd., export merchants of this city, handling the Ford and Hudson in British India and the Orient. According to the ruling no shipment will be permitted to enter India which has left the United States after Jan. 1, 1917. On top of this announcement comes a further increase of 1 cent in the price of gasoline for export.

India has been a good buyer of automobiles, averaging 400 to 500 a month. There are at present about 20,000 cars there. Automobiles coming into that country are taxed 7½ per cent.

—

Hayes Mfg. Capital $1,750,000

Detroit, Dec. 27—Hayes Mfg. Co. stockholders have voted to increase the capital of the company to $1,750,000. The plan calls for 75 per cent stock dividends. Common stock worth $625,000 will be placed on the market.

—

Muskegon Company Insures Employees

Muskegon, Mich., Dec. 26—The Muskegon Motor Specialties Co. for a Christmas gift gave its employees, numbering 300 men, insurance policies ranging from $500 to $1,000, depending on the length of service. The policies are effective as long as the men stay with the concern.

Hall Lamp Co. Buys Badger

Has Option on Brass Co., Maker of Solar Lamps—Late News By Wire

KENOSHA, WIS., Dec. 27—The C. M. Hall Lamp Co. of Detroit has an option for the purchase of the Badger Brass Mfg. Co., this city, and is completing details of the purchase this week. The Badger concern has been well known throughout the industry since its inception as manufacturer of Solar lamps.

Late News Over the Wire

DETROIT, Dec. 27—B. F. Kenyon, who has maintained a hangar in Muskegon, Mich., for the past year, will erect a factory there to make aeroplanes for government mail service.

Many large gasoline distributers in Detroit are suffering from a famine of gasoline because of freight congestion. Prices have advanced 2 to 3 cents, and many gasoline stations have shut down entirely.

The Dort Motor Car Co., Flint, gave each of its employees $600 toward an insurance fund for Christmas.

Business of the Ohio Electric Car Co., Toledo, was 40 per cent higher in December than last year, and the company is adding all the workers it can get.

G. E. Willis, Russian representative of the Studebaker Corp., returned this week from Petrograd.

Packard, Buick and Chevrolet plants are taking inventory and are closed until Jan. 2.

Reynolds, of Studebaker, Dead

DETROIT, Dec. 26—C. J. Reynolds, purchasing agent for the Studebaker Corp., died suddenly at his home last Sunday. Mr. Reynolds was connected with Studebaker for the past 30 years.

Falcon a Four-Wheel Drive

MEMPHIS, TENN., Dec. 23—Automobiles with a four-wheel drive will be manufactured in this city by the Falcon Motor Car Co., recently formed with a capital of $150,000 by local business men. The car will be assembled. The company is composed of J. G. Hamblett, E. E. Karlson, J. R. Manley, G. A. McGill and C. F. Kessler.

Peerless Tire & Rubber Co. Formed

GREEN BAY, WIS., Dec. 23—The Peerless Tire & Rubber Co., which has been incorporated here by F. E. Burrell, J. T. Jessen and A. W. Brown, all of Green Bay, who now are operating a factory in the Ohio rubber district. The company is capitalized at $50,000. It owns the molds and controls the output of the existing plant. The product is being marketed from Green Bay at this time and as soon as practicable it is planned to transfer manufacturing operations from Ohio to Wisconsin.

255,000 Cars Registered in Ohio

COLUMBUS, OHIO, Dec. 23—There are over 255,000 automobiles in Ohio, or more than double the number 2 years ago. It is predicted there will be over 300,000 next year.

300,000 1917 Registrations for N. J.

TRENTON, N. J., Dec. 23—It is estimated that 300,000 automobile licenses will be given in this state in 1917. Beginning Jan. 1, uniform drivers' licenses, costing $3, will be issued, and 3-week permits for beginners, heretofore free, will cost 50 cents.

115,645 Cars in Wisconsin

MILWAUKEE, Dec. 23—Wisconsin registration for 1916 numbers 115,645 cars. The final issue of 1916 licenses was made on Dec. 15, on which date the first applications for 1917 licenses were accepted. The total registration in 1915 was 79,791. showing that Wisconsin absorbed 35,854 cars during the present year. A. J. Cobban, in charge of motor registry in the office of the Secretary of State, estimates an issue of at least 150,000 licenses in 1917.

198,050 Cars in Iowa

DES MOINES, IOWA, Dec. 26—At the close of automobile registrations in Iowa for 1916 the total for the year stood at 198,050 with the total of fees collected at $1,854,501. The increase in the number of cars registered as compared with 1915 is 52,942 and the increase in fees collected is $321,448. A table showing the number of cars registered and the fees collected since 1911 follows:

1911	27,988	$259,736
1912	44,188	485,300
1913	70,068	646,468
1914	106,087	1,040,135
1915	145,109	1,533,053
1916	198,050	1,854,501

Luverne to Expand

LUVERNE, IND., Dec. 26—The Luverne Automobile Co., this city, is enlarging its operations, and in connection with such enlargement it is offering an issue of $50,000 6 per cent cumulative and participating preferred stock.

Shuger Resigns from Auburn

AUBURN, IND., Dec. 23—J. Frank Shuger has resigned as superintendent of the Auburn Automobile Co., after filling that office for 12 years. Mr. Shuger has announced no plans for the future.

Three More Price Increases

Hal, Briscoe and Regal Companies Add to List Prices for 1917 Models

CLEVELAND, Dec. 26—All models of the Hal twelve will be increased in price, effective Jan. 1, 1917. The touring and roadster models will increase from $2,385 to $2,600, the Springfield touring sedan from $3,250 to $3,500, and the Westchester limousine and brougham models from $4,250 to $4,500.

Briscoe Increases Price $60

DETROIT, Dec. 26—The Briscoe Motor Corp. has increased the price of the model 4-24 $60 to $685, effective Jan. 1.

Regal Price Raised $50

DETROIT, Dec. 27—The Regal Motor Car Co. has increased its car price $50, the old price being $695.

Duplex Acquires Plant Site

DETROIT, Dec. 21—The Duplex Motor Truck Co., of Lansing has purchased 15 acres of land on which work will immediately begin for the construction of a plant, 60 ft. by 800 ft. The plans are for a daily production of ten trucks. The new factory will employ 250 men. More than $50,000 worth of new machinery has been ordered which will be used to enlarge the plant that is to be moved from Charlotte.

Oregon Has Car to Every 25 People

PORTLAND, ORE., Dec. 23—The State of Oregon now houses one automobile for every group of twenty-five residents, as compared with one car for every thirty-three people a year ago.

The total registration for the 1916 series is 33,908. For the 1915 series there were only 23,585 cars, the gain for this year being more than 10,000 cars, or 44 per cent.

Day-Elder Motors Corp. Incorporates

NEWARK, N. J., Dec. 26—The Day-Elder Motors Corp., this city, maker of trucks, has incorporated for $1,000,000. The incorporators are C. P. Day, F. G. Elder, and Theo. McMarsh.

Working on Low Fuel Carbureter

DETROIT, Dec. 23—P. S. Tice, formerly chief engineer of the Holly Carbureter Co., is working with F. E. Watts, chief engineer of the Hupp company, developing a carburetion unit for low gravity fuel.

U. S. A. Cars Gain in Argentina

Cadillac Agent in Buenos Aires, Here for Show, Tells of Conditions

NEW YORK, Dec. 26—Albert Fehling of Fehling Bros., Buenos Aires, Argentina, who has been Cadillac agent in Argentina for 14 years, and who has handled the Jeffery line for the past year, arrived in this city Saturday for the purpose of visiting the automobile show as well as factories. Mr. Fehling advises that the demand for U. S. A. automobiles has increased. He is searching for town car bodies which previous to the war Buenos Aires dealers purchased in Europe. In Argentina, where Latin customs prevail, the sedan or coupé types are not in use at all. The business man and members of his family refuse to sit in the same compartment with the chauffeur. Consequently closed types are restricted to limousines and town cars, with a few landaulets. The majority of those using limousines and town cars prefer that passengers occupying the auxiliary seats face forward instead of backward. This seating arrangement calls for a slightly larger closed compartment than where the passengers on the auxiliary seats face the rear.

Mr. Fehling advises that the selling season in Argentina is now at its height and that owing to the very dry season roads throughout the country which are at best in an unimproved condition, have been better this year than in many seasons, a fact which has visibly accelerated the sale of cars. Unfortunately, owing to the dry weather, cable dispatches this week from Buenos Aires place the wheat crop of the country at 50 per cent that of a year ago. This should have a serious effect on the sale of cars unless prices are proportionately higher.

Wide Treads Essential

The sale of automobiles with 56-in. treads is practically limited to the city of Buenos Aires. In the country, or camp, owing to bad roads the 60 or 62-in. tread is imperative. He accounts for the greatly increased sale of several U. S. A. cars to the fact that they have wide treads and Mr. Fehling thinks it practically impossible to sell cars with 56-in. treads in the country districts. Several makes of U. S. A. cars at present in Argentina with 56-in. treads are not selling. The wide tread and 10-in. clearance are essential. Right-hand steering is also essential.

Mr. Fehling is of the opinion that owing to the great difference in price between touring bodies and closed bodies in U. S. A. that it will be necessary for Buenos Aires dealers to begin the manufacture of their own closed types. He states that previous to the war the difference in price between an open body and closed body built in Europe was only 50 per cent of the present difference between open and closed bodies in U. S. A. The greatly added cost of closed types will make it practically prohibitive for the Argentine dealer to import our closed style.

Owing to the winter season coming in the months of May, June, July and August in Argentina, the closed car business alternates with that in this country. This should make it favorable for the purchase of closed cars in New York. It would call for deliveries in Buenos Aires May 1, and for a month or 6 weeks thereafter. Owing to this difference in seasons, it would be possible for U. S. A. builders to seriously consider South American closed-car trade.

—

Ford Victor in Appeals

DETROIT, Dec. 23—The supreme court of Michigan denied the petition of John F. and Horace Dodge for the further extension of the injunction against the expenditure by Henry Ford of the accumulated cash dividends, and shortly afterward, yesterday afternoon, granted Mr. Ford's petition asking that he be permitted to continue the execution of the contracts for the River Rouge smelting plant on condition that he file a bond protecting Dodge Brothers from possible loss.

—

Ford Appeals to High Court

DETROIT, Dec. 21—Henry Ford's attorneys will file petitions with the supreme court at Lansing which will bring the injunction issued in favor of Dodge Bros., in their suit against Ford, before the highest court in the State for review.

—

Ford Wins Windshield Case

NEW YORK, Dec. 23—The Ford Motor Co. has won a decision against the Stahlbrodt Co., Rochester, N. Y., holder of a patent purporting to cover a certain type of windshield commonly known as the "zig-zag windshield," in the United States circuit court of appeals for the second district, in this city.

The decision reverses a prior ruling of a lower court. The shield in question is that in which the lower half inclines rearwardly while the upper half is vertical. It is no longer used on the Ford.

—

Reo Working Force Is 5000

LANSING, MICH., Dec. 27—The Reo Motor Car Co. working force now numbers 5000, 1500 more men being employed than in the summer of 1915. The company is shipping 100 cars a day on flat cars because of freight congestion.

P. O. Fraud Order Against I. A. L.

—

Supplemental Order to That of Aug. 2 Bars League Men from Mails

WASHINGTON, Dec. 23—The Postoffice department has issued a fraud order against the International Automobile League, the International Automobile League, Inc., and A. C. Bidwell, president, in the form of a supplemental order to that issued Aug. 2, 1916, under which latter order the Postmaster of Buffalo is instructed not to deliver to 637 Main Street, that city, any mail addressed as above except mail under the frank of a member of Congress or mail matter not under seal. The order also covers the payment of money orders addressed to the above.

In issuing the order the Solicitor of the Department suggests that the names against the fraud order is issued seem to have been adopted by Bidwell for the sole purpose of avoiding the effect of the fraud orders issued against his business last Aug. 2. The order also states that Bidwell has been sending out postcards under the new name as a result of which he seeks to collect alleged past dues for membership in the organization.

—

Disco Corporation Plans Expansion

DETROIT, Dec. 26—The Disco Electric Starter Corp. will occupy a new building in January and plans to produce starters on a vast scale, the 1917 output being practically sold at this time.

—

Disco Creditors Meet

DETROIT, Dec. 23—Creditors of the Disco company had their final meeting before the United States court, here, yesterday to receive the last report of the Security Trust Co., trustee. Within the next 30 days, the trust company will distribute the remaining assets in a payment of about 2 per cent. This combined with the two earlier payments of 10 per cent and 12½ per cent will give the creditors about 25 cents on the dollar.

—

Parker Rust-Proof Factory at Flint

FLINT, MICH., Dec. 26—The Parker Rust-Proof Co. of Detroit will build a branch factory in this city. The company plans to erect twenty-five branch plants in the leading metal cities of the United States.

—

Western Motor Appliance Moves

DETROIT, Dec. 26—The Western Motor Appliance Co. of Charles City, Iowa, will move its plant to Alma, Mich.

Sweden Has Only 9000 Cars

Fisk Tire Representative from Stockholm Says Poor Roads Hamper Car Sales

NEW YORK, Dec. 26—Sweden will be represented at the New York automobile show by at least one, and perhaps by several automobile and accessory dealers. Hans Osterman of Stockholm, who has sold Minerva cars for 6 years, has been in this country some weeks and will remain until the close of the show circuit. In addition to selling the Minerva in all Sweden since 1908, he has handled a line of tires and accessories, being at present Swedish representative for Fisk tires.

Although Sweden is a little larger in area than Germany, it has a population of only 6,000,000, approximately the same as Australia, and just a little more than half as large as Canada or Argentina. Mr. Osterman estimates that in all Sweden there are approximately 9000 cars, of which number 3000 are in the city of Stockholm. This city has 350,000 population.

At present many of the cheaper makes of U. S. A. cars are represented in Stockholm, and have been sold for years. The bad condition of roads has held back considerably the sale of cars, which has largely been confined to the cities. Up to the present the farming community has not purchased cars and it is doubtful if the farmers will ever be a purchasing factor as in this country. In Sweden farms are smaller.

Centers at Stockholm

The automobile industry of Sweden largely centers in Stockholm where there are thirty dealers, eight of whom are important, and maintain salesrooms similar to those in any American city of corresponding population. Stockholm has not its automobile row as in many of our American cities, but the dealers are now locating in the best quarter of the city. In addition to these dealers there are perhaps fifty garages, some of which have capacity for sixty cars. In the large garages each car is kept in a separate stall as in South American cities. Practically all of the cars in Stockholm are driven by chauffeurs, but the simplifying of cars by electric starters, electric lighting, etc., is already having its influence and private owners and women are taking up driving.

The average car owner in Stockholm has one chassis and two bodies, a summer body and a winter body. The winters in Stockholm are much the same as in New York, but further north the weather gets very cold and in the most northerly points there is winter for several months of the year. In Stockholm are six good body builders who handle much of the closed car trade. Bodies are, however, more expensive than those that were procured from Belgium, France and England previous to the war.

As with all European countries, Sweden has suffered greatly because of the war. Her chief difficulty has been in securing pneumatic tires and tubes which have all had to come through London. As a result of the tire restrictions over one-half of the taxicabs are out of commission and a good percentage of private cars are in storage. Many cars have been operated for several months with the worn-out casings filled with rags. It is expected that for 1917 tire restrictions will be somewhat relieved.

Since the war U. S. A. cars have been about the only ones reaching Sweden. To these might be added a very few German machines. At present ten different makes of U. S. A. cars are entering the country.

Sweden exists practically as a consumer market for automobiles, her status as an automobile manufacturing country being limited to two makes of Swedish cars. One of these is manufactured in quantities of approximately 300 per year. It is made in two models selling at approximately $2,500 and $3,500 each. The car is known as the Scania Vabis. It is manufactured almost entirely in the factory. The other manufacturer produces motor trucks in very small quantities.

Mechanics Plentiful

The automobile industry in Sweden is blessed with plenty of good mechanics. The Swedes are mechanically inclined, and the fact that much good machinery is manufactured in the country has had its influence on developing the mechanical phase of the people.

The importation of cars into Sweden is not seriously hampered by prohibitive custom duties. Automobiles are assessed 15 per cent on the value at the port of entry. This includes freight which at present amounts to $500 to $600 per car.

Tires are taxed at the rate of approximately 35 cents per kilo weight. A kilo is 2 1/5 lb.

There are various custom schedules for accessories: For example, magnetos are assessed 15 per cent of their value. On brass lamps the rate is 12 cents per kilo; on lamps with a nickel finish 20 cents per kilo; and on brass lamps which are enameled 20 cents per kilo. These figures are sufficient to show the general scope of custom duties.

Fine Touring Country

As a country for the use of automobiles Sweden is best described as being hilly, and consequently favored with fine natural beauty attractive to the motorist. The country is well served with macadam roads which wind and twist through the mountain districts as well as the agricultural sections. It is possible to go north from Stockholm approximately 600 miles on good roads. Very satisfactory hotels are found through the entire country. It is possible on a day's drive to average 25 m.p.h. for much of the time. This means hard driving. Up to the present the speed law has been 10 m.p.h., but beginning with Jan. 1, 1917, the legal limit has been raised to 25. It costs approximately $9 to register an automobile in Sweden. This is not an annual registration, but a continuous one, the registration going with the car and not the owner.

Continental Service Stations

To Help Users of Its Engines With Service in Principal Cities

DETROIT, Dec. 27 — The Continental Motors Co., this city and Muskegon, will establish service stations in all of the principal cities in the United States. The company has closed large contracts in both New York and California for the first of the service stations. While the details have not been disclosed, an official of the company states that the plan includes not only the policy of serving the owner but also the manufacturer in solving his service problems.

A special meeting of the stockholders of the company will be held Dec. 30 for the purpose of acting upon the proposal to sell the assets, business and good-will of the company to the new proposed corporation to be formed under the reorganization plan.

Jennings Becomes Advertising Mgr.

BOUND BROOK, N. J., Dec. 22—W. F. Jennings has become eastern sales and advertising manager of the Bound Brook Oil-less Bearing Co., this city. He has been connected with this company for nearly 3 years.

Latour with Chalmers Advertising

DETROIT, Dec. 27—J. F. A. Latour has joined the advertising staff of the Chalmers Motor Co. Mr. Latour was formerly connected with *The Evening Ledger* of Philadelphia.

Collins Joins Harroun Staff

DETROIT, Dec. 26—J. F. Collins has joined the staff of the Harroun Motors Corp. Mr. Collins was formerly the cost and system expert for the Cadillac company.

Ask Forfeiture of Charter

State Authorities File Suit Against All-Steel Co. After Investigation

ST. LOUIS, MO., Dec. 23—The State Attorney General's Department yesterday filed suit in the Circuit Court at Macon, Mo., to forfeit the charter of the All-Steel Motor Car Co. This action was taken after an investigation of A. L. McCawley, head of the corporation department of the office of the Secretary of State. This company recently has been conducting an energetic stock selling campaign here, much of their advertising being done under the name of the Macon Motor Car Co., which name it was explained that the company would take at its annual meeting.

The night before the suit, McCawley met and addressed a mass meeting of those who recently have bought stock and explained that they could reorganize under the name they wished and that the suit would not impair the value of the assets. The suit, he said, was necessary because of irregularities in the actions of the All-Steel Motor Car Co. affairs. He charged that:

Patents of Doubtful Value

The All-Steel company, when organized for $400,000 capital, half paid in, had filed a statement that $5,000 of this was cash and $195,000 in value of patents on a combined body and chassis and device for transmitting power to wheels. He said the company never had $5,000 and the patents had lapsed and were of doubtful value.

The company, he said, removed from St. Louis to Macon without notice.

The change of the record to show 40,000 shares of $10 each instead of 4000 at $100 each, he said, was without notice to his office.

That no explanation had been made of the return of $100,000 worth of stock by C. L. Smith, the inventor, had never been explained.

After hearing these charges and receiving assurance that the present stockholders could retain the real estate, worth including a former buggy factory building, $275,000, practically a present from the citizens of Macon, and that the money already advanced for parts of cars to be assembled for next season's selling, the stockholders voted to reorganize at once.

The present officers of the company are Macon business men, who practically took over the All-Steel company when they believed that it was going to collapse. They have provided the present assets in an endeavor to build up an industry for the town to take the place of the buggy factory. A stock selling office has been maintained at 707 Olive Street, this city, for several weeks and a car of the type that is to be assembled at the plant is on display there. How many of the 40,000 shares at $10 each have been sold is not made public but the end of the campaign is not yet. It is said that later an effort will be made to sell stock to the value of $1,000,000. The company has been making purchases of assembly plant material and of some parts here within the last few weeks and is reported to have paid cash on such purchases.

The present officers and promoters have made no pretense that they expected to use the Smith patents, asserting that the departure for a combined body and chassis and for transmission of power to wheels was too radical an innovation for them to undertake. C. L. Smith, who promoted the all-steel patents, participated in the stockholders' meeting.

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Morron Succeeds Meyer

NEW YORK, Dec. 22—J. R. Morron has been elected a director and member of the executive committee of the Maxwell Motor Co., Detroit, to fill the vacancy caused by the resignation of Eugene Meyer, Jr.

J. C. Brady was elected chairman of the board, and of the executive committee in the place of J. C. Jay, Jr. Mr. Jay will continue as a director of the company, and has been elected a vice-president.

Mr. Morron is president and a director of the Atlas Portland Cement Co., and is also a director in the following companies: Baltimore & Ohio Railroad, Chicago, Great Western Railroad, Guarantee Trust Co., the American Surety Co., and the National Bank of the Republic of Chicago.

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Steele Succeeds Barber

MOLINE, ILL., Dec. 23—M. A. Steele has become sales manager of the automobile department of the Moline Plow Co., maker of the Stephens car. He succeeds A. C. Barber. Mr. Steele has been connected with the company for several years. He was formerly manager of the Stephens Six factory, where he is succeeded by H. J. Leonard, who assisted him.

B. F. Durham has become associated with the company as assistant sales manager.

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Williams Goes to Antipodes

DETROIT, Dec. 23—E. F. Williams, special foreign representative for Dodge Brothers, will leave shortly for Manila, Australia and New Zealand.

$170,000,000 in Overlands

Dealers Contract for Cars to That Value—Co. Has Abundant Material

TOLEDO, Dec. 22—The final group of Willys-Overland dealers to visit that company's factory during the convention added approximately $10,000,000 worth of contracts for cars, bringing the total value of cars ordered during the convention up to $170,000,000. The company built 96,000 cars in the first 6 months of 1916.

John N. Willys, president of the concern, addressed the guests and stated that the shipping facilities of Toledo would be a boon to the company in 1917 and that the company has $30,000,000 worth of raw material on hand, including more aluminum than any other manufacturing concern in the world. A silver loving cup was given to Mr. Willys by Mayor Joseph Bell of Indianapolis as a token from the Gibson Raiders, the salesmen from Indiana and Illinois.

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Gardner, of Chevrolet, to Retire

ST. LOUIS, MO., Dec. 23—Russell E. Gardner, president of the Chevrolet Motor Co. of St. Louis, a manufacturing branch of the larger Chevrolet company, will retire from business after the first of the year. He will turn his large plant over to his sons, R. E. Gardner, Jr., and Fred Gardner. Mr. Gardner, who is rated at several millions, came to St. Louis from Tennessee 37 years ago without means. He began at the bottom in the buggy business and later acquired complete ownership of the Banner Buggy Co. and as the business began to fail he absorbed several other plants. It was this equipment that he made the basis of the organization of the Chevrolet Motor Co. of St. Louis.

—

D. A. C. Honors Hugh Chalmers

DETROIT, Dec. 22—A banquet was held last night by directors of the Detroit Automobile Club as a token of friendship and mark of gratitude for the work of Hugh Chalmers as director of the organization. Mr. Chalmers will retire from the presidency of the D. A. C. on Jan. 1.

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Christiansen Goes to Detroit

NEW HAVEN, CONN., Dec. 22—E. S. Christiansen will become manager of the Detroit office of the United Smelting & Aluminum Co., this city. He was formerly purchasing agent. W. T. Schmitt, formerly of the Bosch Magneto Co., has been appointed assistant manager at the Detroit office.

56,539 Fords in October

Schedule for 1917 Calls for 750,000—Average Selling Price $400

DETROIT, Dec. 23—The Ford Motor Co. produced 56,539 cars in October, which is almost equal to the highest month, March, in which 58,394 cars were made. The scheduled output for the current fiscal year is 750,000 cars, as against actual production of 523,920 in the 1916 year and 308,213 in the 1915 year.

The average selling price of the Ford product for the past year was a trifle over $400, gross business amounting to $206,867,000 and cars sold totaling 508,000. With the present $80 reduction on Ford cars, the total gross business for the current fiscal year should be approximately $240,000,000.

Ford Plant Closes for Week

DETROIT, Dec. 21—The Ford Motor Co. will close its plant for the entire week between Dec. 22 and Jan. 3 to aid the railroads to move food and fuel shipments.

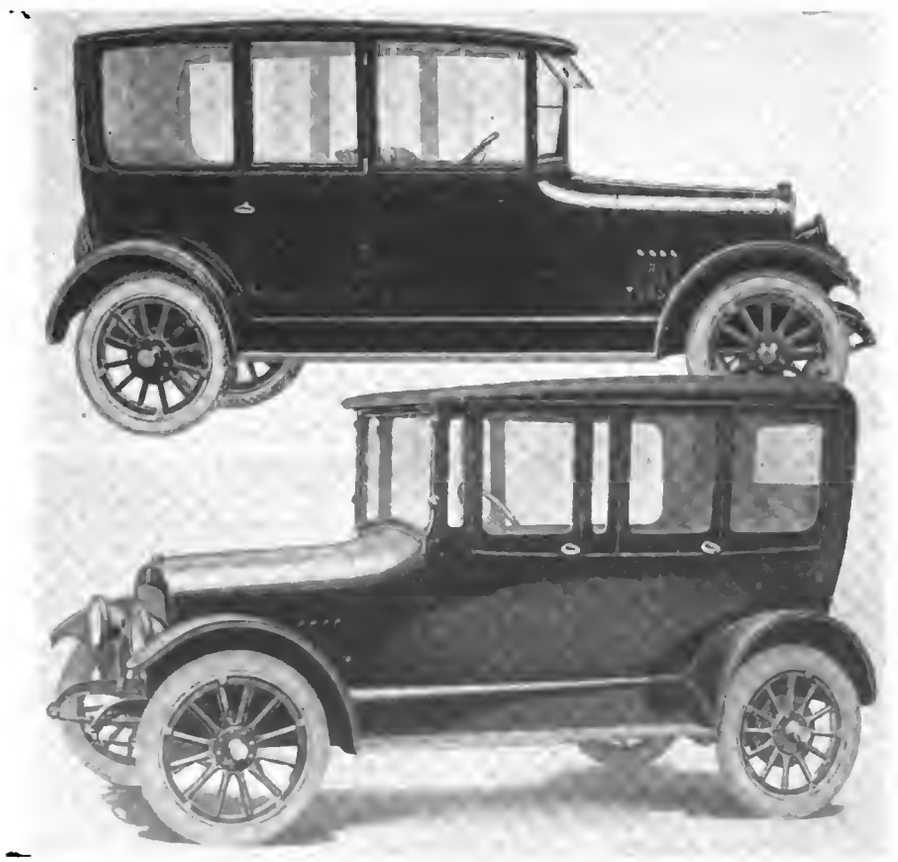
F. L. Klingensmith, vice-president of the company states that the officials of the concern do not believe it to be right for the company to use railroads for shipment of cars when the various communities are threatened by famine because of railroad congestion. The suspension means a production loss of 175,000 cars for the week and affects 42,000 workers who will suffer a wage loss of $200,000 a day or $1,400,000 for the week.

The plant will also allow the steel mills which are now far behind on orders to catch up to some extent.

No work will be done during the suspension and no cars will be shipped or coal used except as is necessary to keep the plant just above the freezing point. An attempt will be made later to catch up in production though no plans have been formulated as yet. Officials of the company state that there is plenty of material on hand, that cars are being sold more quickly than they can be made and that the reason for closing is purely a humane one.

Holland Joins Myers Machine

SHEBOYGAN, WIS., Dec. 23—H. F. Holland, Indianapolis, Ind., has been appointed sales manager of the motor truck division of the Myers Machine Co., Sheboygan, Wis., to succeed L. P. Helm, resigned. The Myers company absorbed the Wisconsin Motor Truck Co., Baraboo, Wis., early this year, purchasing the interests of Mr. Helm, who joined the Myers company as manager of the truck department.



Above—Dort five-passenger sedan selling for $1,065. Below—Sedanet listed at $815

Pontiac Tractor Co. Formed

Hubbard, Welsh and Wright Behind Co.—To Sell at $750

DETROIT, Dec. 21—The Pontiac Tractor Co. has been incorporated for $42,000 in this state and will take over the Wright Mfg. Co. plant at Pontiac for the manufacture of a tractor to sell at $750. The officials of the new concern will include M. D. Hubbard, of the Hubbard Spring Co.; Fred S. Welsh, who was at one time connected with the Welsh Motor Car Co., which is no longer in existence, and N. A. Wright, of the Wright Mfg. Co. The tractor has been tried out during the past year and was found to be successful, according to officers of the concern. It is constructed with a steel frame, and a single-cylinder oil-burning engine of 30 to 35 hp. The complete tractor weighs 4200 lb. The company plans to produce from three to five tractors per day.

Four Dort Models for 1917

FLINT, MICH., Dec. 23—The Dort Motor Car Co., this city, is now manufacturing four models, a five-passenger sedan at $1,065, a sedanet with a permanent top but detachable if required at $815, a five-passenger touring car at $695, and the Fleur-de-lys three passenger roadster at $695. All these models are on the same chassis. The sedan, however, carries 31 by 4 tires instead of 30 by 3½, the standard size for all the other models.

Scofield Is Drexel Sales Manager

DETROIT, Dec. 26—H. H. Scofield has joined the Drexel Motor Car Co. as director of sales. He has been connected with the Acme White Lead and Color Works, this city, the Studebaker Corp., General Motors Co. and the Paige-Detroit Motor Car Co. He will have full charge of sales and supervision over advertising and service.

Pearce Elected President

ASHTABULA, OHIO, Dec. 22—A. E. Pearce has been elected president of the Pearce Tire & Rubber Co., succeeding J. L. Smith, resigned. H. J. Atwood was elected secretary-treasurer in place of P. C. Remick, resigned. The following directors remain on the board: A. E. Pearce, H. J. Atwood, J. L. Smith and F. L. Kerr. A. W. Green resigned from the board.

Victor Buys Jenkintown Factory

PHILADELPHIA, Dec. 23—The Victor Motor Co., this city, has purchased the property of the Jenkintown Switch and

Signal Co., north of Philadelphia, where it is planned to make the Victor four. The property includes 25 acres of land and nine buildings owned by the former concern. The cost of the property is $92,000 to be paid within a year. The location previously selected at Grubbs Landing, Del., has been abandoned. C. V. Stahl, vice-president of the company and inventor of the Victor engine, said the company has an order for 5000 cars as soon as completed, out of which fifty are to be shipped to a firm in Norway.

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Economy and Bellefontaine Merge

BELLEFONTAINE, OHIO, Dec. 22—The Economy Motor Car Co., of Tiffin, Ohio, and the Bellefontaine Automobile Co., of Bellefontaine, plan to merge and will locate their combined factory in this city.

—

Blagden American Malleables President

LANCASTER, N. Y., Dec. 22—A. S. Blagden has been elected president of the American Malleables Co., this city, succeeding W. G. Pearce, who has been made chairman of the board. This company specializes in malleable iron automobile castings.

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Langerbacher With Duplex Truck

DETROIT, Dec. 21—Andrew Langerbacher has become sales manager of the Duplex Truck Co., of Lansing. Mr. Langerbacher was formerly with the sales organization of the Reo Motor Car Co.

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Gerlinger Builds Six-Cylinder Truck

TACOMA, WASH., Dec. 23—The Gerlinger Motor Car Co., this city, is building a ton and a half, six-cylinder, self-starting and electric-lighted truck that will be ready for delivery Feb. 1, 1917.

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Detroiter Convertible Coupé and Sedan

DETROIT, Dec. 26—The Detroiter Motor Car Co., this city, has brought out a convertible coupé and sedan, selling at $1,398 and $1,373, respectively.

Paterson Chummy Roadster

New Model Added to Line—Bodies Improved for 1917—Few Changes

FLINT, MICH., Dec. 19—The W. A. Paterson Co. is continuing its six-cylinder chassis without change for 1917. In addition to the touring body, however, a chummy roadster has been added and a number of refinements are incorporated in both.

The movements in the 1917 touring car are principally in the way of providing more room in the body. The lines are longer and wider, giving a greater amount of room. The front seat is 41 in. wide by 18 in. deep. The rear seat is 48 in. wide by 20 in. deep. This is about 5 per cent increase in seating area.

Four passengers are seated in the new roadster, which is on the same chassis of 117 in. wheelbase. The two front seats in the roadster are 17 in. wide by 16¾ in. deep and the rear seat is 36 in. wide by 16¾ in. deep. This is a clover-leaf layout.

The Paterson chassis has a six-cylinder Continental engine, Delco electrical equipment, Willard battery, Stewart vacuum feed, Stromberg carbureter, Goodrich tires, and one-man top.

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Pfeffer Returns from Cuba

DETROIT, Dec. 21—C. A. Pfeffer, formerly vice-president and assistant general manager of the Chalmers Motor Co. has returned from his visit to Cuba.

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Spohn Leaves Class Journal to Join U. S. Ball Bearing Co.

CHICAGO, Dec. 26—Howard L. Spohn, for the past 8 years with the Class Journal Co., has become commercial manager of the U. S. Ball Bearing Co. of this city Jan. 1. The entrance of Mr. Spohn into this corporation in no wise infers any changes in the organization but is due to anticipated enlargement of manufacturing facilities and the acquiring of additional allied interests.

Walter H. Strom remains as secretary and general manager with an augmented factory organization including S. W. Brandel, factory manager; M. Zelinski, superintendent in charge of production; H. N. Corsline, shop engineer in charge of inspection; W. E. Hutchinson, purchasing manager, and A. L. Moyel, office manager. E. B. Fleisch continues as sales manager, with K. I. Fosdick remaining as western representative.

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Chandler Increases Wages 10 Per Cent

CLEVELAND, Dec. 23—The Chandler Motor Car Co., this city, has increased its wages 10 per cent, affecting all of its employees working on an hourly wage basis. A liberal bonus is given in addition, effective Jan. 2. On July 20, the men employed on an hourly wage basis who are on the company's payroll July 1, will be paid a 10 per cent bonus on the entire wages paid during the year, July 16, 1916 to June 30, 1917.

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To Talk on Headlight Situation

NEW YORK, Dec. 27—The Illuminating Engineering Society will hold a meeting on the evening of Jan. 10 in the Engineering Building, 29 West Thirty-ninth Street, which will be devoted to the subject of automobile headlights.

A paper is to be presented by W. F. Little of the Electrical Testing Laboratories entitled "A Survey of the Automobile Headlight Situation." This paper will present a symposium of the opinions of various men in the lighting and automobile engineering fields in an attempt to arrive at a consensus as to the requirements. The paper will then describe various headlights upon the market, and in connection with these a demonstration will be made of the lamps in general use, together with several types which have not as yet been placed upon the market.

Following the presentation of this paper it is planned to hold a symposium of engineers, legislative authorities, police officials, etc., in an attempt to secure a good discussion of the headlight problem from a number of different viewpoints.

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Charter Oak in New Britain

HARTFORD, CONN., Dec. 23—Temporary factory quarters for the newly formed Eastern Motors, Inc., Hartford, makers of the Charter Oak car, have been secured in New Britain, 10 miles from Hartford and the home of the Corbin. At the offices of the concern it is said that Hartford is to be the ultimate location of the business.

Paterson four-passenger chummy roadster added to the line for 1917

Paige Production Expands

Company Installs Conveyors—Increases Floorspace of Factory—Adds Stockroom

DETROIT, Dec. 23—Many changes for the purpose of increasing production have been made in the Paige-Detroit factory in the past year. Particular effort has been expended toward securing the most modern mechanical improvements, and the company has equipped the plant with every efficient device, besides erecting a new structure 60 by 300 ft. and four stories high which is used entirely as a stockroom. The new building is so arranged that one side of the first floor is convenient for delivery by wagon or truck, while the other side opens directly upon the railroad tracks, allowing freight cars to empty into it. The third and fourth floors feed to the structure adjoining, allowing the stock to be efficiently handled on its journey from the stockrooms to the machine shops and assembly departments. The recently added building gives the company more than 500,000 sq. ft. of floorspace, an increase of 40 per cent as compared with space available in 1915.

The assembly work has been arranged upon the progressive plan, and includes several unique features. The building in which machine and assembly work is done is 60 by 600 ft. The third floor is used for the painting and assembling of frames and wheels. The frames enter the room, receive the necessary rivets, and are placed upon a cable conveyor which carries them to a huge tank where they are cleaned with gasoline and given the first coat of paint. From here they travel on the conveyor to the ovens, where they remain for 110 min. and finally emerge dried and ready for the second coat and succeeding oven. Each frame receives three coats of paint, applied by the spraying method, before it is ready for the wheels, which have been assembled on the same floor and include the rims, tires and tubes. A chute at the end of the structure is used to convey the frame to the floor above, where it is placed on a conveyor and travels the entire length of the building, constantly receiving the various parts it needs until it becomes the finished car, ready for final inspection. The conveyor on this floor consists of a double-track system, one for the little six and the other for the big six, and is unique in its construction, as the return cable lies directly under the pulling cable, allowing more floor space for additional work. The tracks run through the center of the room, and stock booths are arranged on each wall so that the workmen may feed the stock, easily and with few steps, directly to the chassis.

Other floors in this building are used for special paint, equipment and winter top departments, and the entire first floor is devoted to machine work, block testing and adjustment of engines. The block test room is 125 ft. long, and here the engines may be seen hanging from a powerful overhead cable conveyor which carries them in and out of the room for the test. An average of 150 engines are tested daily.

The Paige-Detroit Motor Car Co. employs 900 men now, as against 600 men in 1915. It is doing a business of $2,000,000 a month, as compared with $1,000,000 in 1915. The output this year has been more than 14,000 cars, and plans are being made to increase the production to 20,000 in 1917.

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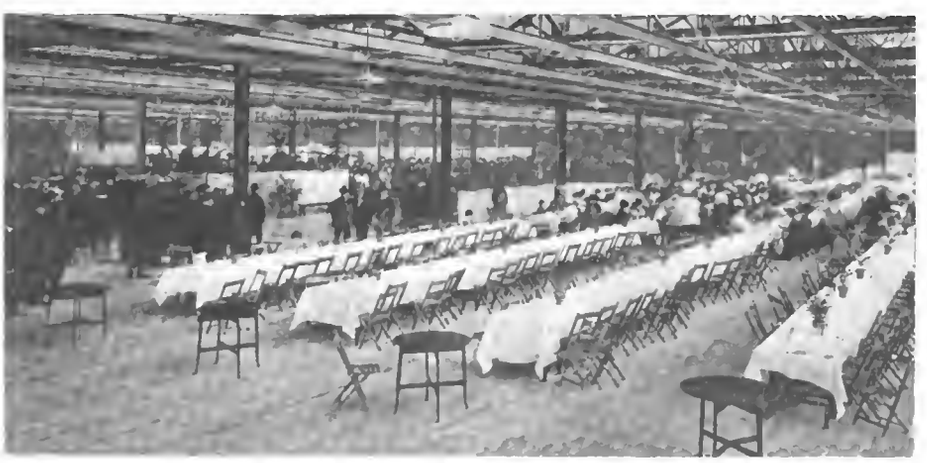
Fergus Moves Offices to Newark

NEW YORK, Dec. 22—The Fergus Motors of America has moved its local office at 80 Maiden Lane to Newark, N. J., at 370 Jelliff Avenue.



One of the rooms where the White Motor Co. of Cleveland entertained 6000 persons at luncheon during the dedication of the new manufacturing building of the company last week. While part of the throng were served at luncheon hundreds of others were entertained by Highlanders and by a band of forty pieces and stringed orchestra of twenty pieces, both of which are composed of men in the White plant

N. S. W. Shipments Not Economical

American Makers Should Send Cars Direct to Retailer in Australia

SYDNEY, AUSTRALIA, Nov. 22—The future of automobile sales of American cars in Australia was the major subject of discussion at the annual dinner of the Motor Traders' Assn. of New South Wales last night. The consensus of opinion is that U. S. A. manufacturers are not giving enough attention to shipment of automobiles and the general business in connection with automobile export trade to hold an even scale against European concerns who have given immeasurably more attention to this subject. There was an expected difference of opinion on this subject but the majority of the speakers were of the opinion that Americans do not do their shipping in so economical a way as the British manufacturer.

Practically all of the speakers were displeased with the method of American automobile and accessory manufacturers handling the Australian trade through indent or clearing houses instead of dealing direct with the Australian dealer. It is necessary to pay these indent houses a commission as they are rarely retailers and do not give any assistance to the retailer. They simply control the importation of the article, and collect the middle man's profit without giving any benefit. The disadvantage is that the retailer has his profit cut proportionately. European houses do not follow this plan but deal direct.

Many members of the Motor Traders' Association have visited England recently, within the last few months and have returned with the opinion that British manufacturers are already organizing for the production of standardized motor cars, which will be taken up immediately war hostilities cease. It is not thought that these British makers anticipate competing with Ford but rather that they will be prepared to compete in a price field with the majority of U. S. A. cars selling above the Ford list.

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First Harroun Building Foundation In

DETROIT, Dec. 22—The foundation of the first unit of the Harroun buildings, at Wayne, was finished Wednesday. The structure will house the assembly units and will be 75 by 540 ft. when completed. The power plant will be started in course of erection within the next 2 weeks.

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Penn Counties Truck Buys Land

PHILADELPHIA, Dec. 22—The Penn Counties Motor Truck Co., supported by

New York financiers, has purchased a tract of land along the Central Railroad of New Jersey at Allentown, Pa. The work of erecting a plant has already been started. Martin E. Kern, one of the organizers of the International Motor Car Co., is vice-president of the new enterprise which is capitalized at $500,000. Trucks of ½ to 2-ton capacity will be made. The company plans to turn out 2000 trucks complete within the coming year.

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Hoelzle, of Parker Rust-Proof, Promoted

DETROIT, Dec. 22—E. C. Hoelzle, who has been the assistant to the general manager, has been elected assistant treasurer of the Parker Rust-Proof Co. of America.

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Cornelius Promoted by Rust Proof

DETROIT, Dec. 21—W. M. Cornelius has been elected assistant secretary of the Parker Rust Proof Co. of America. Mr. Cornelius has been assistant to the president of the company.

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Core Springfield Body Advertising Mgr.

NEW YORK, Dec. 22—Guy Core has resigned as advertising manager of the Sparks-Withington Co., Jackson, Mich., to take a similar position with the Springfield Body Co.

$1,250,000 Addition in Beloit

Concerns Allied with Automobile Industry Responsible for Bulk of Expansion

BELOIT, WIS., Dec. 23—More than $1,250,000 has been expended in Beloit, during 1916 by industrial concerns for extensions to works, and the bulk of the improvements are attributable to the heavy demands of the gas engine, automobile, accessory, garage equipment and allied interests, according to the annual report of the Beloit Commercial Club, now on the press.

The Stewart-Warner Speedometer Corp. is expending $200,000, providing for 400 more workmen, and adding 81,864 sq. ft. Fairbanks, Morse & Co. added 181,208 sq. ft., provided for 1200 to 1500 more men, and spent $500,000. Other large interests included in the figures are the Lipman Mfg. Co., compressors, garage pumps, etc.; Gardner Machine Co. and Chas. H. Besley & Co., disk and other grinders for metal-working shops, and P. B. Yates Machine Co.

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Ford Plans Plant for Belfast

DETROIT, Dec. 26—Reports from Belfast, Ireland, state that Henry Ford is seeking a site for a factory to cost $1,000,000 and to employ 2,000 men. F. L. Klingensmith, vice-president of the Ford Motor Co., states that he has heard nothing of the proposed Belfast plant, but that the project is in the hands of the Ford Co. in England. The English Ford company will operate with British capital and directors by paying the Ford Motor Co. royalties on patents. Plans have been completed for factories in Manchester and Southampton.

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Columbia Starting Production

DETROIT, Dec. 22—The Columbia Motor Co. will occupy its new Detroit quarters on January 1 and will immediately begin production.

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New Men at Grant Plant

CLEVELAND, Dec. 21—F. F. Wood has been appointed as assistant sales manager of the Grant Motor Car Corp. Mr. Wood was formerly with the Ford Motor Co. at the Akron branch. J. B. Bray, who was formerly with the Curtis Airplane Co., has been made the service manager of the Grant company.

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Bassett With Buick Company

DETROIT, Dec. 21—Harry H. Bassett has been appointed assistant general manager of the Buick Motor Co., of Flint. Mr. Bassett was formerly general manager of the Weston-Mott Co.

Above are portrayed only a part of the 8000 persons in attendance at a dance given by the White Motor Co. of Cleveland as a feature of the factory house warming in the new manufacturing building, which is 240 by 304 ft. Between dances the guests were shown motion pictures of the factory's products in unusual form of service as well as current feature films. Cabarets were also held

Northwest Conditions Favorable

Though Car Shortage Is Felt, Business Improves and Bank Deposits Grow

MINNEAPOLIS, Dec. 23—General conditions throughout the Northwest are favorable in spite of the reduced wheat crop, railroad car shortage and higher prices of coal. According to the Northwestern National Banks' Review of November conditions, general business is improving, bank deposits are growing and collections are good. Those sections which suffered most from disappointing harvests are not complaining. Even in these districts bank deposits are a little ahead of a year ago. Bank deposits are generally 25 per cent ahead of a year ago.

Car shortage, evidenced at Minneapolis is more serious this year than formerly, and is having an influence on those industries handicapped by lack of cars, and although a larger general business than ever before is being conducted the rolling stock has not been materially added.

A commendable action of one of the railroads is noted in the daily press, that of the tender of the use of its ore cars from certain mining regions in the Northwest to relieve the demand in another section.

Agricultural districts in this territory are not being greatly affected by the car shortage. Some bankers report no particular trouble, though others note some inconvenience. Shippers of hay and potatoes in west central Minnesota are experiencing difficulty in moving their produce. Western North Dakota is finding an insufficiency of cars for its wheat consignments that is surprising considering the crop shortage. It is believed that a considerably larger percentage of wheat was held over from last year in that section than was counted upon. Lumbering interests and loggers in northeastern Minnesota are feeling the car shortage, and it also exists at the head of the lakes. The extensive mining districts of our territory are experiencing no great difficulty. The copper district in northern Michigan is reported as being practically free from the shortage. Grain receipts here are lower than a year ago. The daily average for this market for September, October and November of 1916 is about 945,000 bushels; for the same period last year the daily average was 1,218,000 bushels, and in 1914 and 1913 the averages were 934,168 bushels and 827,761 bushels respectively. Our terminal elevators are filled to about three-fourths their capacity and grain is arriving at the rate of about 900,000 bushels per day. The flour mills are feeling the effect of the car stagnation, but at this writing only two or three of the smaller ones had been forced to stop grinding, and this for very short periods of time. Weather conditions have been favorable for traffic, on the whole, but this cannot be expected to continue as the winter progresses.

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Bogus District Manager of Commerce Co. Swindles Dealers

DETROIT, MICH., Dec. 23—The Commerce Motor Car Co., truck manufacturer of this city has wired THE AUTOMOBILE as follows:

"An imposter claiming to represent us as district manager is operating in Pennsylvania, West Virginia, and Ohio, passing bogus checks on dealers and hotelmen. These checks are printed with our name and are on the First National Bank of Detroit. Checks are signed F. M. Wilson, manager of sales. The trade should be on the lookout for such a person and wire us promptly in case he is located."—(Signed) Commerce Motor Car Co., Detroit, Mich.

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Akron-Ardmore Tire Company Formed

ARDMORE, OKLA., Dec. 26—The Akron-Ardmore Rubber Co. has been organized at Ardmore, Okla., with a capital of $1,000,000. John C. Harmony, E. D. Ford, C. A. Besaw, A. C. Fox and R. G. Wood have been active in the formation of the concern.

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Aluminum, lb.	.62	.62	.62	.60	.60	...	— .02
Antimony, lb.	.14⅜	.14⅜	.14	.14	.14	...	— .00⅜
Beams and Channels, 100 lb.	3.42	3.62	3.62	3.62	3.62	...	+ .20
Bessemer Steel, ton	55.00	60.00	60.00	60.00	60.00	...	+5.00
Copper, Elec., lb.	.33½	.33½	.31	.31	.31	...	— .02½
Copper, Lake, lb.	.33½	.33½	.31	.31	.31	...	— .02½
Cottonseed Oil, bbl.	12.35	12.50	12.45	12.50	12.50	...	+ .15
Fish Oil, Menbaden, Brown, gal.	.72	.72	.72	.72	.72	...	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	...	...
Lard Oil, prime, gal.	1.30	1.30	1.30	1.30	1.30	...	...
Lead, 100 lb.	7.75	7.75	7.75	7.75	7.75	...	...
Linseed Oil, gal.	.93	.93	.93	.93	.93	...	...
Open-Heartb Steel, ton	55.00	60.00	60.00	60.00	60.00	...	+5.00
Petroleum, bbl., Kans., crude	1.20	1.20	1.20	1.20	1.30	...	+ .10
Petroleum, bbl., Pa., crude	2.75	2.75	2.75	2.75	2.75	...	...
Rapeseed Oil, refined, gal.	.98	1.00	1.00	1.00	1.00	...	...
Rubber, Fine Up-River, Para, lb.	.79	.79	.79	.79	.79	...	...
Rubber, Ceylon, First Latex, lb.	.78	.77	.77	.75½	.75½	...	— .02½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	...	...
Tin, 100 lb.	42.63	42.00	41.25	40.50	40.50	...	—2.13
Tire Scrap, lb.	.06½	.06½	.06¼	.06½	.06½	...	...

Steel Prices Rise $5 a Ton

Copper Declines 2½ Cents a Lb.—Kansas Crude Higher—Tin Declines $2.13

NEW YORK, Dec. 27—The materials market last week was on the whole lower. With the exception of a rise in steel prices, the market was otherwise featured with substantial losses in the other metals and rubber. Bessemer and open-hearth steel rose to $60 per ton, a gain of $5. Kansas crude petroleum, accompanied by a general rise throughout the country in gasoline, went up 10 cents a barrel to $1.30.

Aluminum dropped 2 cents to 60 cents a pound. Copper is now quoting 31 cents a pound, a decline of 2½ cents. Tin dropped to $40.50, a loss of $2.13 per 100 lb.

The demand for gasoline is expected to be very large after the war, as its use in Europe is bound to increase enormously. At present in such countries as England, France and Italy restrictions are placed on consumption, and gasoline is so scarce that prices are prohibitive. With these restrictions removed and with the use of the automobile in all countries a growing factor, gasoline requirements will be enormous. The Standard Oil Co. yesterday, probably in anticipation of a larger demand from Europe, raised the price of gasoline 1 cent for export.

—

Fisher Body Sales Increase

DETROIT, Dec. 21—The sales of the Fisher Body Corp. for November amount to $1,650,000, an increase of $180,000 over October, and $400,000 higher than any previous month in the fiscal year. Total sales for the past 9 months are 65.56 per cent higher than for the same period in the previous year.

—

P. R. Creditors Get Dividend

DETROIT, Dec. 21—Creditors of the defunct P. R. Mfg. Co., have received checks covering 5 per cent of their claims. A second distribution of 50 per cent will be made within the next 3 months. The receivership is giving a large return on the common stock in addition to meeting all claims and taking up the preferred.

—

Universal Heater Co. Formed

MARTINTON, ILL., Dec. 26—The Universal Heater Co., this city, has been organized to manufacture a heater for automobiles. Until the company can open its own plant, the heaters will be manu-

factured by the Moline, Ill., Foundry Co. The heater is built in the shape of a foot rest and may be placed either in the rear or front seat of a car and will fit any automobile or other vehicle operated by a gasoline engine.

—

Dividends Declared

Hupp Motor Car Corp. quarterly of 1¾ per cent on 7 per cent cumulative preferred, payable Jan. 2 to stock of record Dec. 20.

Chalmers Motor Corp., 75 cents a share, payable Jan. 15 to holders of record Jan. 5.

Signal Motor Truck Co., 3½ per cent, to be paid Jan. 2 to stock of record on Dec. 26.

Billings & Spencer Co.; extra of 3 per cent with quarterly of 2 per cent, payable Jan. 1 to holders of record Dec. 23.

—

Herschell-Spillman 100 Per Cent Dividend

NORTH TONAWANDA, N. Y., Dec. 26—The Herschell-Spillman Co., this city, will pay a 100 per cent stock dividend, in addition to the regular quarterly cash dividend.

—

Hall Lamp Extra Dividend

DETROIT, Dec. 23—The Hall Lamp Co. has declared an extra dividend of 2 per cent for December on the $600,000 outstanding common stock, making a total of 4 per cent for the month.

Automobile Shares Are Firm

—

Subjected to Severe Grilling at Hands of Bears—General Motors Drops 100 Points

NEW YORK, Dec. 27—Despite the fact that they were subjected to a severe gruelling at the hands of the bears, automobile and accessory securities were conspicuously firm in last week's sensational market. Though the automobile shares were lower on an average last week, they did not decline as much as was expected, considering the light demand before the landslide. The demand picked up, however, and yesterday stocks were higher.

Chevrolet, Hupp, International Motors, Regal and Willys-Overland, featured the market with substantial gains. General Motors, which has been subject to spasmodic jumps of 100 points, either way, dropped 100 points to 500 last week. Springfield Body common was a little weak at 70, a loss of 20 points.

Studebaker and Willys-Overland held up strong with small losses. The common of the latter rose 1¼ points. It is estimated that the profits of the Studebaker Corp. for the fiscal year ending Dec.. 31 will amount to between $10,500,000 to $10,800,000.

The $1,000,000 Paige-Detroit 7 per cent cumulative serial preferred was several times oversubscribed and the books of the underwriters have been closed. The stock, which is now selling above its issue price, was placed largely with investors. It is the first serial issue to be placed by an automobile company and will be redeemed at the rate of $100 par value each year from Jan. 1, 1918, to Jan. 1, 1927, inclusive.

—

General Motors Extends Time

NEW YORK, Dec. 27—The time to exchange preferred and common stock of the General Motors Co. of New Jersey for securities of the General Motors Corp. of Delaware, on the basis of 1 1/3 shares of new preferred for one share of old and five shares of new common for one share of old, has been extended to Jan. 19. Exchanges will be made as of Nov. 1, last. There have been deposited 117,406 shares of preferred and 103,071 of common under the new plan.

—

General Motors on Exchange

DETROIT, Dec. 21—General Motors new common was admitted to the New York stock exchange Wednesday morning. In their application for admittance, the General Motors Corp., which will take over the General Motors Co., stated that of the $45,314,000 common outstanding Dec. 9, the Chevrolet Motor Co. held $16,644,500 in one certificate.

—

Carl Page Takes Over Jordan

NEW YORK, Dec. 27—The Carl H. Page Motors Co., this city, has taken over the distribution of the Jordan car, formerly handled by John G. Dale, a former distributor of the Simplex and now handling the Phianna.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
Ajax Rubber Co	72½	73	—7½
J. I. Case T. M. Co. pfd	86	90	+ ¾
Chalmers Motor Co. com	125	140	—5
Chalmers Motor Co. pfd	100	105	—5
*Chandler Motor Car Co	98	102	—5
Chevrolet Motor Co	125	135	+17
Fisher Body Corp.	37	41	—1
Fisk Rubber Co. com	70	80	..
Fisk Rubber Co. 1st pfd	110	115	..
Fisk Rubber Co. 2d pfd	90	100	..
Firestone Tire & Rubber Co. com	135	140	..
Firestone Tire & Rubber Co. pfd	107	108	..
*General Motors Co. com	500	800	—100
*General Motors Co. pfd	120	125	+6
*B. F. Goodrich Co. com	59¾	60	—4½
*B. F. Goodrich Co. pfd	110	112	—3½
Goodyear Tire & Rubber Co. com	285	290	—5
Goodyear Tire & Rubber Co. pfd	108¾	109½	..
Grant Motor Car Corp	7	9	..
Hupp Motor Car Corp. com	3½	4	..
Hupp Motor Car Corp. pfd	88	92	+8
International Motor Co. new com	12	17	+2
International Motor Co. 1st pfd	60	80	+10
International Motor Co. 2d pfd	20	40	—10
*Kelly-Springfield Tire Co. com	58½	60	—9
*Kelly-Springfield Tire Co. 1st pfd	94	96	—1
*Lee Tire & Rubber Corp	30	31	—3
*Maxwell Motor Co. com	53	53½	—6
*Maxwell Motor Co. 1st pfd	72	73	—2
*Maxwell Motor Co. 2d pfd	37	37½	—3
Miller Rubber Co. com	245	250	—5
Miller Rubber Co. pfd	106	107	..
Packard Motor Car Co. com	170	173	..
Packard Motor Car Co. pfd	100	103	..
Paige-Detroit Motor Car Co	40	41	— ½
Peerless Truck & Motor Corp	16	18	—2
Portage Rubber Co	178	182	..
Regal Motor Car Co. pfd	23	30	+3
Reo Motor Car Co	41	42	+1
Saxon Motor Car Corp	65	75	—8
Springfield Body Corp. com	70	85	—20
Springfield Body Corp. pfd	115	130	—5
Standard Motor Construction Co	6	9	+1
Stewart-Warner Speed. Corp. com	97	100	—5
Stewart-Warner Speed. Corp. pfd	..	..	..
*Studebaker Corp. com	111	112	—1
*Studebaker Corp. pfd	107½	112	..
Swinehart Tire & Rubber Co	..	85	..
United Motors Corp.	45¾	46	—4
*U. S. Rubber Co. com	60	62	—5½
*U. S. Rubber Co. pfd	111½	113	— ½
White Motor Co	48	50	— ½
*Willys-Overland Co. com	37¾	37½	+1¼
*Willys-Overland Co. pfd	96	98	—2½

*At close Dec. 23, 1916. Listed New York Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co	46	47¼	..
Chalmers Motor Co. com	120	135	..
Chalmers Motor Co. pfd	110	..	..
Continental Motor Co. com	39¼	39½	—4¼
Continental Motor Co. pfd	9½	..	..
Ford Motor Co. of Canada	..	290	..
General Motors Co. com	..	800	..
General Motrs Co. pfd	118½	121½	..
Maxwell Motor Co. com	49	53	—13
Maxwell Motor Co. 1st pfd	79	83	..
Maxwell Motor Co. 2d pfd	34	37	—6
Packard Motor Car Co. com	..	170	..
Packard Motor Car Co. pfd	..	101	..
Paige-Detroit Motor Car Co	39¼	39¾	+ ¼
W. K. Prudden Co	49	51	—1
Reo Motor Car Co	38½	38¾	—3½
Studebaker Corp. com	111½	114½	— ½
Studebaker Corp. pfd	107	..	..
C. M. Hall Lamp Co	..	30¾	..

INACTIVE STOCKS

Atlas Drop Forge Co	30	34	..
Kelsey Wheel Co	55	60	..
Regal Motor Car Co. pfd	25	..	..

The Automobile

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Pilgrims from Abroad

MORE automobile engineers, manufacturers and dealers from other lands will attend the coming national shows at New York and Chicago than ever before in the history of the industry. For months many of them have been visiting factories in our great production centers, studying methods of manufacture and marketing as well as the points of construction in the cars themselves.

Now they will have an opportunity of viewing the products which will represent the industry for 1917, grouped under the most favorable conditions possible for imparting a correct perspective.

When a representative of an U. S. A. manufacturing firm returns from abroad, he is immediately besieged by people who are anxious to learn the conditions and opportunities for business development in the countries he has visited, and it is not only the people with whom he comes into daily association who seek this information. Often he receives letters and telegrams from companies and individuals all over the United States who are interested in his experiences and the knowledge he has gained. Similarly with the men from other lands who return from a sojourn in this country.

It must be remembered that these men will carry home with them impressions of our methods, our products and their value, which cannot fail to influence the markets in their respective countries, and every member of the industry who comes in contact with these men should keep this fact in mind, as it may mean an enormous difference in dollars and cents in the future development of our export business.

The Little Things

WHILE newspapers and the trade press have frequently lectured American manufacturers for slackness and lack of perspicacity in handling their export business, there is apparently some basis for complaints on the subject. For example, Latin-Americans, in buying tires of European manufacture, have been accustomed to receive inner tubes packed complete with nipple, washer and dust cap, so that they can be put on without depending on possible relics in the possession of the purchaser. Many of the leading tire makers of the United States, partly due to increased cost of materials and manufacture, and partly because of no demand for these details of equipment on the part of U. S. A. car owners, have discontinued the practice of furnishing these parts with their inner tubes. This action has caused no complaint in this country, which is perhaps the reason that these tire makers have not considered its effect on their export business.

In Cuba, Porto Rico and the South American countries, the omission of these almost negligible details has caused much dissatisfaction with the result that many car owners who have been converted to the use of U. S. A.-made tires since the beginning of the European war will return at once to the use of European tires as soon as possible.

Our manufacturers should be careful to take into consideration at all times not only the different conditions under which their products operate in other countries, but also the peculiarities of demand in each market which can only be brought to the surface by a close study and intimate relationship with the people who are buying these products.

A New Era

THE year just closing marks a new era in the automobile industry, one that has been unequaled in production and progress. Hampered on every side by a shortage of materials, with high prices, higher wages, and a freight car shortage, the manufacturers are to be commended on their wonderful showing. Financial statements show much larger returns, dividends have been frequent and large, and in general the automobile and allied industries have gone up another step toward the pinnacle of success.

What are we to expect of 1917? What new marks will be recorded? Will we be prepared for conditions, if the war should stop? What new production marks will be made by the further standardization work of the S. A. E? The year 1916 has been phenomenal in the demand for automobiles. Will 1917 mark another record, and if so, are we prepared to take care of it?

1916

The Dawning of a New Era in The Industry

¶ Unparalleled Growth in Production, Registration and Exportation of Cars Marks New Epoch in Progress During the Year.

¶ Notable Development of Year Is Consummation of Mergers Involving Large Companies and Refinancing To Meet New Conditions Which Now Confront Manufacturers.

AS each year comes and goes, there is usually some dominating feature, marked and epoch-making, brought out in the industrial world. either through invention, or through other important manifestations. The automobile industry, which is occupying a leading position in the world's business activities, has each year come to the fore with its progressiveness and with its keen insight to the future. The year 1916 will be recorded as one in the automobile industry of unprecedented production and expansion, of record earnings and exports, of big mergers, and of an increased domestic demand.

This year has seen the farm tractor enter the zone of larger production. A step ahead has been taken by aviation, and the government's huge appropriation of tens of millions should have untold influence on the science, coming as it does at such an early age in the art.

Over 3,000,000 Cars

Notwithstanding a scarcity of materials and consequently high prices, automobile registrations have passed the 3,000,000 mark, some of the large cities having more automobiles registered than a few of the European countries. This year has seen the reduction of the working day, with large wage increases. Extraordinary dividend payments have been frequent, reflecting the large earnings of the automobile and accessory industry. Welfare work has been taken up more extensively, the worker being benefited by more hygienic working conditions. More companies have been refinanced than in previous years as a result of demand. A record demand has had to be taken care of, thereby necessitating large plant additions. All automobile shipment records were broken in 1916, despite a freight car shortage, nearly 250,000 carloads of automobiles being shipped by the factory during the first 11 months.

Several patents have been adjudicated during the year. The Perlman demountable rim suit against the Standard Welding Co. was of more than ordinary interest, because it affected the use of demountable rims on nearly all the automobiles made and now in service. The restrictive injunction, entirely preventing manufacture, was for a time one of the most serious situations faced by the industry in many years.

Important Patents Adjudicated

The Hanlon adjustable windshield patent, which had been adjudicated and declared valid and infringed by Rauch & Lang and the National Automobile Chamber of Commerce, was brought before the United States Circuit Court of Appeals, where the injunction was dissolved, affecting all the members of the National Automobile Chamber of Commerce and also the Rauch & Lang Carriage Co. The Hanlon patent covers a windshield using a double glass, which can be placed at an angle, forming a roof to keep rain or sleet from the vertical pane. The device is now free for general use.

The final decree in the Austin-Cadillac two-speed axle case was signed in the early part of the year, sustaining the patent and preventing its manufacture except under license. Suit was started by W. S. Austin, of the Austin Automobile Co., in 1914, claiming infringement on his two-speed axle patent, No. 1,091,618, issued March, 1914.

Other patents were upheld, including the Discher patent covering a bumper bracket construction. G. F. Discher, president and general manager of the Gemco Mfg. Co., Milwaukee, had brought suit against the Auto Parts Mfg. Co. for infringement on patent No. 1,052,224. This broadly covers radiator bumpers which are attached to the frame with adjustable clamps, thus avoiding drilling of the frame side members.

Another patent upheld was that issued to D. McRa Livingston, No. 1,156,017, covering a mask for concealing the engine and radiator casing of a

AUTOMOBILE SHIPMENTS IN CARLOADS

Month	1916	1915	1914
January	18,054	8,369	11,114
February	21,502	11,273	10,572
March	28,600	16,442	13,117
April	28,000	17,112	14,122
May	24,000	13,642	12,405
June	23,879	15,325	8,617
July	18,079	12,517	5,605
August	18,254	16,959	9,612
September	21,660	18,940	12,209
October	19,510	17,848	12,003
November	17,250	17,138	7,710
December	——	15,582	7,378

Ford car. The patent permits of a combination hood and radiator mask which gives a distinctive stream-line effect.

Several patents are now before the courts, one being the Springfield type body. The suit is against the Fisher Body, charging infringement of design patents, Nos. 47,252 and 47,630, covering the Springfield type of convertible and four-door bodies.

Exports Pass $100,000,000

Automobile, truck and accessory exports this year have far passed the $100,000,000 mark. The wonderful showing the United States has made in the shipment of automobiles to foreign countries is reflected in the figures for the first ten months, a total of 67,616 cars and trucks, valued at $100,147,636, compared with 53,380 cars and trucks, and $94,434,432 in the same period in 1915, the war being the potent factor in this growth. Notwithstanding the restrictions made by Great Britain, Italy and France on the importation of our cars and trucks, the export figures have increased each month. Foreign markets, formerly supplied by Europe, have been developed, and the United States is fast getting a foothold which is not only continuing, but will mean increased sales after the war has stopped. South America is developing as an automobile field, shipping conditions are being bettered, and better credit relations are being opened. Australia, which for the past two years has been a large buyer of American cars, bought more of our cars and parts this year than ever before. British South Africa has prospered greatly because of the war, and here purchases of our automobiles and accessories have greatly increased. The West Indies have developed much as automobile consumers during the past year.

Automobile and commercial vehicle exports are now receiving more attention by the makers. A majority of them are building their cars with larger treads and with right or left steering, according to the demand from the specific locality. Special representatives are being sent to different parts of the world to study conditions and the American makers are fast taking advantage of the openings for increased trade caused by the war.

Truck exports during the year have not been as large as in 1915, but passenger car exports have averaged about 1000 more each month over the corresponding month of 1915. Truck exports have been lower since April. The American automobile, especially the medium and low-priced models, have proved popular in foreign countries, especially those not now engaged in war. These countries are sending men to the United States to investigate the automobile industry and ultimately to open agencies in their own countries.

More combinations of business interests in the automobile field have been made this year than ever before. Nearly twenty new companies have resulted from mergers, affecting fifty concerns. One of the large mergers during the early part of the year was the formation of the United Motors Corp., with a capital of $60,000,000, including at that time five of the largest parts and accessory making concerns. It has since merged four more concerns. Another important merger was that of the Motor Products Corp., a combination of five parts makers from the Detroit territory. Then came another merger of parts companies into the Steel Products Co., Detroit. In order to concentrate production, the Signal Motor Truck Co. and the Commerce Motor Car Co., Detroit, effected a merger, known as the Signal-Commerce Motor Truck Co.

Another consolidation was that of the Perfection Spring Co. and the Standard Welding Co. into the Standard Parts Co., Cleveland, capitalized at $35,000,000. This merger was important in that it eliminated the friction regarding the Perlman rim patents, as the Standard Parts Co. had contracts with the Perlman interests, permitting manufacture of demountable rims at a fair profit.

Monster Merger Plan

So far there has been no combination of the automobile companies, the nearest to that being the monster merger planned in June. According to plans, there was to be a capitalization of $223,000,000, and was to include Overland, Hudson, Chalmers, Auto-Lite and the United Motors. If the plans had not miscarried, this combination would have ranked in magnitude second only to the U. S. Steel company.

On account of the record output of the automobile and allied plants, the year 1916 has been one of large factory expansion, and, as a result, many of the companies were induced to refinance or reorganize. Others have added considerably to their capital, to take care of needed factory additions.

Thirty-Six New Companies

That the need for new capital has been well distributed is indicated by the fact that of thirty-six companies, which have refinanced and changed their names or reorganized, thirteen were automobile producers, seventeen accessory makers, and six truck manufacturers.

The large demand for the American automobiles and accessories was responsible for the formation of many new companies this year. Out of an approximate total of 130, a large majority of these companies have finished their organization work and have started the erection of plants. Some of them are producing, despite the shortage of machinery and the high cost of materials. New automobiles and many new accessories have been put on the market, and are finding a big demand.

During the year many men, formerly connected with the automobile industry, branched out for themselves by forming new companies. One of these companies, and one which is now producing, is the Jordan Motor Car Co., Cleveland, maker of the Jordan automobile. E. S. Jordan, formerly secretary and general sales manager of the Thomas B. Jeffery Co., together with Paul Zens and R. S. Begg, were the organizers. Later came the organization of the Liberty Motor Car Co., by Percy Owen, formerly connected with the Saxon company in the capacity of vice-president and sales manager.

The Columbia Motors Co., Detroit, was another new company formed by men prominent in the automobile field. Both these men, J. G. Bayerline and W. L. Daly, were formerly connected with the King Motor Car Co.

The year 1916 was featured by the entrance of many notable outside manufacturers into the automobile field. One of the most prominent was the Brunswick-Balke-Collender Co., Muskegon, Mich., maker of billiard tables, bowling alley fixtures, etc. This firm has started the manufacture of tires. Another concern to enter the field was the Niles Car & Mfg. Co., Niles, Ohio, maker of railroad cars. This concern is now making ¾ to 1-ton and 2 to 2½-ton trucks. During the latter part of the year A. Howard, pioneer in the buggy business in Galion, Ohio, formed a company to produce an assembled car.

Many Big Dividends

Dividends this year have been frequent and large. A number of the makers have bought back certain issues of stock and a majority of them have put their stock on a higher dividend paying rate. One of the largest dividend payments of the year was that of the Diamond Mfg. Co., which declared a 300 per cent cash dividend as a result of the change of control at the time of being taken over by the Motor Products Co. Several of the companies declared large stock dividends, ranging from 50 to 108 per cent, the latter being given by the Haynes Automobile Co. Several of the automobile makers have put their stocks on an 8 per cent basis, one of the first being the Chandler Motor Co., Packard Motor Car Co., and the Pierce-Arrow Motor Car Co. The Maxwell Motor Co. inaugurated quarterly payments of $2.50 per share on its common, practically putting that stock on a 10 per cent basis.

This year has been featured by a general rise in automobile prices on account of the increase in the cost of materials. The year previous saw a general reduction in the list price of automobiles, due to improved factory machinery, conducive of a much larger production, and to a general reduction in material prices. As wages, rents, and nearly everything that goes into the manufacture of automobiles have risen, it is remarkable that the makers have held their increases on an average to so low a mark. That the accessory people have taken care of the future is proved by the fact that few have gone up in price; a small number have announced reductions. Prices on automobiles for 1917 will show increases ranging from $20 to $300.

During the first 6 months of 1916 a great many of the leading automobile manufacturers announced increases in price on their various models, but as these were the past season's models they are not included in the list appearing on page 1092, which is made up of the changes in price announced since July 1. During the past month there has been almost a landslide toward higher prices due to the greatly increased cost of the materials which enter into the construction of chassis, body, and every part of the car. In some cases, an example of which is Maxwell, the company announced a reduction in prices during the summer only to find that the increase in the cost of production did not permit of continuing at this figure, with the result that higher

AUTOMOBILE EXPORTS

	1914	1915	1916
January	2481 $2,174,392	1803 $1,313,153	4520 $3,044,995
February	3837 $2,378,494	2230 $1,785,330	5651 $4,063,429
March	3538 $2,984,915	2429 $1,958,302	5539 $3,726,939
April	3239 $2,760,478	3078 $2,804,741	6242 $4,998,350
May	3157 $2,857,601	4921 $3,971,483	6275 $4,069,690
June	1982 $1,870,882	4418 $4,785,998	4905 $3,416,396
July	1265 $1,143,419	4118 $3,835,347	5258 $3,663,563
August	385 $441,879	3839 $3,121,834	5254 $3,574,485
September	646 $597,904	4299 $3,215,459	3585 $2,819,405
October	732 $678,387	3479 $2,749,255	4880 $3,756,768
November	776 $634,659	3690 $2,791,507	....
December	1297 $998,698	3664 $2,710,758	....

TRUCK EXPORTS

	1914	1915	1916
January	45 $74,491	935 $2,545,527	1269 $3,416,818
February	57 $83,461	1002 $3,022,482	2063 $6,170,367
March	50 $63,932	1339 $4,725,563	1878 $4,909,179
April	52 $72,676	2267 $5,240,481	1790 $5,294,801
May	141 $236,383	2426 $6,583,912	1717 $4,357,238
June	90 $120,257	2990 $8,578,802	1416 $3,551,148
July	50 $106,400	2469 $6,803,001	1243 $3,062,670
August	66 $124,016	1614 $4,387,193	1565 $4,442,158
September	128 $294,288	2227 $5,882,255	1835 $4,442,158
October	672 $2,286,964	1596 $4,307,190	1144 $3,635,291
November	842 $2,244,518	1553 $3,837,307	....
December	1279 $3,387,729	1664 $3,920,533	....

Market Prices for Each Month of the Year 1916

Material	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.*
Aluminum, lb	.53	.57	.65	.58	.58	.63	.58	.58	.61	.65	.65	.63
Antimony, lb	.42½	.44	.44½	.40	.29½	.18½	.13	.13½	.11	.13	.14	.14½
Beams and Channels, 100 lb	2.16	2.17	2.62	2.77	2.77	2.67	2.67	2.67	2.76	2.87	3.17	3.42
Bessemer steel, ton	32.00	34.00	45.00	45.00	45.00	42.00	40.00	45.00	45.00	45.00	52.50	55.00
Copper, Elec., lb	.25	.28½	.28½	.29½	.29½	.26½	.26½	.28	.28½	.28½	.35	.34
Copper, Lake, lb	.25	.28½	.28½	.29½	.29½	.26½	.26½	.28	.28½	.28½	.35	.34
Gasoline, bbl	.22	.23	.24	.24	.24	.24	.24	.23	.22	.22	.22	.22
Lard oil, prime, gal	.94	.95	.95	.98	1.10	1.05	1.05	1.05	1.08	1.10	1.30	1.30
Lead, 100 lb	6.10	6.30	8.18	7.50	7.22½	6.88	6.35	6.70	7.00	7.05	7.30	7.63
Linseed oil, gal	.73	.75	.77	.76	.73	.65	.69	.72	.73	.88	.96	.93
Open-hearth steel, ton	33.00	35.00	45.00	45.00	42.00	42.00	42.00	45.00	45.00	45.00	52.50	55.00
Petroleum, bbl., Kans., crude	1.25	1.30	1.55	1.55	1.55	1.55	1.45	.90	.90	.90	.90	1.20
Petroleum, bbl., Pa., crude	2.25	2.35	2.60	2.60	2.60	2.60	2.60	2.30	2.30	2.60	2.60	2.75
Rubber, Fine Up-River, Para, lb.	.86	.76	.75	.73	.68	.63½	.66	.68½	.72	.75	.80	.79
Rubber, Ceylon, lb	.93	.91	.91	.82	.70	.62	.56	.57½	.60	.61	.70	.75
Tin, 110 lb	42.50	42.13	50.00	49.50	39.50	48.88	38.25	39.25	38.75	41.25	45.50	42.63
Tire Scrap, lb	.05¾	.06½	.06½	.06	.05½	.05½	.05½	.05¾	.05¾	.06	.06½	.06½

*To Dec. 18.

prices had to be announced. In the case of Maxwell, however, the new prices are still considerably lower than those in effect before July 1, so this case is an exception. Ford is the only other company which has lowered its prices during the past 6 months. There seems to be very little uniformity in the amount of increase made by the different manufacturers, doubtless due to the fact that each maker has his own individual problems to solve and finds conditions different at his factory from those to be found at other centers of production. As a rule the cars selling at under $1,000 have increased their prices anywhere from $10 to $50; cars selling from $1,000 to $2,000 adding from $50 to $300; and cars selling at $2,000 up, increasing their list from $300 to $600.

Automobile production far outstripped previous efforts. During the first half of the year, 754,902 automobiles were produced. This output of 6 months is little behind the entire output for 1915, which was 892,618. Ninety-nine factories were included in this 1916 figure, and of these 96 per cent being made in Michigan, Ohio and Indiana. During the first half of the year, Ford manufactured 298,000 cars, with Overland next with 94,477. In the year ending Aug. 1, Ford recorded a production of 533,921 cars, an increase of 225,708. Truck production for 1916 is estimated at 98,000

Shipments Break All Records

Shipments this year have been unparalleled, notwithstanding a freight car shortage, which for a time menaced the industry. Carload shipments passed the 1916 mark in the first 11 months, amounting to 249,755 carloads up to the end of November, as compared with 192,575 in the whole of 1915.

Many Concerns Refinanced

Prominent among those automobile producers which inaugurated extensive expansion policies by refinancing are: Chalmers Motor Co., taken over by the Chalmers Motor Corp., with a capital of 600,000 shares of no par value; National Motor Vehicle Co., Indianapolis, taken over by the National Motor Car & Vehicle Corp., with an offering of 53,000 shares at $42.50 per share; Pierce-Arrow Motor Car Co., Buffalo, taken over by the Pierce-Arrow Motor Car Corp., formed with 100,000 shares of 8 per cent convertible preferred and 250,000 shares of common without par value; Mitchell-Lewis Motor Car Co., Racine, Wis., taken over by the Mitchell Motors Co., with a capital consisting of 125,000 shares of common without par value; Thomas B. Jeffery Co., Kenosha, Wis., taken over by C. W. Nash, former president of the General Motors Co., and Lee, Higginson & Co., Boston, with the formation of the Nash Motors Co., capitalized at $24,999,500; Stutz Motor Car Co., Indianapolis, taken over by the Stutz Motor Car Co. of America, with a capital of 75,000 shares, no par value.

The Royal Equipment Co., Bridgeport, Conn., in order to take care of expansion, formed the Raybestos Co., with a $1,500,000 capital. Another prominent accessory concern to refinance was the Auto Crank Shaft Co., Detroit, taken over by the Automobile Crank Shaft Corp., with a stock issue of $250,000, divided into 2500 shares of 7 per cent cumulative preferred stock and 7500 shares of common of no par value. The Pennsylvania Rubber Co. was reincorporated with a capital of $6,000,000, increasing its capital $4,000,000. The Torbensen Axle Co., Cleveland, was formed to take over the Torbensen Gear & Axle Co., the new company having a capital of $1,000,000 preferred and $750,000 common. Late this year the Hess-Bright Mfg. Co. announced that controlling interest in its company had been purchased by a group of financial men, who also own a substantial interest in the S. K. F. Ball Bearing Co. The Hess-Bright manufacturing facilities are to be increased materially, though the two companies will be operated quite independently of each other.

One of the first of the truck companies to add new capital was the Republic Motor Truck Co., which incorporated with a capital of $1,312,500, divided into 72,500 shares, 62,500 without any par value, and 10,000 with a par of $1,000 a share. Another prominent truck maker to expand this year was the Gramm-Bernstein Co., which reorganized and increased its capital stock to $4,000,000, forming a new company under the name of the Gramm-Bern-

stein Motor Truck Co. The capital is composed of $3,000,000 common and $1,000,000 preferred. The reorganization plan of the International Motor Co., New York, was approved by the stockholders and creditors, and as a result the International Motor Truck Corp. was formed to carry on business with $7,372,790. Thus additional capital of $1,500,000 was raised, and the $2,881,000 notes maturing the first of November were obliterated. Another prominent concern, the Smith Form-A-Truck Co., in order to enlarge production, was taken over by Michaelis & Co. and banking associates, who formed the Smith Motor Truck Corp., with a capital of 20,000 shares of 8 per cent cumulative and convertible preferred stock, and 1,200,000 shares of common, par $10.

Accessory Companies Expand

As was expected, the accessory makers would need additional space during the year. Some of them took care of their increased facilities through the ordinary channels, others added capital, and still others were forced to follow the lead of the automobile makers, and refinance. Stromberg Carbureter Co., Chicago, was one of the first to refinance when it went under new control. The Stromberg Carbureter Co. of America was formed under the control of Allan A. Ryan & Co. and a syndicate of prominent banking interests in New York. The new company issued 50,000 shares of no par value. Another was the Empire Rubber & Tire Co., Trenton, which formed a new company, the Empire Tire & Rubber Co., capitalized at $1,500,000 preferred and $4,500,000 common. As a result of increased business, the A. O. Smith Co. was taken over by the A. O. Smith Corp., Milwaukee, with an offering of $3,000,000 preferred and 100,000 shares of common. The Kemco Electrical Mfg. Co., Cleveland, was reorganized with an entirely new ownership and personnel.

Factory additions were large as usual, there being 9,362,881 sq. ft. added by all the branches of the automobile industry, costing $9,449,065. Additional equipment cost $8,233,190, making a grand total of $17,682,255, as compared with $12,886,345 in 1915.

Welfare Work Progresses

More attention this year has been given to the betterment of working conditions. Club houses, athletic fields, etc., have been installed in a large number of the factories. Working conditions have been improved, labor-saving machinery installed, improved lighting arrangement, shorter hours and increased wages, all have worked toward bringing about a complete change for the better. Firestone Tire & Rubber Co. opened a large clubhouse for employees. Many other concerns added materially to their welfare work.

Another interesting development of the year has been the indorsement of the principles set forth by advocates of the Safety First movement, especially with regard to protecting the workers from bodily harm by machinery or accidents of any kind in yard and factory. Among the companies who have taken up this phase of the welfare work possibilities may be mentioned the Republic Rubber Co., which has recently installed devices for safeguarding its employees at every point throughout its plant and yards where danger might arise.

In addition to caring for the bodily safety of their workers, most of the leading automobile and accessory manufacturing concerns have devised plans of assisting employees in developing their economic welfare. Arrangements whereby a certain amount of each worker's earnings may be put in a savings fund or other similar institution regularly are common in nearly all the large factories, as are also co-operative plans providing for life and accident insurance as well as sick benefits. Clubhouses for employees provide entertainment, exercise and social recreation outside of working hours and in other ways the workers are cared for.

Engineering Development

There is no vast advance in design to chronicle, as was the case a year ago. The design of American cars was improved enormously during 1915, and 1916 has been a year devoted mainly to improving the methods of manufacture and cleaning up little details of design. The high spots of the 1917 cars are better lubrication, easier controls and steering, and still more comfortable bodies. The V-engine has made no great advance, the six and four hold about the same proportion that they exhibited last year.

Materials Are Better

The terribly difficult conditions of the markets and the greater stresses called into being by higher speed engines have together caused engineers to give more attention to materials. It has been neces-

DIVIDENDS DECLARED

Company and Nature of Dividend

H. H. Franklin Mfg. Co.—100 per cent stock dividend on common.
General Motors Co.—Common on 20 per cent basis.
Packard Motor Car Co.—10 per cent stock dividend on common and cash dividend of 1¾ per cent.
Studebaker Corp.—Quarterly of 1½ per cent and an extra of 1 per cent on common. Also regular 1¾ per cent on preferred. Common placed on 10 per cent basis in August.
Continental Motor Mfg. Co.—100 per cent stock dividend and 5 per cent on common.
Chandler Motor Car Co.—Stock on 8 per cent basis. Extra cash dividend of 1 per cent.
Hydraulic Pressed Steel Co.—50 per cent stock dividend.
Miller Rubber Co.—66⅔ per cent stock dividend on common.
Paige-Detroit Motor Car Co.—80 per cent stock dividend on May 24 and a 50 per cent stock dividend on Sept. 6.
Willys-Overland Co.—Common on 12 per cent basis. Extra stock dividend of 10 per cent.
Haynes Automobile Co.—Stock dividend of 108 per cent.
Maxwell Motor Co.—Common on 10 per cent basis. $7 a share on preferred and $6 a share on second preferred.
Bower Roller Bearing Co.—Quarterly of 15 per cent cash. Recommended stock dividend of 100 per cent to be approved by holders at January meeting.
Sparks-Withington Co.—2 per cent on common for 6 months; also 1¾ per cent on preferred.
White Motor Co.—$1 a share, placing stock on 8 per cent basis.
Four Wheel Drive Automobile Co.—Stock dividend of 100 per cent and cash dividend of 30 per cent.
Kelsey Wheel Co.—50 per cent stock dividend on common.
Auto Body Co.—209 per cent stock dividend and 5 per cent cash.
Firestone Tire & Rubber Co.—$4 a year on new common with a par value of $10.
Saxon Motor Car Co.—Stock on 7 per cent basis.

sary to discover means for doing without some of the higher grades; for instance, there has not been anything like enough tungsten to allow all those makers who wanted it to get a supply. In consequence we have now got some tungsten substitutes which are doing good service.

A feature of the year's engineering work, which must be mentioned, is the way in which several of the leading manufacturers have turned their attention to aircraft motors. Some openly and some behind locked doors have been working engines for airplanes, and there are now American motors as good as the best of the European ones in existence. They are hardly yet in production, but they will be next year.

Carburetion has, perforce, received much attention, owing to the increasing trouble with low-grade fuel, and manifold design has been modified also, the principal aims being to atomize the fuel more completely and keep it hot till it is actually ignited. Ignition has been featured by a general improvement in the construction of battery systems which are stronger and simpler. Transmission has not changed, though some new electric drives will be found at the shows. Frames are stronger and more rigid, and spring design is better, the attention this received in 1915 now bearing fruit.

In brief, the automobile of 1917 is just a bit better job all around than was the car of 1916. Its average price is a few dollars higher, but more than enough value is being given in return.

Materials Cost More

The material markets have played an important part in the activities of the automobile industry. Prices have reached record quotations on account of the large demand and the small supply. Steel prices have risen skyward, reaching $60 a ton in December, practically double the quotation in January. Copper is higher, beams and channels are much above their quotations of January.

Pennsylvania crude petroleum has risen to $2.60 per barrel, the highest price in its history. Gasoline has fluctuated throughout the year. When retail prices reached the 30-cent a gal. mark, Federal investigation resulted in a small decline. Prices are now above normal.

Rubber and cotton duck prices were higher, the latter rising from 50 to 96 cents a lb. Naturally automobile and tire prices went higher. Tire prices rose 15 to 20 per cent in the early year, and a similar increase is looked for in January.

The crude rubber market opened in a very unsatisfactory condition, with Para selling at 95 cents a lb. and Ceylon at $1.05. With the Suez Canal temporarily closed, and submarine warfare hampering shipments, prices rose to new heights. Cotton was at that time costly, and compounding ingredients were at prohibitive prices. Naturally with over 60 per cent of the crude rubber used coming from the Eest, and with an increased demand, a general rise was imperative.

These high crude rubber prices, however, were short-lived, for in February and March quantities of rubber scrap, notably automobile tires, came into the market. Under improved reclaiming processes this surplus became crude rubber, and proved one of the factors in driving the price down to a reasonably low figure. Prices gradually dropped from 73 cents for Para and 75 for Ceylon in February to 63 and 62 respectively in July. Ceylon reached 57 cents a lb. in August, and is a little higher at the present time. Para rose in October on account of an unusual drought on that river.

The Year in Speed Events

The year has been a 100 m.p.h. speedway era. All records on speedways and road have been broken, all transcontinental records have been shattered, and new marks in fuel economy have been made. In ten of the events, 100 m.p.h. or over was recorded. This year saw twenty-one finishers with an average of better than 100 m.p.h. in speedway races.

A new 24-hr. record was made by a Hudson Super-six, which traveled 1819 miles in that period, shattering the old record by 238 miles, made by Edge in a Napier at Brooklands.

A new transcontinental record was made by a Hudson, which covered the San Francisco-New York trip in 5 days, 3 hr., and 31 min., making the round trip in 10 days, 21 hr., and 3 min. The year witnessed three well-planned and executed attacks on the transcontinental mark. Cadillac opened the drive in May, cutting the old figure, 1 day and 14 hours. In July Marmon cut this figure by nearly 2 days, and lastly came the Hudson, establishing the present record.

Car Price Increases

Car	Change	Effective
Hudson	$175	Dec. 1
Maxwell	$60 lower on Tourer $55 lower on Roadster	July 1
Reo	$100 lower $75 lower on truck	Aug. 5
Dort	$30	Aug. 1
Ford	$35 to $95 lower	Aug. 1
Ross	$200	Sept. 1
Chevrolet	$50 on Baby Grand	Aug. 26
Daniels	$200	Sept. 1
Chalmers	$70 on 7-Tourer $90 on Sedan $70 on Town Car and Limousine	Dec. 1
Pullman	$85	Oct. 24
King	$50	Nov. 6
Cole	$100	Jan. 1, 1917
Packard	$185 on Model 225 $235 on Model 235	Feb. 1, 1917
Marmon	$150	Jan. 1, 1917
Kissel	$90 to $115	Dec. 1
McFarlan	$300	Dec. 1
Chase Truck	$75	Nov. 27
Riker Truck	$100	Dec. 1
Winton	$200	Dec. 15
Saxon	$50	Jan. 1, 1917
Premier	$200 to $215	Dec. 1
Allen	$100 on Closed Cars	Jan. 1, 1917
Mitchell	$100	Dec. 1
Cadillac	$160	Dec. 14
Mack Truck	$100 to $250	Jan. 1, 1917
Austin	$350 to $600	Dec. 11
Buick	$10 Model D-4-34 and D-4-35 $55 Model D-6-44 $50 Model D-6-45 $15 Model D-6-46 $35 Model D-6-47	Jan. 15, 1917 Jan. 15, 1917
Maxwell	$40 Touring Model and Roadster	Jan. 1, 1917
Franklin	$100 all models	Mar. 1, 1917
Standard	$100 all models	Jan. 1, 1917
Auburn	$60 Model Six	Jan. 1, 1917
King	$185 seven and four-passenger touring cars and roadster $200 on seven-passenger sedan	Dec. 19, 1916
Stanley	$225 five-passenger and seven-passenger touring $250 seven-passenger sedan	Dec. 4, 1916
Paige	$120 on Model 51 Stratford $85 on Model 39 Linwood $105	Dec. 19, 1916

S. A. E. Adds 36 Standards in Year

1916 Proves Epochal Period in Society's Development—Horizon Widens with New Year

ON many occasions when writing of the Society of Automobile Engineers its immensely rapid progress has been the theme. Year by year, it seems, the pace increases, and 1916 has been more important to the S. A. E. than any which have gone before. In fact it has actually been an epochal year for the society, for it has seen the S. A. E. make its way forward till it stood among the leading engineering societies of the world 2 years and more ago. In 1916 it has amalgamated with the aeronautic engineers and it is extending its activities to care, in a specialized way, for tractor and marine motor engineering.

Probably the biggest factor in bringing to pass the broadening of the society's scope is the work of standardization accomplished by the S. A. E. in the automobile field and the obviousness of the immense amount to be done in the other allied industries. That of the aeroplane has already been begun and new divisions of the standards committee will soon spring into being to look after the other departments.

As the outward and visible sign of the society's growing activities is the change of name to Society of Automotive Engineers, which will certainly be ratified at the January meeting of 1917. From the automobile industry, the aeroplane, tractor and motor boat industries have branched out and automotive is a peculiarly happy word to express the wide field they cover. Previously there has been no one word which could be used in a generic sense to cover all these new allied industries. We are now provided with one and it is likely that automotive engineering will be used in the way it is intended throughout the English-speaking world.

The enlargement is being accompanied by a substantial increase in membership, and the total of 2121, 317 more than on Jan. 1, 1916, at which the society now stands will certainly be much increased very soon. Not only is the broadening of scope bringing in many members, but it is bringing keen men, enthusiasts in their subject, into the organization. The newer branches of the automotive industry have been created by the most active and most persevering types of men, men who will use the opportunities of membership to the full.

Immense Growth of Sections

There is no better index to the much greater use which the membership is making of the advantages of membership than the amazing change that has taken place in the character of the meetings of the sections. Two years ago the Detroit section met in a small room; to-day it uses the largest gathering place in the city and shows attendance at papers and discussions equal to, or even greater than the near 700 members of the section. Cleveland has shown similar growth, the rise of the new section being even more rapid, though it has not yet reached Detroit's totals. The Metropolitan section has had better gatherings than ever, while the Mid-West section at Chicago and the Pennsylvania at Philadelphia are growing healthily. Within the past month the Buffalo section has been created, and bids fair to be soon among the largest, if the meeting for its formation may be taken as any indication. Buffalo now having so many aeronautic engineers at work within it is likely to be a place where papers and discussions on this phase of automotive engineering will be common.

Giving the figures in order of magnitude, Detroit has 710, of which 361 are section associates; Cleveland has 268, of which 122 are section associates; the Metropolitan section has 235, sixteen being associates; the Mid-West has seventy-six, with twenty-six associates; Indiana has sixty-seven, fourteen being associates and Pennsylvania forty-five, with twenty-one associates. These associates are members of the sections only, and not members of the parent society, but it is probable that a majority of this 560 men may become so.

Standards Finally Accepted by S. A. E. in 1916

JANUARY MEETING

1—Instructions for testing materials and some new standard test specimens.
2—Cone clutch flywheel housing (bell housing).
3—Basis of speed and mileage rating for electric vehicles.
4—License plates and brackets.
5—Tire pump bases.
6—Location of chassis number.
7—Location of engine number.
8—Sizes of hose connections.
9—Lock washer dimensions.
10—Forms for specifications and methods for commercial testing of springs.
11—Sizes and specifications for insulated wires and cables.
12—Industrial truck tires.
13—Diameters of truck tires.
14—Dimensions of truck wheel felloe bands.
15—Standard weight definition.
16—Piston ring groove widths (part of final complete standard).
17—Location of slots in headlamp bulbs (revised later).
18—Resolution in favor of 42-in. rule for minimizing headlamp glare.

JUNE MEETING

19—Standard nomenclature.
20—Series of standard sizes of flexible metallic tubing.
21—Headlamp bracket dimensions.
22—Minimum height of headlamp above ground.
23—Resolution that current reducing dimmers are of no value for glare reduction.
24—Specification (partial) for focussing device.
25—Location of headlamp bulb slots.
26—Revision of bulb nomenclature.
27—Fitting and wiring of storage battery.
28—Throttle lever rod ends.
29—Throttle lever end throw.
30—Charging plug receptacles for electric vehicles.
31—Nickel steel.
32—New table of physical tests of several S. A. E. steels.
33—New test specimen recommendations.
34—Formula for and tabulation of sizes of piston ring grooves (final form).
35—Increase of length of thread on S. A. E. bolts.
36—Complete tabulation of taper roller bearing sizes.

The work of the standards committee is about to be reorganized, having now grown to such dimensions that the old system is developing weakness in places. During the year the committee divisions have mostly been very active and a number of difficult subjects have been disposed of. The actual number of new standards is not large, but those which have been accepted are mainly of a really useful character. In some respects the difficulty of getting agreement on standards increases just as the demand for them grows. Standards are now being worked out for things which a short while ago were declared unstandardizable, mainly because individuals who used to be jealous competitors have discovered the immense advantages of getting together.

In January K. W. Zimmerschied resigned the chairmanship of the standards committee having, in his time of office, stimulated the work to an enormous extent and by constant personal appeal, spread the standardization idea far and wide. With the appointment of A. Ludlow Clayden, the chairman for 1916, several divisions were discontinued and such work as they had unfinished turned over to other divisions. At later dates there were created the tire and rim division, which is now proceeding rapidly with the standardization of pneumatic tires and

rims under the chairmanship of K. W. Zimmerschied; and the aeronautic engine division, Chairman Henry Souther, which has a hard task before it in getting order from the present chaos of aeroplane engine detail. Also the nomenclature committee was created a regular division, also under Mr. Zimmerschied's chairmanship.

Standard nomenclature for every part of an automobile chassis was accepted by the society at the summer meeting and an illustrated book containing all the names will probably be published in the spring of 1917.

Three meetings of the standards committee have been held, one in April at Cleveland; the second at the summer meeting on the Noronic and the third at the Bureau of Standards, Washington, in October. The standards accepted at the summer meeting are listed on this page and a number of others will be submitted to the January meeting for acceptance.

Throughout the year the electrical equipment division has been concerned mainly with matters relating to lamp standardization and headlamp glare and much useful detail work has been done, though there has been no settlement of the glare problem in the form of a general resolution.

The truck standards division has been reorganized as to personnel now being composed entirely of engineers from truck factories under the chairmanship of H. D. Church. The division has been mainly concerned with military specifications and has been in close touch with Washington on this subject. Its most important accomplishment is the formulation of a standard control which will come up for acceptance in January.

The big work of the engine and transmission division has been the revision of the engine test forms which is now just finished, and another important work nearing completion is a standard for generator and starting motor mounting, this being handled by a sub-committee of both the engine and transmission and the electrical equipment divisions.

The miscellaneous division has completed its piston ring groove standardization, has examined with great care and finally reported as impossible, a standard speedometer drive and has several recommendations for the January meeting. Steering wheel hub standards, taper fittings for such things as fender irons, fine pitch threads and a number of other similar matters are in an advanced stage.

The ball and roller bearing, the iron and steel and the electric vehicle divisions have proceeded steadily and have several new standards to their credit. The springs division, which presented a voluminous report last January, has recently completed some additions, principally relating to spring bolts and spring clips which are nearly ready for acceptance. The research division has devoted the whole year to the perfection of the recommended form of procedure for testing a car for fuel economy and acceleration. Some tests of the system have been made and further tests are to be made.

Automobile Securities Quotations Range Throughout the Year 1916

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
Ajax Rubber Co	71¼	71	68½	66	66	64	64	64	64½	63	70
J. I. Case T. M. Co	86	85	75	86	86	86	83½	82	82	84⅜	87
Chalmers Motor Co. com	120	130	158	150	160	160	175	150	145	100	134
Chalmers Motor Co. pfd	100	99	99	97	96	99	98	98	96	90	111
Chandler Motor Car Co	.....	.....	.....	.....	96½	108	107½	103	105	106	172
Chevrolet Motor Co	132	134	164	178	231	214	216	197	204	197	172
Fisher Body Corp	.....	.....	.....	.....	.....	.....	.....	39¾	40¼	40	38
Fisk Rubber Co. com	.....	.....	.....	.....	.....	.....	160	150	100	100	80
Fisk Rubber Co. 1st pfd	.....	.....	.....	.....	.....	.....	114	114	110	110	100
Fisk Rubber Co. 2nd pfd	.....	.....	.....	.....	.....	.....	120	120	100	100	90
Firestone Tire & Rubber Co. com	730	735	745	800	830	880	915	1000	1050	1130	168
Firestone Tire & Rubber Co. pfd	112	112	113	114	113	112	111	112	110	110	106
General Motors Co. com	486	477	480	400	431	470	480	525	700	830	510
General Motors Co. pfd	112	114	113	111½	116½	112½	110⅛	121⅝	124	120⅛	120
B. F. Goodrich Co. com	71⅛	72⅜	72½	73½	75¾	73	73⅛	71¾	72¼	74⅛	70½
B. F. Goodrich Co. pfd	110	113	114	114	115	113½	113	113⅛	112	114¼	113½
Goodyear Tire & Rubber Co. com	338	342	340	405	380	230	225	240	270	296	294
Goodyear Tire & Rubber Co. pfd	114	116	112	116	105	106½	106	106¾	106½	108	108½
Grant Motor Car Corp	.....	.....	.....	.....	11	9	9	7	8	8	8
Hupp Motor Car Corp. com	.....	.....	.....	.....	.....	.....	6½	6½	6	5	4
Hupp Motor Car Corp. pfd	.....	.....	.....	.....	.....	.....	80	80	80	90	80
International Motor Co. com	23	22	20	10	10	12	5	6	5	4½	5
International Motor Co. pfd	38	35	35	20	22	18	17	15	15	17½	23
Kelly-Springfield Tire Co. com	74⅝	71	74½	68	74	69	70¼	73¾	83	78¾	76¼
Kelly-Springfield Tire Co. pfd	86	95	96	95	96	95	96	95	98	98	96
Kelsey-Wheeler, com	.....	.....	.....	.....	.....	.....	60	60	60	60	55
Kelsey-Wheeler, pfd	.....	.....	.....	.....	.....	.....	100	100	100	100	100
Keystone Tire & Rubber Co. com	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15¼
Keystone Tire & Rubber Co. pfd	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15¾
Lee Rubber & Tire Corp	.....	.....	.....	.....	.....	.....	45	44	45¾	42¾	38¼
Maxwell Motor Co. com	66½	65¼	69	69½	86	80⅜	81½	82½	96	89¾	74
Maxwell Motor Co. 1st pfd	88¼	86	85	77	88½	85	87½	85	87½	87	81⅜
Maxwell Motor Co. 2nd pfd	53	49¾	54	50	57½	54	57¾	54¾	58	55½	49½
Miller Rubber Co. com	260	275	235	265	300	300	200	220	250	250	255
Miller Rubber Co. pfd	113	113½	112	113½	115	115	104	105	104	105	107
Mitchell Motors Co	.....	.....	.....	.....	.....	.....	67	66	66	64	59
Packard Motor Car Co. com	162½	170	160	165	204	190	168	165	150	170	173
Packard Motor Car Co. pfd	102	102	100	100	100	100	100	100	95	95	101
National Auto Corp	.....	.....	.....	.....	.....	.....	.....	.....	.....	42¾	40¾
Paige-Detroit Motor Car Co	710	665	690	750	980	45	45	46	32	36¾	38
Peerless Truck & Motor Corp	38½	26	26	20	20	24	23	24½	26	24	25
Portage Rubber Co. com	70	65	70	75	85	85	113	150	160	174	165
Portage Rubber Co. pfd	102	107	106	108	107½	107½	115	150	160	173	173
Regal Motor Car Co. pfd	11½	13	10	20	20	20	17	17	18	17	25
Reo Motor Car Co	25	27¼	26	28¼	37	37¼	37¼	36	43½	43¼	45½
Reo Motor Truck Co	32	34	33½	38	44½	40½	43½	43¼	44½	.....	.....
A. O. Smith Corp	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	43
A. O. Smith Corp	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	96½
Saxon Motor Car Corp	.....	.....	.....	.....	73½	78	75	72	82	80	78
Spicer Mfg. Co	.....	.....	.....	.....	.....	.....	.....	.....	.....	101½	47¼
Springfield Body Corp. com	.....	.....	.....	.....	.....	.....	77	84¾	82	92	90
Springfield Body Corp. pfd	.....	.....	.....	.....	.....	.....	120	120	120	120	120
Smith Motor Truck Co	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6¾
Stewart Warner Speedometer Corp. com	88	86½	87	84¾	88	96½	103	117	112½	113	106
Stewart Warner Speedometer Corp pfd	108	108	109	109	109	109	109	109	109	109	109
Studebaker Corp. com	153¾	146	141	120	137¼	137½	126½	125¼	130½	135	124
Studebaker Corp. pfd	110	109	111	108	109	107	109	107½	107⅝	111	109¼
Stutz Motor	.....	.....	.....	.....	.....	58	02¾	05	65	68	65
Stromberg	.....	.....	.....	.....	.....	.....	42	42¼	42	42	42
Swinehart Tire & Rubber Co	87	87½	88	84	83	83	85	95	90	86	85
United Motors Corp	.....	.....	.....	.....	68½	09½	69	60½	67¼	66⅝	61⅛
U. S. Rubber Co. com	54½	51¾	52¼	50½	54¾	52	53⅜	56½	59	61	65⅜
U. S. Rubber Co. pfd	107¼	106	109	106	109	108½	108	111⅛	113	111½	112½
White Motor Co	49½	49¾	51	49½	51½	53	54	53⅝	54¼	57	54
Willys-Overland Co. com	221	208	229	210	259	277	60½	46	45⅞	46⅛	38½
Willys-Overland Co. pfd	110	104	104	102½	106	106¼	105⅝	104¼	102¾	103	98⅛

Financing a Feature of the Year

Many New Companies Formed, Important Mergers Consummated and Rearrangement of Finances Effected

New Companies

A. B. C. Starter Co., Detroit, Mich. Capital $150,000—A. B. C. Ford starter—Jan.

Jordan Motor Car Co., Cleveland, Ohio. Capital, $800,000—Jordan cars—Jan.

Liberty Motor Car Co., Detroit, Mich. Capital, $400,000—Liberty car—Feb.

Harding Motor Car Co., Cleveland, Ohio. Harding Twelve—Jan.

Columbia Motors Co., Detroit, Mich. Columbia car—Feb.

American Motors Corp., Plainfield, N. J. Capital, $1,250,000—American car—Feb.

States Motor Car Mfg. Co., Kalamazoo, Mich. Capital, $600,000—States car—Feb.

Castaluminum Body Co., Detroit, Mich. Capital, $100,000—Aluminum bodies—March.

Fergus Motors of America, New York. Capital, $2,000,000—Fergus car—March.

Roto Motor Co., Hannibal, Mo. Capital, $350,000—Roto truck—March.

Twin City Four Wheel Drive Mfg. Co., St. Paul, Minn. Capital, $1,000,000—Trucks—March.

Perlman Rim Corp., New York. Capital, $10,000,000—Demountable rims—March.

Covert Gear Co., Lockport, N. Y. Capital, $1,000,000—Trucks and tractors—April.

Union Tire & Rubber Co., St. Louis, Mo. Capital, $500,000—Tires—March.

Premier Motor Corp., Indianapolis, Ind. Capital, $2,500,000—Premier car—April.

Bournonville Motors Corp., New York. Bournonville rotary valve motors—April.

Day-Elder Motors Co., Newark, N .J. Capital, $100,000—Day-Elder trucks—April.

J. & D. Tire & Rubber Co., Charlotte, N. C. Capital, $500,000—J. & D. tires—April.

Kerosene Carbureter Co., Pittsburgh, Pa. Harroun kerosene carbureter—April.

Ohio Gas Generator Co., Columbus, Ohio. Webber kerosene vaporizer—April.

Warner Lens Co., Chicago, Ill. Warner glass lens—April.

United Motor Fuel Corp., New York. Capital, $25,000—Gasoline—April.

Essex Motor Truck Co., New York. Capital, $600,000—Ranier truck—June.

S. S. E. Co., Philadelphia, Pa. Capital, $5,000,000—S. S. E. car—June.

Comet Automobile Co., Rockford, Ill. Capital, $1,000,000—Comet car—June.

Higrade Motors Co., Buffalo, N. Y. Capital, $250,000—Higrade truck—June.

Gillette Motor Co., Mishawaka, Ind. Wilmo rotating sleeve motor—July.

Aland Motor Car Co., Detroit, Mich. Capital, $500,000—Aland car—July.

Nash Motors Co., Kenosha, Wis. Capital, $24,999,500—Jeffery car—July.

Enger Motor Car Co., Cincinnati, Ohio. Capital, $4,000,000—Enger car—Aug.

Phianna Motor Co., Newark, N. J. Capital, $500,000—Phianna car—Aug.

General Engineering Co., Detroit, Mich. Capital, $200,000—Doble steamer—Aug.

Metropolitan Motors, Inc., New York. Capital, $1,000,000—White Star truck—Aug.

Westgard Tire & Rubber Co., Warren, Ohio. Capital, $1,500,000—Westgard tire—Aug.

Parker Collapsible Rim Corp., Cleveland, Ohio. Capital, $500,000—Rims—Aug.

Iowa Rubber Tire Co., Davenport, Iowa. Capital, $1,000,000—Tires—Aug.

A. Howard Co., Galion, Ohio. Capital, $500,000—Howard car—Sept.

Auto Crank Shaft Corp., Detroit, Mich. Capital, $1,000,000—Crankshafts—Oct.

Kent Motors Corp., Newark, N. J. Kent car—Sept.

Budd Wheel Corp., Philadelphia, Pa. Capital, $2,000,000—Steel and wire wheels—Oct.

Union Products Co., Rockford, Ill. Capital, $200,000—Parts and accessories—Sept.

Eastern Motors Syndicate, Hartford, Conn. Charter Oak car—Oct.

Harroun Motor Corp., Detroit, Mich. Capital, $10,000,000—Harroun car—Sept.

Cook Attachment Patents, Inc., New York. Capital, $10,000—Issues licenses on Cook patents—Sept.

United Truck & Equipment Co., Detroit, Mich. Capital, $400,000—to operate United Motor Truck Co.—Oct.

Olympian Motors Co., Pontiac, Mich. Capital, $1,000,000—Olympian car—Oct.

Pilgrim Motor Co., Portland, Me. Capital, $750,000—Pilgrim car—Oct.

Emerson Motors Co., New York. Capital, $10,000,000—Emerson car—April.

Dey Electric Corp., New York. Steinmetz electric car—Nov.

Lozier Bros. Co., Cleveland, Ohio. Capital, $10,000,000—Automobiles—Nov.

Brunswick M. C. Co., Newark, N. J. Capital, $500,000—Brunswick car—Nov.

Sterling Automobile Mfg. Co., Bridgeport, Conn. Ams—Sterling car—Nov.

Winther Motor Truck Co., Kenosha, Wis. Capital, $330,000—Winther truck—Nov.

Ball & Ball Carbureter Co., Detroit, Mich. Capital, $20,000—Ball & Ball carbureter—Nov.

A. C. Axle Mfg. Co., Philadelphia, Pa. Csptal, $1,000,000—Compensating driving axle—Nov.

Electro-Pneumatic Gearshift Corp., Pittsburgh, Pa. Electro-pneumatic gearshift—Dec.

Duryea Motors, Inc., Wilkes-Barre, Pa. Capital, $4,000,000—Duryea Gem—Dec.

Rahan Co., Detroit, Mich. Capital, $100,000—Ford starters—Dec.

Refinancing

Stutz Motor Car Co. of America, Indianapolis, Ind. (old name Stutz Motor Car Co.). Capital, 125,000 shares, n.p.v.

Mitchell Motors Co., Racine, Wis. (old name Mitchell-Lewis Motor Co.). Capital, 125,000 shares, n.p.v.

Scripps-Booth Co., Detroit, Mich., reorganized. Capital, $1,000,000.

Portage Rubber Co., Barberton, Ohio. Capital increased from $1,250,000 to $3,000,000.

Stromberg Carbureter Co. of America, Chicago, Ill. (old name Stromberg Motor Devices Co.). Capital increased from $50,000 to $5,000,000.

Republic Motor Truck Co., Alma, Mich. Capital increased from $852,219.98 to $1,312,500.

Redden Motor Truck Co., Detroit, Mich. Recapitalized at $500,000.

Enger Motor Car Co., Cincinnati, Ohio (old name Frank J. Enger Co.). Capital, $4,000,000, divided into $1,000,000 7 per cent pref. and $3,000,000 common.

Alliance Tire Co., Alliance, Ohio. Capital increased from $150,000 to $650,000.

Pennsylvania Rubber Co., Jeannette, Pa. Reincorporated with capital of $6,000,000. Previous capital $2,000,000.

Polack Truck Tyre Corp., Bridgeport, Conn. (old name Polack Tyre & Rubber Co.). Capital, 100,000 shares, n.p.v.

Abbott Corporation, Detroit, Mich. (old name Consolidated Car Co.). Capital increased from $500,000 to $1,250,000.

Torbenson Axle Co., Cleveland, Ohio (old name Torbenson Gear & Axle Co.). Capital, $1,750,000, divided into $1,000,000 preferred and $750,000 common.

McFarlan Motor Corp., Connersville, Ind. (old name McFarlan Motor Co.). Capital, $3,000,000.

General Motors Corp., New York (old name General Motors Co.). Capital, $102,600,000, divided into $82,600,000 common and $20,000,000 non-voting preferred. Preferred is 6 per cent cumulative.

Winton Co., Cleveland, Ohio. Capital issue of $1,500,000 7 per cent cumulative preferred.

Gramm-Bernstein Motor Truck Co., Lima, Ohio (old name Gramm-Bernstein Co.). Capital, $4,000,000, divided into $3,000,000 common and $1,000000 preferred.

Firestone Tire & Rubber Co., Akron, Ohio. Sale of $5,000,000 new preferred at 6 per cent.

Star Rubber Co., Akron, Ohio, reorganized. Capital increased from $200,000 to $400,000 preferred.

Fisk Rubber Co., Chicopee Falls, Mass. Capital increased from $15,000,000 to $39,500,000. New capital, $7,500,000 first preferred, $5,000000 second preferred, $12,000,000 common.

Hydraulic Pressed Steel Co., Cleveland, Ohio. Issue of $1,000,000 7 per cent cumulative preferred.

National Motor Car & Vehicle Corp., Indianapolis, Ind. (old name National Motor Vehicle Co.). Capital, 53,000 shares at $42.50 per share.

Raybestos Co., Bridgeport, Conn. (old name Royal Equipment Co.). Capital, $1,500,000.

Manhattan Electrical Supply Co., New York (no change in name). Capital, $5,000,000. First preferred, $1,500,000, 7 per cent cumulative. Second preferred, $500,000, 7 per cent cumulative. Common, $3,000,000.

International Motor Truck Corp., New York (former name International Motors Co.). Capital, $7,372,790. 71,043 shares, p.v. $100. 53,638 shares n.p.v.

Pierce-Arrow Motor Car Corp., Buffalo, N. Y. (old name Pierce-Arrow Motor Car Co.). Capital, 100,000 shares 8 per cent convertible preferred. 250,000 shares of common, n.p.v.

Monitor Motor Car Co., Columbus, Ohio (old name Cummins-Monitor Co.). Capital, $10,000.

Emil Grossman Mfg. Corp., New York (no change in name). Capital, $320,000. First preferred, $150,000. Second preferred, $160,000. Common, 10,000 shares, n.p.v.

Smith Motor Truck Corp., Chicago, Ill. (old name Smith Form-A-Truck Co).. Capital, 20,000 shares of 8 per cent cumulative and convertible preferred; 1,200,000 shares of common, p.v. $10.

Duplex Truck Co., Lansing, Mich. (old name Duplex Power Car Co.). Capital, $1,000,000.

Empire Tire & Rubber Corp., Trenton, N. J. (old name Empire Rubber & Tire Corp.). Capital, $6,000,000. Preferred, $1,500,000 7 per cent cumulative convertible. Common, $4,500,000, common p.v. $10.

Knickerbocker Motors, New York (old name Knickerbocker Motor Truck Mfg. Co.). Capital, $500,000 all common, p.v. $10.

Kokomo Tire Co., Kokomo, Ind. (old name Kokomo Rubber Co.). Capital, 100,000 shares, n.p.v.

Four Wheel Drive Automobile Co., Clintonville, Wis. Capital increased from $250,000 to $500,000.

Kelsey Wheel Co., Detroit, Mich. Capital increased from $1,000,000 to $1,500,000.

Ogren Motor Works, Waukegan, Ill. (old name Ogren Motor Car Co.). Capital, $1,000,000, from $25,000.

Sparks-Withington Co., Jackson, Mich. Capital increased from $300,000 to $1,000,000.

M. & S. Gear Co., Detroit, Mich. Capital increased from $1,000,000 to $1,750,000.

Hurlburt Motor Truck Co., New York. Capital increased from $150,000 to $450,000. $350,000 7 per cent preferred; $100,000 common.

Lancaster Tire & Rubber Co., Lancaster, Ohio (old name Midgley Tire & Rubber Co.). Capital increased from $550,000 to $850,000.

Goodyear Tire & Rubber Co., Akron, Ohio. Capital increased to $50,000,000. $25,000,000 preferred; $25,000,000 common.

Packard Motor Car Co., Detroit, Mich. Capital increased to $21,000,000. Preferred, $8,000,000; common, $21,000,000.

Garford Motor Truck Co., Lima, Ohio. Cap-

ital increased to $5,000,000. Common, $2,500,000; preferred, $2,500,000.

Autocar Co., Ardmore, Pa. Capital increased from $300,000 to $1,800,000.

Auto Body Co., Lansing, Mich. Capital increased from $500,000 to $1,000,000.

Republic Motor Truck Co., Alma, Mich. Capital increased from $250,000 to $1,000,000.

Elgin Motor Car Corp., Chicago, Ill., Capital increased from $1,000,000 to $3,500,000.

McCord Mfg. Co., Detroit, Mich. Capital increased from $1,000,000 to $2,500,000.

Cadillac Auto Truck Co., Cadillac, Mich. Capital increased from $100,000 to $200,000.

Willys-Overland Co., Toledo, Ohio. Capital increased from $25,000,000 to $75,000,000. $50,000,000 common. $25,000,000 pref.

Wyman & Gordon Co., Worcester, Mass. (no change in name). Capital increased to $3,000,000.

Mergers

Motor Products Corp., Detroit, Mich.
Includes: Rands Mfg. Co., Detroit.

Vanguard Mfg. Co., Detroit.
Diamond Mfg. Co., Detroit.
Universal Metal Co., Detroit.
Superior Mfg. Co., Ann Arbor, Mich.
Capital—100,000 shares, n.p.v.

Fisher Body Corp., Detroit, Mich.
Includes: Fisher Body Co., Detroit.
Fisher Closed Body Co., Detroit.
Fisher Body Co. of Canada, Ltd., Walkerville, Ont.
Capital—$5,000,000 7 per cent cumulative pref. 200,000 shares, n.p.v.

Elgin Motor Car Corp., Chicago, Ill.
Includes: New Era Motor Car Co., Joliet, Ill.

Willys-Overland, Ltd., Toronto, Ont.
Includes: Willys-Overland of Canada, Toronto.
Russell Motor Car Co., Toronto.

Edmunds & Jones Corp., Detroit, Mich.
Includes: Edmunds & Jones Mfg. Co., Detroit.
Canadian Lamp & Stamping Co.
Chicago Electric Mfg. Co., Chicago.
Capital—$1,000,000 of 7 per cent pref.; 5000 shares of common.

Corcoran-Victor Co., Cincinnati, Ohio.
Includes: Corcoran Lamp Co., Cincinnati.
Victor Lamp Co., Cincinnati.
Victor Auto Parts Co., Cincinnati.
Capital—$2,250,000. $750,000 pref. $1,500,000 common.

United Motors Corp., New York.
Includes: Perlman Rim Corp., New York and Jackson, Mich.
Dayton Engineering Laboratories Co., Dayton, Ohio.
Remy Electric Co., Anderson, Ind.
Hyatt Roller Bearing Co., Newark, N. J.
New Departure Mfg. Co., Bristol, Conn.
Lovell-McConnell Mfg. Co., Newark, N. J.
Harrison Radiator Corp., Lockport, N. Y.
Houk Mfg. Co., Buffalo.
Brown-Lipe-Chapin Co., Syracuse, N. Y.
Capital—1,200,000 shares n.p.v.

Steel Products Co., Cleveland, Ohio.
Includes: Steel Products Co., Cleveland.
Michigan Electric Welding Co., Detroit.
Metals Welding Co., Cleveland.
Capital—$4,000,000.

Signal-Commerce Motor Truck Co., Detroit, Mich.
Includes: Signal Motor Truck Co., Detroit.
Commerce Motor Car Co., Detroit.
Capital—600,000 shares, n.p.v.

Kelsey Wheel Co., Detroit, Mich.
Includes: Kelsey Wheel Co., Detroit.
Kelsey Wheel Co., Windsor, Ont.
Herbert Mfg. Co., Detroit.
Capital—$13,000,000. Pref., $3,000,000 7 per cent cumulative. Common, $10,000,000.

H. J. Koehler Motors Corp., Newark, N. J.
Includes: H. J. Koehler S. G. Co., Newark.
L. E. Schlotterback Mfg. Co., Newark.
Capital—$425,000.

Perfection Tire & Rubber Co., Chicago, Ill.
Includes: Perfection Tire & Rubber Co., Fort Madison.
Perfection Tire & Rubber Co., Ltd.
Champion Auto & Equipment Co.

Velie Motors Corp., Moline, Ill.
Includes: Velie Motor Vehicle Co., Moline.
Velie Engineering Co., Moline.
Capital—$2,000,000.

Standard Parts Co., Cleveland, Ohio.
Includes: Perfection Spring Co., Cleveland.
Standard Welding Co., Cleveland.
Capital—$35,000,000. Pref., $10,000,000 7 per cent cumulative. Common, $25,000,000.

Automobile Registrations for First 6 Months of Past 5 Years

State or Territory	1912	1913	1914	1915	1916
Alabama	3,970	5,170	7,500	11,800	19,977
Arizona	2,085	1,037	4,104	5,426	9,743
Arkansas	3,366	3,000	4,695	7,200	12,300
California	78,603	108,156	107,173	138,600	187,519
Colorado	11,083	9,300	16,500	21,588	38,000
Connecticut	15,400	19,005	24,530	34,199	45,731
Delaware	1,780	2,118	2,608	4,135	5,438
District of Columbia	10,000	10,829	14,964	8,500	5,268
Florida	4,964	8,361	9,578	12,493	25,000
Georgia	15,900	21,210	19,000	22,150	31,259
Idaho	4,080	2,700	2,588	5,928	10,909
Illinois	47,104	76,039	115,000	151,832	203,757
Indiana	46,826	61,712	56,500	81,208	116,121
Iowa	38,009	55,601	88,557	117,407	169,558
Kansas	9,917	27,000	39,889	59,485	89,223
Kentucky	3,500	8,256	6,376	14,820	24,725
Louisiana	6,067	6,898	2,500	4,000	13,594
Maine	16,835	8,540	12,000	16,865	24,027
Maryland	9,100	12,355	18,248	25,732	26,868
Massachusetts	42,000	52,193	64,717	76,168	105,488
Michigan	34,588	47,198	65,517	93,669	132,000
Minnesota	25,000	39,000	61,950	82,000	122,000
Mississippi	1,800	3,000	1,500	8,500	16,500
Missouri	20,579	32,088	45,147	64,460	83,742
Montana	3,329	3,759	3,181	11,000	19,580
Nebraska	28,791	42,451	55,989	60,000	80,959
Nevada	720	823	1,265	1,190	3,900
New Hampshire	5,000	6,023	8,266	10,422	14,837
New Jersey	42,632	36,666	50,002	58,179	75,420
New Mexico	1,989	1,500	2,416	3,695	6,226
New York	92,407	110,618	140,653	185,767	259,105
North Carolina	5,000	8,678	11,600	16,315	24,460
North Dakota	7,900	8,697	15,020	24,000	33,669
Ohio	56,000	74,625	105,000	152,950	208,705
Oklahoma	4,659	8,000	4,000	25,000	46,000
Oregon	8,872	11,929	14,629	20,419	26,110
Pennsylvania	52,257	66,488	109,174	128,062	189,082
Rhode Island	6,517	6,173	11,000	15,000	19,427
South Carolina	8,366	10,500	12,975	16,000	18,000
South Dakota	13,492	10,913	16,200	22,700	37,240
Tennessee	7,464	12,200	17,282	24,951	26,437
Texas	20,588	38,000	70,000	72,433	105,000
Utah	2,290	3,299	5,396	6,615	10,729
Vermont	3,632	4,655	6,548	9,489	12,272
Virginia	4,797	7,406	11,642	17,799	31,272
Washington	10,589	20,000	20,636	35,000	44,607
West Virginia	2,244	9,249	6,158	12,000	15,771
Wisconsin	21,965	29,750	45,000	70,490	99,000
Wyoming	2,328	4,478	2,034	3,262	5,900
Total	866,384	1,157,646	1,537,207	2,070,903	2,932,455

1916—A 100 M. P. H. Speed Era

All Records Broken—106.71 M. P. H. Reached—Three New Speedways—Resta Champion Driver

THE year 1916 will be recorded as a year of high speed contests on track and road. With tbe exception of the 300-mile race at Indianapolis, Decoration Day, when Resta's average was 83.99 m.p.h., as compared with 89.84 m.p.h., made by De Palma in 1915, all speedway records were broken. An average of 88.62 m.p.h. was recorded at all of the speedway races. In the fifteen championship award events an average speed of 92.45 m.p.h. was made. In ten of the speedway events this year, 100 m.p.h. or over was recorded. Whereas last year but seven drivers attained a speed of better than 100 m.p.h., 1916 saw twenty-one finishers with an average of better than 100 m.p.h. The fastest race of the year was the 20-mile Coney Island Cup Race, New York, on May 13, in which Aitken averaged 106.71 m.p.h. Aitken also has the honor of recording the long distance record of 105.95 m.p.h. for 100 miles, and 104.83 m.p.h. in the 250-mile Astor Cup Race, New York, Sept. 30. Both the Vanderbilt Cup and Grand Prize road races were featured by new records of 86.98 and 85.55 m.p.h., respectively.

498 Starters in 37 Events

This year there were 498 starters in tbe tbirty-seven races with 238 finishers. Last year 333 cars started in twenty-two races and 137 finished. Out of twenty-seven races on speedways, and including the Vanderbilt and Grand Prize road events, Aitken finished first in seven, Resta in six, De Palma in four, Rickenbacher in three, Wilcox three, and Mulford, D'Alene and Cooper, one each. D'Alene and Cooper took second tbree times eacb, and Hugbes, Milton, Lewis, Rickenbacher and Aitken each finished with two seconds to their credit. Lewis entered more races than any other driver, having participated in twenty-one events and placing in twelve. Rickenbacher entered nineteen races, took three firsts, two seconds, two thirds, one fourth and was unplaced in eleven. Resta enjoyed the distinction of winning every event in which he finished.

$243,781 in Prize Money

The distribution of prize money this year was lower than in 1915, a total of $243,781 being given in twenty-five of the main speedway events, and the two big road events, the Vanderbilt and Grand Prize. This compares with $282,000 in 1915. Of this total, Dario Resta, the champion driver of the year, received $44,400 in prize money, $5,000 of the Goodrich and $2,000 of the Bosch prize money and the $1,000 silver trophy of the latter. Aitken, who finished second in the championship award, received $30,206 in prize money. Rickenbacher was third with $20,050, wbile De Palma won $15,454 and D'Alene, $15,394. Tbese five were the only drivers to win in excess of $10,000. By winning fourteen firsts the Peugeot won first honors for the year. Three new speedways were opened in 1916 at Kansas City, Cincinnati, and Uniontown. The latter is a 1⅛-mile board track. The Kansas City speedway is a 1⅛-mile dirt track. Cincinnati opened a 2-mile board oval; and Uniontown, Pa., a 1⅛-mile board track.

Records in 1916 Speedway and Road Races

Barney Oldfield, driving the Christie, broke the speedway record in the Ventura trophy race on the Ascot speedway March 19, turning a lap in 45 sec. flat.

Bob Burman, driving a Peugeot, from a standing start, made a lap in 58 1/5 sec., which made a new record. This was also at the Ascot speedway, March 19.

John Aitken, driving a Peugeot, established a new world's record in the 20-mile event at Sheepshead Bay, May 13. His time was 11:15, or at an average speed of 106.71 m.p.h., lowering the record made by Resta on the same track in 1915, namely, 11:40.92.

R. R. Duff set amateur's speedway lap record of 94 m.p.h. on Chicago speedway, May 21.

Barney Oldfield, driving his Christie, circled the Chicago speedway in 1 min. 3¾ sec., or at 113 m.p.h.

Dario Resta set new record for Chicago speedway, June 11, his time being 3 hr. 2 min. 31.64 sec. for the 300-mile event, or at a speed of 98.61 m.p.h. Resta also broke the record made by Porporato last year for 100 miles, which was 1 hr. 28 sec., his time being 59 min. 34.7 sec. Resta bettered his time or 2 hr. 2 min. 17 sec. for 200 miles last year by a second.

June 10 Ralph De Palma established a new American record for distance covered in 1 hr., driving on a speedway track, when in the 60 min. he covered 93.72 miles. The record was made on the Chicago speedway between qualifying trials for the annual derby.

In a dual meet with Ralph De Palma at the Chicago speedway, June 18, Dario Resta established new American records for 10, 24 and 50 miles. His mark of 96 m.p.h. for the 50-mile broke the record of 88.87 m.p.h. set by Christiaens in 1914. The new records for the 10-mile and 24-mile are 102.5 and 105.1 m.p.h. respectively.

Harry Hurtz, driving a Houk Special, broke the mile record for cars under 231 cu. in. when he turned the mile oval at Ascot in 54 sec., June 27.

Harold Brinker, driving a Cadillac eight, July 4, lowered former record for 132-mile road race from Denver to Laramie, Wyo., by 33 min., his time being 2 hr. 55 min. 10 sec.

Dario Resta set record of 1 hr. 30 min. 43 sec. for 150 miles on 1¼-mile tracks at Omaha, July 15.

Eddie Rickenbacher, driving the Maxwell, broke the world's 25-mile record at Omaha, July 9, his time being 14:36.47, against 17:30.4, made by Oldfield at Indianapolis in 1914.

Dario Resta, driving the Peugeot, broke the world's 5-mile record at Omaha, July 9, his time being 2:44.82, against 3:11.75, made by Bragg at Los Angeles in 1912.

W. Rader, driving a Packard racing test car, fitted with a twelve-cylinder aviation engine, broke previous track record at Indianapolis, Aug. 2, turning the 2½-mile oval in 1:29:32, an average speed of 100 m.p.h.

Aitken broke world's 250-mile record at Sheepshead Bay, Sept. 30, driving a Peugeot at an average speed of 104.83 m.p.h. The previous record was made by Resta on the Chicago speedway, namely, 2:33:31/16.

In October Ralph De Palma was granted an official 50-mile speedway record for his performance on the Omaha 1¼-mile track, his time being 29:02.47, or at a speed of 103.45 m.p.h. The previous record was held by Resta with a time of 81:57.40.

Aitken broke 100-mile record at Sheepshead Bay, Oct. 28, driving a Peugeot at an average speed of 105.95 m.p.h.

A new record for the grand prize race was set at Santa Monica, Nov. 18, when a Peugeot, piloted twenty laps of the 8.04-mile course by Howard Wilcox and the remaining twenty-eight by Aitken, won the race in 4:42:47, or at an average speed of 85.59 m.p.h., lowering the former record of 77.20 m.p.h. made by Pullen in 1914.

A. H. Patterson, driving a Hudson super-six, set a new world's record for non-stop road race of 403 miles at an average of 78.13 m.p.h. at Santa Monica, Nov. 18.

In the Vanderbilt Cup race at Santa Monica, Nov. 16, Dario Resta established an average of 86.9897 m.p.h. for 294.0355 miles, or thirty-five laps of the 8.041-mile circuit, a new record for both the Vanderbilt and the Santa Monica course over which Tetzlaff in 1912 averaged 78.72 m.p.h. for 302 miles.

Factory Additions Total 9,362,881 Square Feet in 1916

Partial Returns Show Large Expansion in All Branches of Manufacture—Additions and New Equipment Cost $17,682,255

PARTIAL, though fairly complete, returns in a census conducted by THE AUTOMOBILE throughout all branches of the automobile, motor truck, accessory and allied industries show that during the year 1916 nearly 10,000,000 sq. ft. were added to factories at a cost of approximately $10,000,000, while new machine equipment, etc., added during the year amounted to over $8,000,000. Although complete cost figures are not available, the total outlay for enlarged and improved manufacturing facilities, as indicated by the census returns, represents a total of over $20,000,000, the exact amount of expenditures given being $17,682,265.

Last year the extent of floorspace added was slightly larger according to the partial returns made in the census conducted at that time, giving a total of 11,142,508 sq. ft. for the 12 months of 1915. However, the expenditures for these additions last year total only $8,251,755, or over $1,000,000 less than was expended by manufacturers during 1916 for additional floorspace. Moreover, the expenditure for new equipment last year was only $4,770,590, only a little more than half of the outlay during 1916 when $8,233,190 was devoted to this purpose. As indicated by last year's returns the total cost of increased factory facilities was $12,886,342, as compared with $17,682,255.

These figures are so tremendous in themselves that they do not convey a full understanding of the enormous expansion which has characterized the industry during the past 12 months. To bring this out a little more strongly a few graphic illustrations may be of value. For example, if the entire extent of the floorspace added to automobile, truck and accessory factories this year were to be contained in a single one-story building 100 ft. wide, this would be nearly 18 miles in length. To give an idea of the magnitude of the sums expended for increased factory facilities this year, if the $9,449,065, which went for factory additions, were converted into silver dollars and piled one on top of another, the column would reach over 18 miles in height. As for the $8,233,190 in added equipment, if this were treated in the same manner it would attain a height of 16 miles, so that the total expenditure, if it could be imagined in such a form, would represent a column 34 miles high. If paper dollars were used and placed end to end, the $17,682,255 would form a band about 2040 miles in length, or over twice the distance from New York to Chicago and two-thirds of the distance across the United States from coast to coast.

Many Large Additions

Taking up the additions made by the automobile manufacturers, 3,775,776 sq. ft. were added by forty-one companies at a cost of $2,312,000, and equipment representing an outlay of $1,321,023 brought the total expenditure up to $3,633,023. Willys-Overland added half a million square feet, as did Apperson; Hudson added 484,392; Haynes 350,000; Velie 200,000, and Reo 176,294. Unfortunately cost statistics for a number of the largest additions are not available so that the total is far lower than it should be. Similarly in numerous other cases the cost of the additions is given, but the number of square feet of floorspace added is not furnished, so that it can be easily seen that this total is also below its actual value. Of the expenditures cited in the table herewith the $386,000 spent by Premier on new equipment for its large factory is of interest. Apperson's new factory group cost $300,000 and Briscoe's addition $250,000, with another $200,000 expended for equipment. Haynes spent a round half million, equally divided between factory additions and new equipment; and White paid $200,000 for enlarged manufacturing room.

Truck Makers Expand Plants

In the commercial vehicle field large additions have been made in many factories which failed to send in returns, but the total of 278,017 sq. ft. added by some twenty concerns is a fair indication of the marked expansion taking place throughout the entire industry. These additions were made at an expense of considerably more than the $150,000 given in the returns, as will be noted by referring to the numerous blank spaces in this column of the tabulation. In the way of added equipment the returns were a little more complete, making a total of $272,500, the largest item of which is the $75,000 spent by the H. J. Koehler Motors Corp. The largest increase of factory space in this division, according to the returns, has been made by the Gramm-Bernstein Motor Truck Co., which is credited with the addition of 75,000 sq. ft. constructed at a cost of $27,000. This company also expended $70,000 for new equipment, making the total expenditure for the purpose of increasing and facilitating production $97,000. Other truck manufacturers who have made notable additions to their factory and equipment during the year are: Kleiber & Co., Inc., 46,000 sq. ft., costing $75,000; Cadillac Auto Truck Co., 33,792 sq. ft., and Republic Motor Truck Co., 30,000 sq. ft.

Tractor and trailer companies have increased their facilities as might be expected from the development of their respective fields during 1916. Reports from only three tractor manufacturers show 28,000 sq. ft. added at a cost of $251,000, an expenditure of $108,500 bringing the total for these three concerns alone to $359,500.

Engine Builders Increase Facilities

Nine engine manufacturers report 406,740 sq. ft. of additional floorspace during the past 12 months, partial returns showing the additions of only five concerns cost $247,000 and the new equipment increased this expenditure by eight concerns to $1,033,000, the equipment installed by these companies during the year amounting to $786,000.

Axle makers added 74,600 sq. ft. and $166,000 of new equipment and the carbureter manufacturers, although recording only 18,600 sq. ft. of additional floorspace, spent $106,000 for new machinery, etc. Bearing makers added 81,200 sq. ft., this including reports from only two companies, the U. S. Ball Bearing Mfg. Co. spending $160,000 for 80,000 sq. ft. Four bearing makers added $321,000 worth of new equipment.

In the body field three companies added over 100,000 sq. ft., the Auto Body Co., Dayton Body Co. and W. S. Seaman Co. In this division 494,588 sq. ft. of floorspace was added by thirteen companies, total expenditures for buildings and equipment being $570,800.

The largest addition reported by wheel manufacturing

concerns is that of W. K. Prudden & Co., which spent $250,000 in securing 185,000 sq. ft. Ten companies added 319,230 sq. ft. and $289,000 worth of new machinery at a total expenditure of $695,700.

Tire makers added nearly a million sq. ft. during the year, the total for nineteen companies being 914,400 sq. ft., costing $2,195,000, the $621,100 worth of additional machinery bringing the total spent to $2,816,100.

Parts makers added nearly as much space as the tire manufacturers, the total for thirty-five companies being 767,165 sq. ft. costing $930,000, while they spent twice as much for new equipment as reported by the tire factories, the $1,305,000 expended for this making the total expenditu parts makers $2,235,000.

The accessory field naturally reports the largest incr in all respects, adding 2,201,565 sq. ft., the cost figures given totaling $2,350,865, and the $2,722,767 spent for added equipment makes the total outlay for expansion as reported by 134 concerns in this branch of the industry $5,073,632. Some of the largest items which might be mentioned are the 375,000 sq. ft. added by Stewart-Warner and costing with equipment $885,000; 180,500 sq. ft. added by Prest-OLite; 130,000 by Bosch and 120,650 added by the American Auto Trimming Company.

A Summary of the Principal Factory Additions

Cost of New Facilities, Including Additional Equipment Required by the Industry in 1916

AUTOMOBILES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Alter Motor Car Co	51,600	$45,000	....	$45,000
Apperson Bros	500,000	300,000	....	300,000
Auburn Automobile Co	48,000	18,000	....	18,000
Autocar Co	85,000	....	....	....
Babcock Co., H. H	87,126	....	....	....
Baker R. & L. Co	1,000	3,500	$35,723	39,223
Bartholomew Co	....	....	40,000	40,000
Bimel Automobile Co	500	500	250	750
Briscoe Motor Corp	....	250,000	200,000	450,000
Chalmers Motor Co	156,000	....	....	....
Crow-Elkhart Motor Co	75,100	80,000	27,000	107,000
Dodge Bros	....	340,000	....	340,000
Dort Motor Car Co	....	60,000	....	60,000
Fargo Motor Car Co	....	....	350	350
Franklin Mfg. Co., H. H	143,000	....	....	....
Haliaday Co., L. P	....	....	12,000	12,000
Haynes Automobile Co	350,000	250,000	250,000	500,000
Hudson Motor Car Co	484,392	....	....	....
Jordan Motor Car Co	30,000	....	20,000	20,000
Kent Motors Corp	....	....	50,000	50,000
King Motor Car Co	....	20,000	10,000	30,000
Kissel Motor Car Co	....	100,000	75,000	175,000
Kline Car Corp	....	....	2,000	2,000
Lexington-Howard Co	30,000	50,000	3,500	53,500
Madison Motors Co	175,000	....	....	....
Moore Motor Co	6,000	....	....	....
National Motor Car & Veh. Corp.	68,400	125,000	50,000	175,000
Oakland Motor Car Co. of Mich.	132,300	150,000	....	150,000
Ogren Motor Wks	45,000	120,000	5,000	125,000
Packard Motor Car Co	90,000	....	....	....
Pilot Motor Car Co	50,000	10,000	2,000	12,000
Premier Motor Corp. of N. Y.	....	....	386,000	386,000
Reo Motor Truck Co	176,294	....	....	....
Saxon Motor Car Corp	150,000	10,000	5,000	15,000
Singer Motor Co., Inc	2,500	....	2,200	2,200
Stanley Motor Carriage Co	....	....	10,000	10,000
Stutz Motor Car Co	65,300	100,000	50,000	150,000
Velie Motors Corp	200,000	80,000	75,000	155,000
White Co	73,264	200,000	....	200,000
Willys-Overland Co	500,000	....	....	....
Woods Motor Vehicle Co	....	....	10,000	10,000
Total	3,775,776	$2,312,000	$1,321,023	$3,633,023

COMMERCIAL VEHICLES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Available Truck Co	3,000	$2,000	$500	$2,500
Beck Automobile Wks	....	....	2,000	2,000
Bessemer Motor Truck	....	....	2,000	2,000
Burford Motor Truck Co	12,000	....	7,500	7,500
Cadillac Auto Truck Co	33,792	....	....	....
Denby Motor Truck Co	....	....	50,000	50,000
Diamond T Motor Car Co	20,000	....	....	....
Four Wheel Drive Auto Co	27,000	....	15,000	15,000
Gary Motor Truck Co	....	....	1,000	1,000
General Motor Truck Co	....	....	25,000	25,000
Gramm - Bernstein Motor Truck Co.	75,000	27,000	70,000	97,000
Indiana Truck Co	....	....	6,000	6,000
Kleiber & Co., Inc	46,000	75,000	5,000	80,000
Koehler Motors Corp., H. J.	....	....	75,000	75,000
Larrabee-Deyo Motor Truck Co.	7,100	6,000	4,000	10,000
Lewis Hall Iron Wks	1,000	....	....	....
Moreland Motor Truck Co	....	....	5,500	5,500
Republic Motor Truck Co	30,000	....	....	....
Rowe Motor Mfg. Co	10,000	....	2,000	2,000
Zeitler & Lamson Truck Co	13,125	40,000	2,000	42,000
Total	278,017	$150,000	$272,500	$422,500

TRACTORS

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Ford Tractor Co., Inc	18,000	....	$5,000	$5,000
Brillon Iron Works	....	$1,000	3,500	4,500
Sweeney Tractor Co	10,000	250,000	100,000	350,000
Total	28,000	$251,000	$108,500	$359,500

TRAILERS

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Detroit Trailer Co., Inc	....	....	$3,000	$3,000
Michigan Auto Trailer Co	3,000	....	1,500	1,500
Warner Mfg. Co	....	....	5,000	5,000
Total	3,000	....	$9,500	$9,500

ENGINES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Buda Co	50,000	$105,000	$175,000	$280,000
Continental Motors Co	30,000	....	....	....
Davis Mfg. Co	35,000	60,000	80,000	140,000
Duesenberg Motor Co	10,000	....	14,000	14,000
Lycoming Foundry & Mach. Co.	39,000	60,000	70,000	130,000
Rutenber Motor Co	....	10,000	300,000	310,000
Teetor-Hartley Motor Co	8,640	12,000	10,000	22,000
Van Blerck Motor Co	1,100	....	97,000	97,000
Weidely Motors Co	233,000	....	40,000	40,000
Total	406,740	$247,000	$786,000	$1,033,000

AXLES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Empire Axle Co	54,600	....	$25,000	$25,000
Torbensen Axle Co	15,000	....	110,000	110,000
Walker Weiss Axle Co	5,000	$10,000	25,000	35,000
Zeigler Mfg. Co	....	....	6,000	6,000
Total	74,600	$10,000	$166,000	$176,000

CARBURETERS

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Breeze Carbureter Co	10,000	$18,000	$13,500	$31,500
Fiechter & Co., L. V	....	....	2,500	2,500
H & N Carbureter Co	5,000	....	20,000	20,000
Master Carbureter Corp	....	....	10,000	10,000
Shakespeare Co	3,600	....	15,000	15,000
Stromberg Motor Devices Co.	....	....	25,000	25,000
Zenith Carbureter Co	....	40,000	20,000	60,000
Total	18,600	$58,000	$106,000	$164,000

BEARINGS

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Ahlberg Bearing Co	1,200	....	$5,000	$5,000
Lumen Bearing Co	....	$12,500	41,000	53,500
Schafer Ball Bearing Co., Inc.	....	....	75,000	75,000
U. S. Ball Bearing Mfg. Co	80,000	160,000	200,000	360,000
Total	81,200	$172,500	$321,000	$493,500

BODIES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Auto Body Co	174,240	$200,000	$50,000	$250,000
Collins V. W. Co., R. N	20,000	35,000	35,000	70,000
Dayton Body Co	107,000	40,000	300	40,300
Fleetwood Metal Body Co	63,000	60,000	5,000	65,000
Fry Brothers Mfg. Co	4,000	....	800	800
Griswold Motor & Body Co	....	....	4,000	4,000
Hayes-Ionia Co.	15,800	6,000	36,000	42,000
Metropolitan Auto & Crg. Co.	....	....	50,000	50,000
Monroe Body Co	1,548	....	....	....
Motor Truck Body Co	4,000	20,000	2,000	22,000
New Haven Carriage Co	5,000	5,000	6,000	11,000
W. Pfeiffer Auto & Crg. Wks.	....	....	700	700
Seaman Co., W. S	100,000	....	15,000	15,000
Total	494,588	$366,000	$204,800	$570,800

WHEELS

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Baltimore Hub Wheel & Mfg. Co.	....	....	$2,000	$2,000
Bimel Spoke & Auto Wheel Co.	....	$16,000	17,000	33,000
Craftsman Motor Corp	24,000	....	70,000	70,000
Hayes Motor Truck Wheel Co.	1,500	700	20,000	20,700
Great Western Mfg. Co	20,000	10,000	10,000	20,000
National Wire Wheel Wks., Inc.	....	....	45,000	45,000
Sewell Cushion Wheel Co	33,730	100,000	15,000	115,000
Spranger Wire Wheel Co	30,000	....	25,000	25,000
Mutual Wheel Co	25,000	30,000	25,000	55,000
Prudden & Co., W. K	185,000	250,000	60,000	310,000
Total	319,230	$406,700	$289,000	$695,700

A Summary of the Principal Factory Additions

TIRES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Ajax Rubber Co., Inc.	100,000	$350,000	$200,000	$550,000
American Auto Tire Co., Inc.	....	90,000	....	90,000
Brunswick Balke-Collender Co.	40,000	....	....	....
Colorado Tire & Leather Co.	....	18,000	50,000	68,000
Firestone Tire & Rubber Co.	....	105,000	....	105,000
Falls Rubber Co.	450,000	....	30,000	30,000
Goodrich Co., B. F.	....	500,000	....	500,000
Goodyear Tire & Rubber Co.	....	750,000	....	750,000
International India Rubber Corp.	30,000	25,000	....	25,000
International Rubber Co.	....	14,000	37,100	51,100
Keystone Tire Co., Inc.	34,200	....	....	....
Leather Tire Goods Co.	....	....	1,000	1,000
McCreary Tire & Rubber Co.	....	1,000	....	1,000
Mohawk Rubber Co.	28,000	100,000	150,000	250,000
Michelin Tire Co.	150,000	....	....	....
Morgan & Wright Co.	45,000	....	....	....
National Rubber Filler Co.	7,200	12,000	3,000	15,000
Republic Rubber Co.	....	200,000	....	200,000
Star Rubber Co.	30,000	30,000	150,000	180,000
Total	914,400	$2,195,000	$621,100	$2,816,100

PARTS

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
American Brass Fdry. Co.	50,000	....	$1,500	$1,500
American Brass & Iron Co.	....	....	1,000	1,000
Armstrong Rubber Co., Inc.	....	....	5,000	5,000
Bunting Brass & Bronze Co.	6,000	$8,000	10,000	18,000
C. A. S. Products Co.	....	....	10,000	10,000
Champion Mach. & Forging Co.	20,000	35,000	75,000	110,000
C. Cowles Co.	....	....	6,000	6,000
Cotta Transmission Co.	27,000	....	....	....
Crum Wiley Mfg. Co.	....	....	1,000	1,000
Dann Products Co.	30,000	....	25,000	25,000
Detroit Forging Co.	50,000	50,000	25,000	75,000
Doehler Die Casting Co.	90,000	150,000	30,000	180,000
Eccles Co., Richard.	....	1,000	1,800	2,800
Ford-Clark Co.	....	....	15,000	15,000
Frost Gear & Forge Co.	6,000	10,000	55,000	65,000
Fuller & Sons Mfg. Co.	25,000	50,000	75,000	125,000
Ganschor Co., Wm.	8,500	....	40,000	40,000
Hoosier Auto Parts Co.	....	....	26,000	26,000
Indianapolis Brass Co.	....	....	2,500	2,500
Metal Auto Parts Co.	40,000	....	20,000	20,000
Murray Mfg. Co.	100,000	155,000	50,000	205,000
M & L Corp	20,000	....	200,000	200,000
National Bronze & Alum. Fdry. Co	20,000	25,000	12,000	37,000
New Process Gear Corp.	120,000	350,000	400,000	750,000
Oakes Co.	20,000	....	50,000	50,000
Ohio Forge Co.	....	....	25,000	25,000
Peru Auto Parts Mfg. Co.	5,000	3,000	5,000	8,000
Pneumatic Spring Co.	4,500	....	....	....
Puritan Machine Co.	15,000	20,000	5,000	25,000
S. A. Machine Co.	9,000	8,000	12,000	20,000
Thiery & Kendrick Mfg. Co.	....	....	6,000	6,000
Torbensen Gear & Axle Co.	50,000	....	....	....
Universal Car Equipment Co.	....	....	5,200	5,200
Warner Gear Co.	40,000	50,000	100,000	150,000
Wisconsin Aluminum Fdry. Co.	11,165	15,000	10,000	25,000
Total	767,165	$930,000	$1,305,000	$2,235,000

ACCESSORIES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Adame Truck Fdry. & Mach. Co.	....	....	$50,000	$50,000
American Auto Trimming Co.	120,650	....	....	....
American Lava Co.	7,500	....	....	....
American Soap & Washoline Co.	....	....	4,500	4,500
Anchor Corrugating Construction Co.	1,500	$3,500	1,500	5,000
"Angier's"	....	....	8,000	8,000
Atlas Welding Wks.	....	....	500	500
Auburn Ignition Mfg. Co.	300	....	....	....
Automobile Crank Shaft Corp.	19,800	50,000	100,000	150,000
Badger Brass Mfg. Co.	....	....	10,000	10,000
Benford Mfg. Co.	14,000	18,000	28,000	46,000
Bernz, Otto	5,000	2,000	500	2,500
Bosch Magneto Co.	130,000	....	....	....
Butler Mfg. Co.	....	....	5,000	5,000
Carr Fastener Co.	7,500	20,000	75,000	95,000
C & E Mfg. Co., Inc.	2,200	8,500	2,000	10,500
Champion Ignition Co.	23,000	75,000	59,000	134,000
Champion Spark Plug Co.	55,000	....	....	....
Chicago Metal Mfg. Co.	4,000	....	2,000	2,000
Cincinnati Ball Crank Co.	22,500	40,515	65,231	105,746
Cincinnati Elec. Co	5,000	....	6,000	6,000
Cincinnati Screw Co.	12,800	....	100,000	100,000
Cleveland Battery & Elec. Co.	20,000	....	17,000	17,000
Columbia Smelting & Ref. Wks.	14,000	....	76,600	76,000
Columbian Brass Fdry.	400	....	6,000	6,000
Commercial Machine Co.	1,000	....	7,000	7,000
Cortland Carriage Goods Co.	60,000	125,000	60,000	185,000
Crabill Hose Clamp Co.	....	....	1,000	1,000
Detroit Battery Co.	25,000	....	....	....
Detroit Stamping Co.	....	....	2,500	2,500
Diamond Chain & Mfg. Co.	10,000	10,000	25,000	35,000
Ditwiler Mfg. Co.	....	....	4,000	4,000
Dunkirk Corp.	....	....	1,500	1,500
Edmunds & Innes Corp.	35,000	50,000	25,000	75,000
Esco Mfg. Co.	....	....	1,500	1,500
Essex Storage Battery & Supply Co.	4 000	....	4,000	4,000
Fisher Mfg. Co.	7,000	....	10,000	10,000
Fostoria Screw Co.	15,000	....	25,000	25,000
Fyr-Fyter Co.	....	....	7,500	7,500
Geisel's Perfection Endless Web Belt	14,800	....	500	500
Gem Stamped Steel Co.	4,800	....	....	....
Gemco Mfg. Co.	15,000	....	....	....
General Aluminum & Brass Mfg. Co.	15,000	20,000	62,000	82,000
Globe Machine & Stamping Co.	16,000	20,000	15,000	35,000
Globe Shirt & Overall Co.	7,200	12,000	3,500	15,500
Glover Equipment Co.	6,000	3,000	1,000	4,000
Golde Patent Mfg. Co.	10,000	....	....	....
Grier Pressed Steel Co.	....	....	250,000	250,000
Grinden Art Metal Co.	....	....	10,000	10,000
Grossman Mfg. Corp., Emil.	15,000	....	....	....
Grus Leaf Spring Oiler Co.	3,000	5,000	5,000	10,000
Hall Lamp Co., C. M.	15,000	....	....	....
Harcla Research Co.	....	....	250	250
Henning & Sons, V.	6,000	8,000	....	8,000
Hill Insulating & Mfg. Corp.	4,500	....	18,000	18,000
H G Chemical Products Co.	38,000	....	....	....
Hollhan Mfg. Co.	25,000	80,000	15,000	95,000
Hollands Mfg. Co.	1,300	1,000	5,000	6,000
Horat Co., J.	....	....	5,000	5,000
Houpert Machine Co.	10,800	....	60,000	60,000
Imperial Brass Mfg. Co.	....	....	30,000	30,000
Interstate Electric Co.	24,000	....	....	....
Inter-State Machine Products Co.	....	....	3,600	3,600
Isaacson Co., L. G.	5,300	5,500	....	5,500
Alexander Mfg. Co., J.	5,000	....	10,000	10,000
Catherman Mfg. Concern, J. A.	8,000	....	....	....
Kellogg Mfg. Co.	15,000	28,000	25,000	53,000
Kinsler Bennett Co.	3,000	....	30,000	30,000
Kilborn-Sauer Co.	10,000	....	2,500	2,500
Kokomo Electric Co.	7,500	10,000	15,000	25,000
Koven & Bro., L. O.	5,000	....	....	....
Levy Motors Co., James.	16,000	....	1,200	1,200
Limousine Top Co.	54,000	....	4,000	4,000
London Auto Supply Co.	10,000	....	2,000	2,000
McRae & Roberts.	....	....	5,000	5,000
Michigan Hearse & Mtr. Co.	20,000	15,000	1,500	16,500
Michigan Motor Specialties Co.	....	....	15,000	15,000
Modern Elec. & Mach. Co.	3,825	12,000	12,000	24,000
Morse Chain Co.	40,000	40,000	39,000	79,000
Moto-Meter Co., Inc.	16,000	....	10,000	10,000
Muskegon Motor Specialties Co.	13,000	10,000	100,000	110,000
Mutual Electric & Mach. Co.	....	....	25,000	25,000
National Can Co.	20,000	....	....	....
National Elec. Welder Co.	19,000	....	20,000	20,000
National Mfg. Co.	1,000	....	4,000	4,000
National Motor Supply Co.	50,000	....	6,000	6,000
Newark Stamping & Fdry. Co.	10,000	5,000	2,000	7,000
Nilson-Miller Co.	1,750	5,000	....	5,000
Northwestern Chemical Co.	13,000	25,000	3,000	28,000
Ohio Metal Products Co.	10,800	25,000	25,000	50,000
Perkins-Campbell Co.	15,000	10,000	....	10,000
Pittsfield Spark Coil Co.	....	....	1,000	1,000
Piston Ring Co.	6,000	75,000	40,000	115,000
Prest-O-Lite Co.	180,500	375,000	75,000	450,000
Pullau Steel Spring Co.	....	....	3,000	3,000
Reade Mfg. Co.	....	....	5,000	5,000
Remy Electric Co.	36,000	90,000	70,000	160,000
Rens Bros. Co.	1,600	4,500	11,000	15,500
Reilly Co., John	....	....	10,000	10,000
Reliance Co.	....	....	7,500	7,500
Retlaw Mfg. Co.	10,000	25,000	7,500	32,500
Rock Island Mfg. Co.	10,000	8,000	20,000	28,000
Romort Mfg. Co.	....	10,000	5,000	15,000
Saginaw Steel Metal Wks.	....	....	5,000	5,000
Scherer & Co., H.	60,000	75,000	....	75,000
Sevison Electric Co.	....	....	26,000	26,000
Schilling Co., S. F.	1,250	....	3,000	3,000
Sloan & Chase Mfg. Co., Ltd.	14,000	4,750	18,500	23,250
Stewart-Warner Speedometer Corp.	375,000	600,000	285,000	885,000
Splitdorf Elec. Co.	110,000	....	....	....
Spiro Mfg. Co., C.	....	....	12,000	12,000
Steel Products Co.	....	200,000	190,000	390,000
Swan Mfg. Co.	6,000	15,000	11,000	26,000
Syracuse & Elbridge Glove & Mitten Co.	....	....	500	500
Tegufilm Chemical Mfg. Co., Inc.	1,000	....	....	....
Triple Action Spring Co.	9,150	30,000	800	30,800
Troy Carriage Sun Shade Co.	....	....	10,000	10,000
Trump Mfg. Co.	1,580	8,000	10,000	18,000
Tutten Machine & Vise Co.	....	....	35,000	35,000
U. S. Light & Heat Corp.	....	....	72,839	72,839
United States Welding Co.	3,000	500	500	1,000
Universal Machine Co.	3,000	....	40,000	40,000
Universal Motor Prod. Co.	....	....	10,000	10,000
Van Cleef Bros.	5,000	....	....	....
Veeder Mfg. Co.	....	....	2,000	2,000
Wainwright Eng. Corp.	14,000	10,000	15,000	25,000
Weaver Mfg. Co.	11,000	....	....	....
Wells Mfg. Co., R. C.	....	....	3,750	3,750
Webster & Perks Tool Co.	....	....	35,000	35,000
Weiss, Louis T.	....	....	1,000	1,000
Williams Mfg. Co.	2,500	1,100	210	1,310
Wilson & Co.	47,260	60,000	28,000	88,000
Woodison Co.	60,000	....	2,000	2,000
"X" Laboratories	8,000	17,000	19,387	36,387
Total	2,201,565	$2,350,865	$2,722,767	$5,073,632
GRAND TOTAL	9,362,881	$9,449,065	$8,233,190	$17,682,255

Automobile Chronology for 1916

Important Developments in the Industrial and Financial Fields Arranged According to Date of Occurrence

JANUARY

1—Kentucky Wagon Co., Louisville, to assemble cars for the Dixie Motor Car Co.
1—Pfau Mfg. Co., Cincinnati enters automobile field with output of brass specialities.
1—American Rotary Valve Co., Anderson, Ind., discontinues the manufacture of electric motors.
2—Avery Farm Implement Co., Peoria, Ill., to make $295 tractor.
3—Auto Parts Mfg. Co., Milwaukee, reorganizes and absorbs Badger Specialties Mfg. Co.
3—With more than 22,000 miles to its credit, the Maxwell car, in non-stop run started Nov. 22, was stopped Jan. 3 after 44½ days' test. Road records are: 5000 miles in 10 days; 10,000 miles in 20 days; 12,405 miles in 25 days; and 20,000 miles in 30 days.
4—U. S. district court judge signs final decree in Austin-Cadillac two-speed axle case, decision on which was rendered a year ago, granting Austin an injunction and damages against Cadillac.
4—Kelly-Springfield Tire raises 7½ to 26 per cent.
4—Overland reduces price of larger four $55, from $750 to $695.
10—National Automobile Chamber of Commerce cross-licensing agreement in force and includes agreement on exchange of shop right on patents and members.
10—National Acme Mfg. Co., Cleveland, acquires the business and plant of the Windsor Machine Co., Windsor, Vt.
12—Empire, Fails, Globe and Pennsylvania tire companies increase prices 10 to 25 per cent.
14—McClurg Rubber Co., Coshocton, Ohio, takes over S. & M. Tire & Rubber Co.
14—Lion Tire & Rubber Co., Lafayette, Ind., formed with a capital of $150,000, to manufacture tires. Purchases Heinze plant in Lafayette.
15—Fritchie Automobile & Battery Co., Denver, brings out a gas-electric car, with one electric unit and a four-cylinder motor.
15—Entz patents controlled by six members representing General Electric and Owen Magnetic companies.
17—Moline Plow Co., Freeport, Ill., to manufacture the Stephens six-cylinder automobile.
17—Randall-Faichney Co., Boston, reorganized. Management takes over assets of old one.
18—Gasoline 22 cents wholesale in New York City.
24—Stutz Motor Car Co., Indianapolis, doubles plant.
24—Vesta Accumulator Co., Chicago, brings out electric transmission.
25—Gasoline selling at 29 cents in New York.
29—Chevrolet - General Motors syndicate offers for exchange five shares of Chevrolet stock for one of General Motors. Voting trust formed.
29—Stock offer of Chevrolet-G. M. Syndicate changed to four shares of Chevrolet for one General Motors.
30—12,000 carloads of automobiles shipped in January.
30—Woods Motor Vehicle Co., Chicago, to build a gas-electric car at $2,700.
31—Ford produced 44,365 cars in January, second largest month. In April, 1915, produced 46,510.

FEBRUARY

7—Carter Carbureter Co., St. Louis, forms sales department. Cancels selling arrangements with H. W. Johns-Manville Co., to market its products direct.
11—Chalmers Motor Co., Detroit, arranges with Agricultural Credit Co., Chicago, for time payment service for dealers.
11—Studebaker arranges through Commercial Investment Trust, New York, for time payments.
14—General Electric Co. raises prices of Genemotor $10 to $85. Takes out license to manufacture under Coleman starter patents, Nos. 745,157 and 842,827.
15—U. S. circuit court of appeals confirms decision of district court judge, who declared the Perlman demountable rim patent valid and infringed by the Standard Welding Co.
17—Value of automobile output increases 350.3 per cent between 1909 and 1914. Government statistics show value of output in 1914 was 181.7 per cent greater than 5 years before.
17—Toledo, second largest automobile city. Cars numbering 95,650 left its factories in 1915. One thousand electric systems and 25,000 spark plugs per day produced there.
18—Briscoe Motor Co., Jackson, to absorb Jackson Motor Shaft Co., in July.
21—Buick prices advanced $35. Roadster at $985 and touring car at $1,020.
21—Bimel Buggy Co., Sidney, Ohio, reincorporates as Bimel Automobile Co.
24—Thomas B. Jeffery Co. increases wages 10 per cent and reduces working hours to 50 a week for day and 55 for night work.
29—Kardo Axle suit reopened. Ohio court of appeals upholds company's validity and orders rehearing.

MARCH

2—Champion Spark Plug Co., Toledo, increases output to 100,000 spark plugs daily. Former production 45,000 daily.
2—Sparks-Withington Co., maker of Sparton horns, wins patent battle through reversal of a United States district court decision issued in suit of Lovell-McConnell Mfg. Co., maker of Klaxon horns, against Oriental Rubber Supply Co., dealer in Sparton horns. No infringement on patent of Klaxon company was admitted, as patent was declared invalid.
2—Federal court of appeals reverses decision that dismissed axle patent infringement suit brought by the Kardo Co. against H. J. Adams.
3—New York gasoline reaches 24 cents a gallon, wholesale. Owners paying from 26 to 31 cents a gallon. Were paying from 14 to 17 cents year ago.
4—Studebaker Corp. raises prices of five models. In four-cylinder class, three-passenger roadster, $825 to $850; seven-passenger touring car, $845 to $875; landau-roadster, $1,145 to $1,150. Of six-cylinder models, three-passenger touring car, $1,025 to $1,060, and seven-passenger touring car, $1,050 to $1,085.
4—Pierce-Arrow Motor Car Co. plant in Buffalo closed, owing to strike of machinists. Six thousand men out.
6—Maibohm roadster at $595 is product of Maibohm Motors Co., Racine, Wis.
6—Automobiles, trucks and parts rank fifth in exports. Gained 232 per cent in 1915, to $111,180,139. Iron and steel first, with $338,703,720.
7—Locomobile Co. of America changes truck name to Riker.
8—Injunction against Standard Welding Co., Cleveland, prohibiting manufacture and sale of demountable rims, held to infringe Perlman patent No. 1,052,270, filed June 29, 1906.
8—Arbenz Car Co., Chillicothe, Ohio, taken over by National United Service Co., New York.
8—Resulting from suit of Louis H. Perlman against Standard Welding Co., charging infringement of Perlman's basic patent on demountable rim, injunction is issued against Standard Welding Co., prohibiting manufacture and sale by this company of such rims.
12—Plants of H. J. Walker Co. and Briggs Mfg. Co., Detroit, moved to Cleveland, to handle Chandler body work.
12—Chalmers Motor Co. ships $3,000,000 of cars in February. Biggest day was Feb. 29, when 198 cars were shipped.
16—Cadillac Motor Car Co. ships 25,000 Cadillac eights since company commenced manufacturing model in October, 1914.
17—H. J. Koehler S. G. Co., Newark, N. J., raises price of truck from $940 to $955.
18—Saxon Motor Car Corp. raises price of roadster and touring car from $785 to 815.
18—Willys-Overland Co. ships 27,685 Overland and Willys-Knight cars in first 2 months of 1916, as against 10,240 for same period in 1915. During January, 1916, 12,393 cars left factory, as compared with 4613 for the same month of 1915.
20—Wyman & Gordon Co., Worcester, Mass., reorganized with a capital of $3,000,000, and name changed to Wyman-Gordon Co.
20—Studebaker Corp., Detroit, increases output from 300 a day to 400.
21—Great Britain bars automobile imports.
21—Perlman Rim Corp., New York, secures two plants for manufacture of demountable rims.
21—Warner Auto Trailer Co., Beloit, Wis., to make trailers.
21—Nordyke & Marmon Co. increases price $200, bringing five-passenger model to $2,900 and seven-passenger car and three and four-passenger roadster to $2,950.
21—Solid tire suit ends. Court of Appeals affirms $210,000 judgment in favor of Kelly-Springfield Tire Co. against Diamond Rubber Co., on Grant patent No. 554,675, issued Feb. 18, 1896. Litigation has extended over period of 20 years.
23—F. B. Stearns Co., Cleveland, advances prices $50.
23—Pierce-Arrow Motor Car Co., Buffalo, increases wages 10 per cent.
27—Kemco Electrical Mfg. Co., Cleveland, reorganized.
28—Briscoe Motor Corp., Jackson, Mich., disposes of Argo Motor Co. plant in Jackson to Mansell Hackett.

APRIL

1—Michigan supreme court reverses decision awarding $20,000 damages to W. A. Paul, who claimed he invented curtain holder for inside curtains of automobile s, in a case against J. N. Collins, J. A. Bennett and the Novelty Leather Works, Jackson, Mich.
1—Overland ships 47,465 cars in three months. Comes within 1,000 cars of equalling entire yearly output of 1914. Output in March was 19,780, compared with 7,005 in March, 1915.
1—Jordan Motor Car Co. to build $50,000 plant in Cleveland.
1—Guaranty Securities Corp., New York, formed to finance time sales of automobiles.
3—Chalmers advances prices on touring car and cabriolet $40, roadster $20. Pathfinder raises price $275. Anderson Electric raises price $100.
3—Splitdorf Electrical Co., Newark, raises price of Splitdorf-Apelco electric starting and lighting system $10.
3—S. F. Bowser Oil Tank & Pump Co., Fort Wayne, Ind., pays 6 per cent dividend to employees on February wages.
4—Ford builds 58,329 cars in March, 14,450 better than March, 1915. Average daily output was 2,243 cars.
5—Perlman Rim Corp. purchases entire capital stock of Jackson Rim Co., Jackson, Mich.
6—Bock Bearing Co., Toledo, reorganized and name changed to Bock Taper Roller Bearing Co.
6—Great Britain places a treble tax on all British automobiles, ranging from $21 to $630, according to horsepower. Doubles tax on automobiles 16 hp. or less and trebles on cars over 16 hp.
8—Detroit, Toledo, Flint, Jackson and Lansing build 328,366 cars in first three months of 1916. Detroit plants produce 238,076 cars. Production in 1915 for these cities was 106,000 cars.
8—Auburn Automobile Co. advances price of 6-38 from $1,050 to $1,085. Lozier four advanced $100.

10—A Hudson super-six negotiated 1 mile in 35.12 sec. on the Ormond-Daytona beach. Five other trials were under 30 sec.
10—Champion Spark Plug Co., Toledo, produces 1,111,623 spark plugs in March.
12—Automobile industry represents 28 per cent of capital in Detroit manufacturing. U. S. Census statistics for 1914 show 120 concerns making cars, trucks, bodies and parts. Produce 40 per cent of value of all manufactures in that city.
14—Mitchell prices increased $75 for the five and three passenger car.
15—Winton prices raised $200.
16—McFarlan increases prices $210.
17—Studebaker Corp. institutes service policy to increase fuel efficiency.
21—Sears-Cross lowers prices on speedometers $4.
21—Overland wages raised 4 to 10 per cent with a reduced schedule of hours.
24—Briscoe raises prices $40 on 4-24, $35 on 4-38, and $35 on eight.
24—Argo raises prices $20.
24—Monroe Motor Co. turns over Flint plant to General Motors Co. and takes possession of plants formerly occupied by Welch Motor Car Co., Pontiac. W. C. Durant severs connection with Monroe concern.
25—Murray Motor Car Co., Pittsburgh, formed to manufacture cars.

MAY

1—Davis Motor Car Co. takes over Richmond, Ind., plant of Westcott Motor Car Co., which moves to Springfield, Ohio, occupying the plant of the Buckeye division of the American Seeding Machine Co.
1—Brunswick-Balke-Collender Co., Muskegon, Mich., maker of billiard tables, to enter automobile tire manufacturing field.
2—Rittman gasoline patent assigned to the U. S. Government.
2—Doehler Die-Casting Co., Brooklyn, N. Y., acquires controlling interest in American Die Casting Co., Newark, N. J., which will be named Doehler Die-Casting Co. of New Jersey.
2—Ralph Mulford, driving Hudson super-six stock chassis at Sheepshead Bay, breaks all previous 24-hr. records, averaging 75.8 m.p.h. for 1819 miles. The world's record of 65.905 m.p.h made by Edge, who drove 1581 miles 1310 yards, at Brooklands in 1907; the stock chassis record made by Mulford and Patschke in a Lozier at Brighton Beach in 1909, 1196 miles; the non-stock dirt track record made by Patschke at Brighton Beach in a Stearns in 1910, 1253 miles; the non-stock speedway record made by Virbeck and Hirsch at Los Angeles in 1911, 1491 miles, were the previous records.
2—Goodyear Tire and Rubber Co. suit against Firestone Tire and Rubber Co., in which it was held that the latter's tire-making machines infringed the patents held by the Goodyear company, was decided in favor of the Goodyear company.
6—Allen Motor Co., Fostoria, Ohio, shortens working day to 8 hr.
8—Boston Artificial Leather Co., New York, changed name to Zapon Leather Cloth Co.
8—Ford production in April, 51,739 cars, as compared with 46,510 in April, 1915.
8—Studebaker Corp. ships 490 cars on April 29. Biggest single day's shipment of company.
8—First Stephens car made by Moline Plow Co. Freeport, completed.
8—Sparks-Withington Co., American Gear Co., and Argo Motor Co., all of Jackson, Mich., shorten working hours and pay same wages as before.
8—Willys-Overland Co. completes addition, adding 500,000 sq. ft., and bringing entire plant to 103 acres. Shipments average 900 cars a day.
9—Grant Motor Car Co., Findlay, Ohio, to move to Cleveland.
12—Willys-Overland sales gain 174 per cent in year ending April 30. Shipped 137,665 cars as compared with 50,258 in preceding period.
12—Packard acquires Krit plant in Detroit.
12—Standard Steel Tube Co., Toledo, Garford Mfg. Co. and Fisk Rubber Co. reduce working day to 8 hr. with increased pay.
13—Studebaker Corp. sells 16,952 cars in first quarter of 1916, as compared with 9,400 the corresponding period in 1915.
13—Pennsylvania Rubber Co. reduces price on Vacuum Cup and Ebony Tread tires $2 to $6.
15—France prohibits importation from the United States and England of automobile chassis.
17—E. G. Baker, driving Cadillac eight, crosses continent in 7 days 11 hr. 52 min.
20—American Automobile Assn. in favor of singe car tax. Advocates Adamson bill.
27—Flat Automobile Works locates factory in Budapest, Hungary. Factory situated at Kelenfold, in suburbs of Budapest, has been rented.

JUNE

9—Hanlon windshield patent declared invalid. Cases involved: Rauch & Lang Carriage Co. vs. W. H. Hanlon, J. R. Wardrop and Anoerson Electric Car Co., and National Automobile Chamber of Commerce vs. W. B. Hanlon and J. R. Wardrop and Anderson Electric Car Co.
9—Hanlon windshield patent invalid. Injunction against N. A. C. C. members on use of windshield to be lifted. Involved patent No. 13,653, issued to W. B. Hanlon on Dec. 2, 1913.
13—National Automobile Chamber of Commerce approves service and repair parts policies; defines standard truck.
14—Monster $250,000,000 merger abandoned. Included Willys-Overland, Hudson, Chalmers and Fisk.
15—Litigation between the Universal Rim Co. and the Standard Welding Co. settled out of court, the Standard Welding Co. acknowledging validity of patents by paying back royalties and taking out 10-year license under patents.
27—French Government places 70 per cent duty on imports.
29—King eight covers 11,000 miles in 2 weeks in June on non-engine stop test, maintaining an average of over 32 m.p.h.

JULY.

8—U. S. Government receives bids on 2,000 trucks and 400 passenger cars for Mexico service.
10—Results of Saxon 300-mile non-stop test conducted in all parts of country show 206 cars traveled 61,800 miles, and grand average was 23.5 m.p.g. of gasoline and 175 miles to a quart of oil.
12—France lowers truck duty and admits American trucks on pre-war tariff, equivalent to 12 per cent of value. Passenger cars, however, 70 per cent import duty.
14—U. S. district court holds that no infringement of patent was present in the manufacture of the Eclipse-Bendix transmission drive by the Eclipse Machine Co. Suit was brought by the Bijur Motor Lighting Co. against Eclipse Machine Co. and Vincent Bendix.
14—Neville Steering Wheel & Mfg. Co., Detroit, absorbs Neville More-Room Steering Wheel Co.
14—Court rules Eclipse Machine Co., Elmira, N. Y., and Vicent Bendix, Chicago, entitled to Bijur license on starting motor gear.
14—C. W. Nash, retiring president of General Motors Co., together with Lee, Higginson & Co., purchase entire stock of Thomas B. Jeffery Co., Kenosha, Wis. Purchase price about $9,000,000.
20—United States automobile makers produce 754,902 passenger cars in first six months of 1916. Ninety-nine factories contribute; 96 per cent made in Michigan, Ohio and Indiana; Ford alone makes 298,900, Overland 94,477, others over 40,000.
20—Ford Motor Co. adds thirty-four branches.
20—England has standard truck design. Other countries standardize both cars and aviation engines.
22—Forty-three Saxon cars, racing in relays, establish a transcontinental relay record, arriving at San Francisco July 22, 6 days 18 hr. 10 min. after leaving New York. Average speed was about 25 m.p.h.
29—Marmon stock car, driven by S. B. Stevens, Walter Bleiling, Robert Creighton, William Binz and Fred Barbour, cross the continent in 5 days 18½ hr., leaving New York July 23.

AUGUST.

1—Pathfinder twin six crosses continent on high gear, leaving San Diego July 3 and reaching New York Aug. 1. Seals by A. A. A. No attempt at speed record; average daily of 200 miles; total mileage 4921; 4 days no running; gasoline consumption 10.2 m.p.g.
5—Republic Motor Truck Co., Alma, Mich., adopts bonus system in plant.
7—Ford builds 533,921 cars in one year. Makes 225,708 more in 1916 than in 1915. Cars worth $235,000,000. Employs 31,035 men.
14—Ford drops retail sales.
15—Stewart-Warner Speedometer Co., Chicago, purchases the V-Ray Co., Marshalltown, Ia.
15—Chevrolet produced 54,700 cars during fiscal year ending Aug. 1.
15—Ford introduces new body styles.
21—Saxon employees get bonus ranging from 3 to 6 per cent of their yearly salaries.
21—Timken-David Brown Co., Detroit, purchased by the Timken-Detroit Co., and the manufacturing operations consolidated under the management of the axle company.
22—Fuel tests made by 200 representatives of Master carbureter show mileages such as 31.7 m.p.g. in Phoenix; 28, Boston; 24, Tulsa; 22.4, Salt Lake City; 22.3, Los Angeles; and 22, Denver.

SEPTEMBER.

5—Maxwell builds 532 cars in one day. Average production 400 cars daily.
24—Hudson super-six, driven by A. H. Patterson, Ralph Mulford and C. H. Vincent, crosses continent in 5 days 3 hr. 31 min., breaking transcontinetal for the third time in year.
26—Goodyear starts new plan for retailing its tires. Number of dealers reduced. No exclusive territory.

OCTOBER.

2—Automobile industry gains 153 per cent in five years; 1909-1914 value of products is $632,831,000; gain, $383,629,000.
10—Ford car equipped with a Myle-Maker carbureter attachment, with top and windshield up and four passengers, makes 26.6 m.p.g. in test in Chicago.

NOVEMBER.

2—Truck output in 1916 is 58,000 for first six months.
2—Fisher Body Corp., Detroit, buys one of plants of the Regal Motor Car Co., Detroit.
3—Injunction holds up Ford profits. Dodge Bros. in suit seek to prevent investment of surplus money.
14—Bankers secure control of Hess-Bright Mfg. Co., Philadelphia.
20—Carl G. Fisher to build one-wheel tractor in Indianapolis.
21—Knight Tire & Rubber Co., Canton, Ohio, absorbed by Fabricord Tire Co.
20—Discher patent covering bumper bracket construction is held valid and infringed by the Auto Parts Mfg. Co., and a permanent injunction granted to the Gemco Mfg. Co. Verdict is by U. S. district court.
21—Springfield Body Corp. files suit against Fisher Body Corp., the Fisher company and Fred J. Fisher and Louis Mendelsohn, charging infringement of design of patents on Springfield-type body.
28—U. S. Wheel Corp., Chicago, Ill., formed to manufacture Baker pressed steel wheel.

DECEMBER.

1—Moto-Meter Co., Inc., New York, gets temporary injunction to stop Heat-Ometer Co. from making and selling Heat-Ometer and from using the word "Heat-Ometer," which was held an infringement on the trademark "Moto-Meter."
2—Cadillac Motor Car Co. sues Cadillac Auto Truck Co., asking that latter firm be restrained from use of name "Cadillac," "Cadillac Auto Truck Co.," or other name prejudicial to the interest of the Detroit company.
4—Any State may tax non-residents decided by United States Supreme Court in case of New Jersey vs. F. J. Kane. N. J. motor laws upheld.
8—Prest-O-Lite Co. awarded $3,541.45 damages by judgment in suit brought against Camille Bournonville and Ida Bournonville, Newark, N. J., for refilling and sale of Prest-O-Lite tanks and substitution of refilled tanks.
11—Ford Motor Co. wins decision against Stahlbrodt Co., Rochester, N. Y., holder of patent purporting to cover a certain type of windshield commonly known as zig-zag windshield in U. S. circuit court of appeals, decision reversing prior ruling of lower court.
11—United States Army to have caterpillar tractors similar to those used in British army.
12—Ajax Rubber Co., Trenton, purchases Racine Rubber Co., Racine, Wis. Ajax capital increased.
13—Argentine Mercantile Corp., New York, formed to facilitate Argentine shipments. For co-operative trade in non-competing lines.

Financial

JANUARY.

6—Portage Rubber Co., Barberton, Ohio, shows profits of $129,000 for 1915, an increase of 46⅓ per cent. Sales amounted to $1,100,000, or 62½ per cent over 1914.

14—Ford Motor Co. of Canada makes $3,202,000 in 1915. Produced 24,500 cars. Plans 40,000 for 1916.

14—Ogren Motor Car Co. changes name to Ogren Motor Works. Capital raised from $25,000 to $1,000,000. Plans production of 3,000 cars for 1916.

15—Signal Motor Truck Co., Detroit, increases capital $85,000 to $450,000, composed of $300,000 common and $150,000 7 per cent cumulative preferred.

19—Springfield Body Corp. offers $750,000 8 per cent cumulative preferred to finance new Detroit plant.

25—Grant Motor Car Co., Findlay, Ohio, raises capital from $200,000 to $4,000,000, composed of $3,000,000 common and $1,000,000 7 per cent preferred. Earned in 1914 about $165,000. Shipped 4,000 cars.

29—Goodrich surplus $10,305,679, equal to 17.17 on common. Net sales during 1915 total $55,416,866, a gain of 32½ per cent.

FEBRUARY.

5—Spiitdorf Electrical Co., Newark, N. J., shows profits in 1915 of $745,107, or 16 per cent on the $4,393,000 capital stock. Profits in 1914 were $388,921.

8—Briscoe offers $1,500,000 7 per cent cumulative preferred for subscription.

15—Continental Motor Mfg. Co., Detroit, declares 100 per cent stock dividend. Capital increased from $2,900,000 to $5,900,000.

17—Fisk Rubber Co. sales total $14,500,000 in 1915. Net profits total $1,791,579.

26—Studebaker net profits equal $9,067,425 in 1915. Sales total $56,539,006, a gain of $13,094,782. Sells 46,845 cars. Earns $8,236,980, equal to 29.5 per cent on the common.

24—Chandler Motor Car Co. profits total $933,217 for 1915, as against $321,821 in 1914. Has $1,613,515 in bank.

24—Pennsylvania Rubber Co. reports a $4,000,000 business for 1915.

MARCH.

4—Fisk Rubber Co., Chicopee Falls, Mass., has net profits of $1,791,579 in 1915, against $942,204 in 1914.

7—Chevrolet Motor Co. earns $1,653,686 in 4½ months ended Dec. 31, 1915. Cash in hand is $5,377,079. Produced 11,888 cars in that period.

8—Peerless Truck & Motor Corp., profits on trucks for 1915 total $2,555,773, equal to 22½ per cent on the capital stock.

8—U. S. Rubber Co. profits total $11,486,705 in 1915 as against $9,776,873 in 1914. Net sales for 1915 total $92,861,015 as against $83,678,812 in 1914. Has surplus of $2,882,048 as against $721,951 in 1914.

13—Willys-Overland shows income in 1915 of $9,870,678. Earns over 46 per cent on the $21,000,000 common. Profit and loss surplus $14,720,550 as against $7,651,931 in 1914.

18—Electric Storage Battery Co., Philadelphia, has income in 1915 of $1,360,748, equal to 8.37 per cent on $16,249,425 capital, compared with $1,103,237 in 1914, equal to 6.78 per cent on $16,250,000 stock. Surplus after payment of dividend totalled $710,784, as against $453,273 in 1914. Gross sales were $1,770,188 as against $1,395,793 in 1914.

18—M. & S. Gear Co., Detroit, maker of M. & S. differential, increases capital from $1,000,000 to $1,750,000.

18—White Motor Co., Cleveland, declares initial dividend of 1¾ per cent on $16,000,000 stock, placing stock on 7 per cent basis.

APRIL.

22—Goodyear issues $10,000,000 of new preferred to take care of increased output. To produce 25,000 tires a day.

JUNE.

26—Paige-Detroit earnings at rate of $1,500,000 per annum, or 150 per cent on the stock. Tangible assets are $1,504,497, or $15 per $10 share.

JULY.

10—Hupp Motor Car Corp. business increases 47.3 per cent over 1915. Employees increase 74.6 per cent.

20—$1,275,000 profit for Stewart-Warner Speedometer Co., Chicago, during six months ending June 30.

1—Willys-Overland Co., Toledo, earns $4,377,799 in four months ending April 30, 1916. Surplus is $4,193,144.

23—Packard earns $18,636,506 in seven years. Over $9,000,000 charged off for depreciation. Earnings for nine months of fiscal year amount to $6,050,000 as compared with $2,769,518 for 1914 and 1915.

AUGUST.

3—Chalmers assets increased 50 per cent in past year. Gained from $4,857,274 to $13,051,538. Surplus totalled $3,066,673 as against $1,010,422 in 1915.

1—General Motors Co. earned in 11 months ending June 30, $144,000,000 as against $86,000,000 in same period in 1915. Sold 121,133 cars in that period as against 68,604 in same period in 1915.

2—Studebaker earned $6,028,329 in six months ending June 30. Included $180,000 war profits. Common on 10 per cent basis. During the corresponding period in 1915 corporation's profits amounted to $5,774,074, including nearly $3,000,000 of war order profits.

SEPTEMBER.

4—Ford profits in fiscal year ending July 31 were $59,994,118. Had $100,000,000 surplus and $52,550,771 in banks. Gross business was $206,867,347.

13—Maxwell earnings gained 135 per cent in year. Net assets were $11,176,783 as against $3,500,000 in 1915. Cash on hand was $3,269,552 as against $2,652,628 in 1915. Car sales increased 88 per cent over 1915.

29—Reo Motor Car Co. and Reo Motor Truck Co. gross sales amounted to $27,884,000 in 1916, including 23,753 cars and 2,551 trucks. Passenger cars increased 33.08 per cent and trucks 33.38 per cent.

20—Saxon Motor Car Corp. profits are $1,316,272 for year ending June 30, or equal to $22 a share on the $6,000,000 stock. Output of company was 25,500 cars, an increase of 15,651 over 1915.

20—Packard surplus is $10,823,717. Gains, $6,206,419. Total assets increased $11,830,505. More than $6,000,000 added to surplus.

21—White Motor Co. for 6 months' period ending June 30 shows net profits of $2,635,784. Has surplus of $1,623,521, equivalent to 11 per cent on $16,000,000 capital stock. Total income is $2,750,923.

Obituary

FEBRUARY

23—Lewis R. Speare, president of the A. A. A. in 1909 and 1910 and president of Massachusetts State A. A. in Newton, Mass.

APRIL

8—Bob Burman, frequently characterized as the world's speed king, was killed at Corona, Cal.

MAY

13—Carl Limberg, racer, was killed at Sheepshead Bay, N. Y.

15—Ludwig Opel, German car manufacturer, killed at Verdun.

26—Georges Boillot, winner of the French grand prix in 1912 and 1913, was killed in an aerial battle with five German aeroplanes.

JUNE

1—James K. Stewart, one of the founders of the Stewart-Warner Speedometer Corp., Chicago.

JULY

15—Paul Smith, vice-president and general sales manager of the Chalmers Motor Co., Detroit.

SEPTEMBER

21—L. S. Bache, Bound Brook, N. J., first vice-president and general manager of the Bound Brook Oil-less Bearing Co.

OCTOBER

12—R. S. Crawford, founder of the Crawford Automobile Co., Hagerstown, Md.

20—Henry Spiitdorf, inventor of the magneto bearing his name, in New York.

30—Hughie Hughes and Frank Galvin, killed at Uniontown race.

NOVEMBER

4—Philip Braender, president of the Braender Rubber & Tire Co., Rutherford, N. J.

Apperson Bros. Co. New $300,000 Factory

As announced in THE AUTOMOBILE recently, Apperson Bros. Automobile Co. is now in its new $300,000 factory, the transfer having been effected without impairing production by keeping machines working up to quitting time and then moving them to their new location during the night. The main building of the new plant is 150 by 610 ft. and contains the machine shop and erecting department. The blacksmith shop is 40 by 128 ft. and is newly equipped throughout. The metal-working department, enameling room and rough stock rooms are in a building 110 by 230; boiler and engine room is 60 by 78, assembly and paint shops 160 by 245, test barn 34 by 118 and chassis test shed 28 by 254. Over 500,000 sq. ft. additional space is available in the new plant and further additions are already planned. The present capacity is 4500 cars a year.

New $300,000 factory group occupied by Apperson Bros. Automobile Co., Kokomo, Ind.

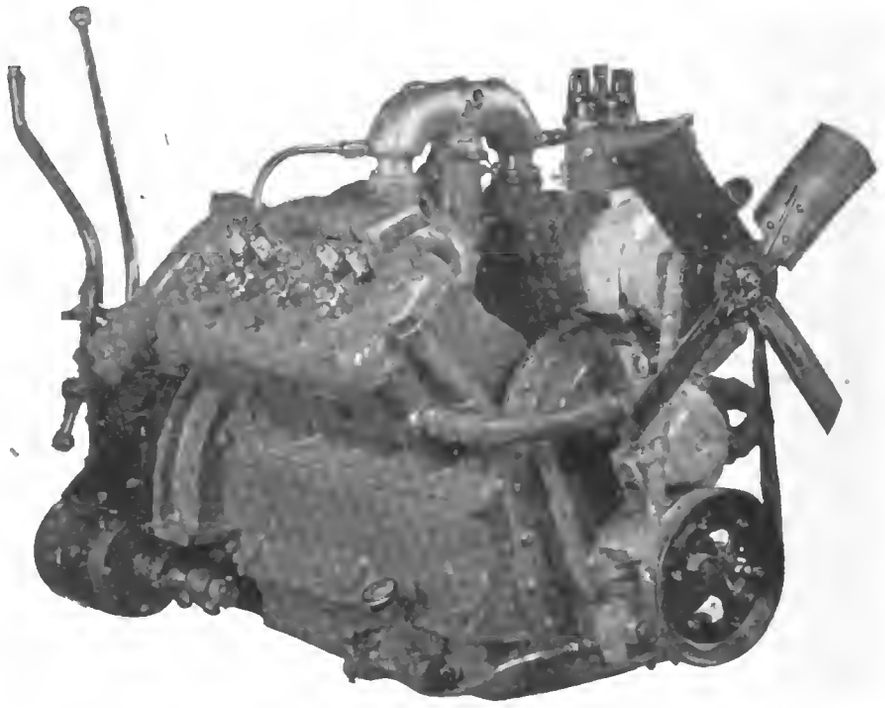
New Eight Succeeds Olds 44

Skeleton of Previous Model Remains but New Product Redesigned and Refined Throughout—Fan and Generator Combined

FUNDAMENTALLY the new Oldsmobile 45 is a continuation of the model 44 eight made last year. It has so many improvements, however, and so many parts have been redesigned that it may well be called an entirely new model. The general dimensions, such as the wheelbase, bore and stroke, etc., have been unchanged, but the details of the car have been altered in a great many respects and a great advance in engineering practice in the many considerations which go to make up performance, has been made.

What has been done may be realized when it is stated that with the same dimensions the power plant shows an increase of 25 per cent in horsepower. The present engine gives 56 hp. at 3200 r.p.m. The previous engine showed 45 hp. at 2800 and both are 2⅞ by 4¾. About the only thing that remains the same on the engine is the cylinder block.

This is a V-shaped unit with a detachable head and vertical-split crankcase. The head has been changed materially so that there is now more water space and the connection to the cylinder block is firmer. Three studs have been added to give a better connection and the head is carried over the cylinder wall to a greater extent, giving more water volume. Another point accomplished by the re-arrangement of the studs is that the strain given in tightening them, is removed from the valve seat so that there is no danger of distortion.



New Oldsmobile eight-cylinder 2⅛ by 4¾-in. engine, which develops 56 hp. at 3200 r.p.m. Note mounting of generator and ignition unit at front of cylinder blocks, generator and fan now being assembled together on the same shaft

While the Lynite pistons have been continued, the design is very different from a year ago, particularly in regard to the elaborate precautions taken to avoid oil pumping. There are three rings above the wristpin and one below. Six holes are drilled in the lower edge of the bottom ring groove and six in the upper edge. There are also two holes drilled diametrically opposite one another at right angles to the wristpin. The lower edges of the three upper ring grooves are chamfered as are top and bottom of the lower groove.

The present connecting-rod assembly weighs 17½ oz. This is a reduction over a year ago obtained by machining the rods all over. These are forked rods with square 2⅛ by 2⅛-in. bearings. The connection to the wristpin at the upper end is unchanged. The pin is locked in the piston boss with a set screw having a cotter pin in the center of the hollow wrist pin. This takes all stress off the cotter pin. The pin is not made of tube but is drilled from the solid piece.

A new crankshaft with a very complete counterbalancing system is now employed. Three counterweights are mounted on the shaft to take care of running balance. The shaft is also in static balance. The counterweights are electrically welded to the shaft after the latter is forged, the weld being a see-saw joint giving the greatest possible area of metal to metal contact at the connection. The shaft is carried on two main bearings, and is noteworthy for its shortness. The overall length is 25¾ in. The front bearing is 1⅞ by 2⅞ and the rear 2⅛ by 3¼.

The entire front end of the engine has been changed. The valve drive is much the same except that a Fabroil gear is now used for silence, but the generator which was formerly driven by chain is now driven by belt, and is mounted on the same shaft as the fan. The generator and fan run on two bearings, a Hyatt roller and a New Departure double row ball, taking thrust and radial load. The two units are now assembled together while the fan was formerly a floating design driven from a spline shaft from the generator sprocket. The belt is a V type, ¾ by ⅜-in. section, riveted on lugs. The ratio of the fan to the shaft is 1½ to 1. This ratio gives pulleys of large diameter and hence imparts considerably longer life to the belt.

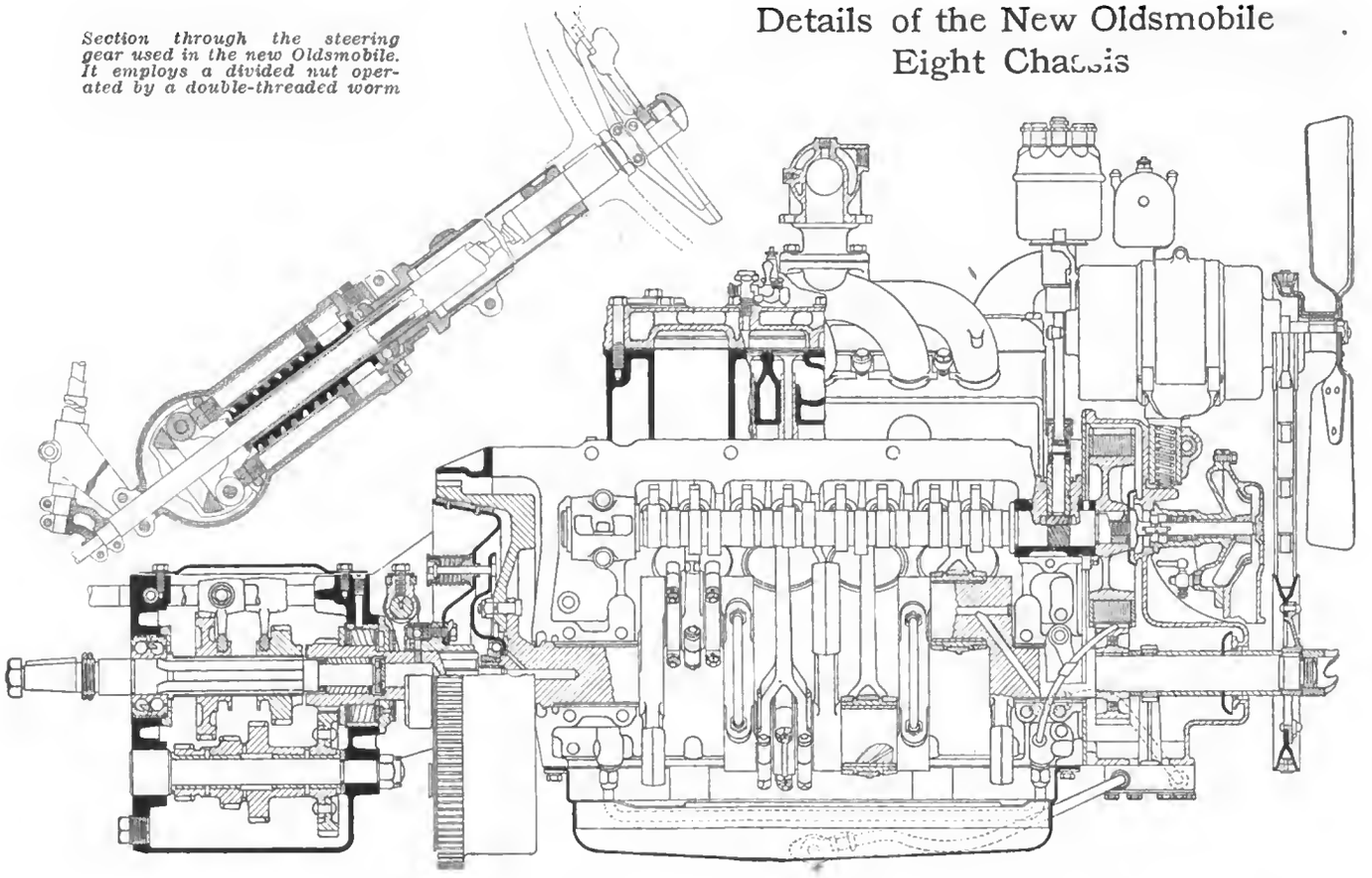
A new adjustment for tension on the fan and generator belt has been installed. This consists of a hollow plunger which is integral with the generator bracket and working in the front gear cover. There is a spring behind the plunger which is held by a pinch bolt. When the pinch bolt is released the spring causes the plunger to take up the slack after which the pinch bolt is again tightened.

To take care of the timing gears more efficiently a change has been made in the oiling system. This is a pressure system and a new lead has been added to the main line by means of which oil under pressure is fed directly to the point of mesh of the timing gears. This forces a 3/16 in. stream directly to the desired point on the gear, after which it drains back to the crankcase reservoir.

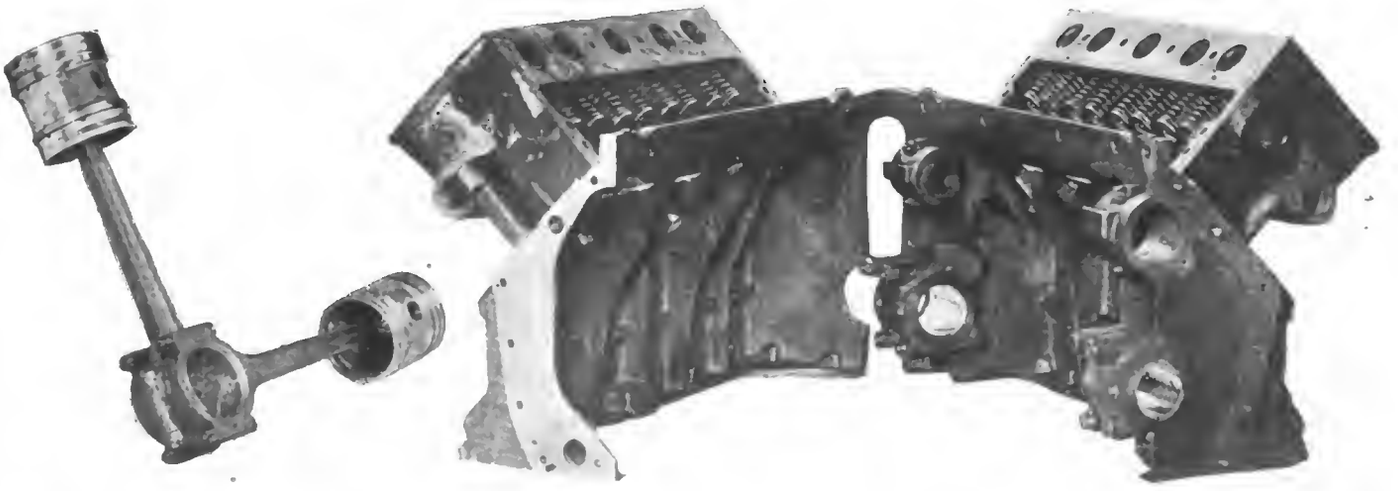
Another change in the oiling system is in the pump. This is now mounted outside of the front gear housing and can be taken off without interfering with any other part of the engine or even dropping the pan. The pump was formerly located in the front chain housing. It is now possible to take

Details of the New Oldsmobile Eight Chassis

Section through the steering gear used in the new Oldsmobile. It employs a divided nut operated by a double-threaded worm



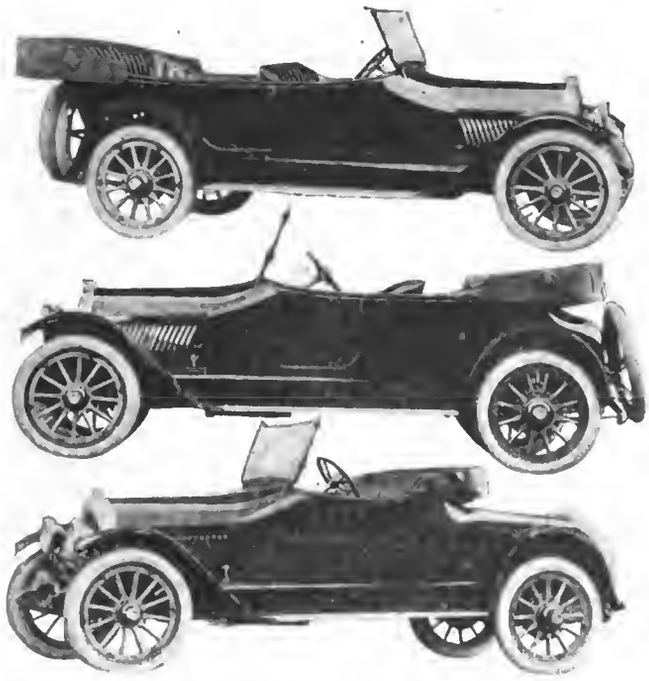
Section through the eight-cylinder unit power plant engine used in the new Oldsmobile eight, showing connecting-rod mounting, details of lubrication scheme and attachment of clutch and gearbox. The engine is 2⅛ by 4¾ and is credited with 25 per cent more power than the model previously employed



Above at the left is the piston and connecting-rod assembly

At the right castings of the new engine, showing the patented feature of having four cylinders block cast with half of the crankcase and bearings in the left hand block

At the left is the new crankshaft, which is very carefully counterweighted for both running and static balance



Upper—Oldsmobile eight-cylinder seven-passenger touring car
Middle—New four-passenger club roadster on same chassis
Lower—Two-passenger roadster, with convertible rear compartment with folding top, providing a seat for two additional passengers

off the pump in 5 min. Another point of simplification is the placing of the oil regulator in the crankcase. This is particularly good from a manufacturing standpoint as it cuts out three unions in the piping.

With the exception of the use of flexible pipe instead of rigid from the vacuum tank to the engine, the gasoline system is the same as a year ago. The object of the flexible hose is to eliminate the effects of non-synchronized vibration. As the engine is mounted flexibly in the frame it is natural that any connections between the chassis parts and the engine should be preferably flexible.

In the cooling system the greatest improvement is in the cylinder head. The radiator has also been changed and is now an oval shape of very distinctive appearance. The capacity of the present cooling system is about 5 gal. as compared with 4½ gal. on the previous model. The pump and pump drive have been improved. The drive is an ingenious sheer-clip scheme in which the drive is taken from the nut holding the camshaft gear in place. The clip is slipped into the slots of two shafts which come end to end and being the weakest part of the drive; in case the pump should freeze the clip would shear thus preventing harm to any other part of the system.

The pump housing is now attached by an oval flange to the front gear cover, giving a rigid connection. Formerly the pump was supported directly on the camshaft and was hence a floating type. An all rubber hose connection is now used instead of a metal elbow.

Some miscellaneous points which should be mentioned in connection with the new cylinder head are the location of the spark plugs which are now over the intake, and the fact that the center line of the valves is inclined at an angle of 8 deg., 55 min. to the center lines of the cylinders. Better combustion is said to result from the first and better gas flow from the second.

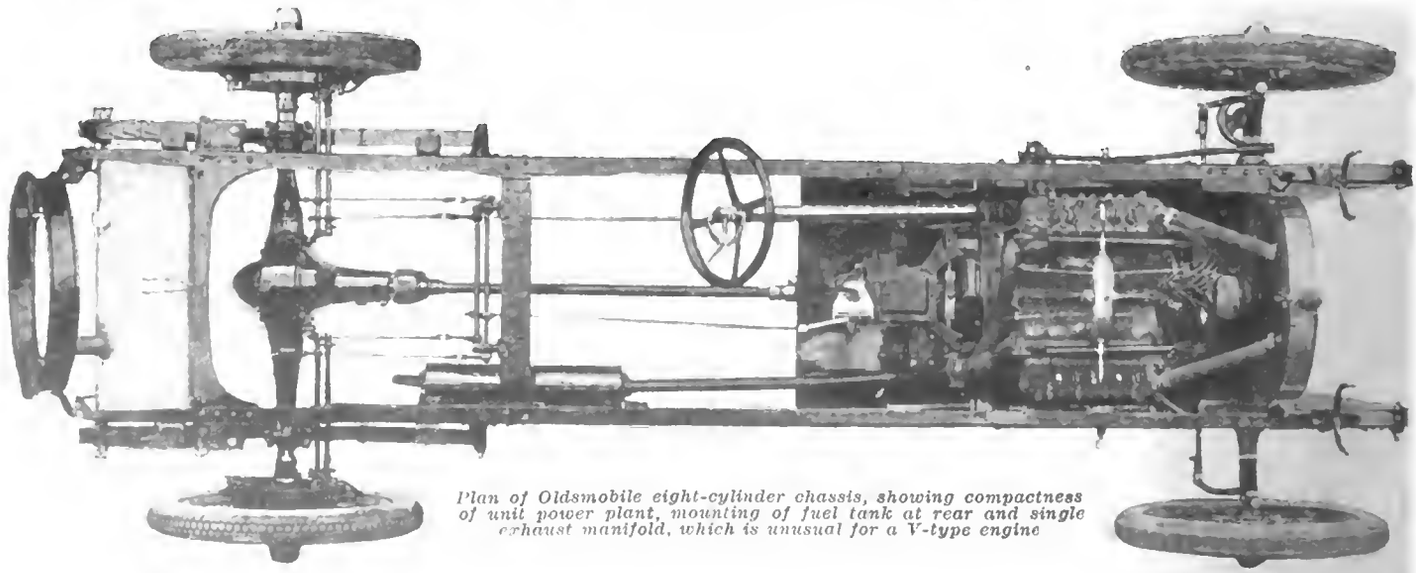
No changes are to be noted in the clutch. This is a cone with four engaging springs and no adjustments. Beneath the facing there are easy engaging springs. A clutch brake is formed by a pad on the front end of the transmission and the throw-out is a ball design. The clutch diameter is 12½ in. maximum.

The gearset also remains unchanged. This is a three-speed box with a four-spline main shaft mounted on a Hyatt roller at the front end and a New Departure double row at the rear. The shafts and gears are chrome nickel steel with ¾-in. face on the sliding gear and 1 3/16-in. face on the constant mesh gear. On the main shaft the bearings are close, giving only 7 ⅛ in. of unsupported shaft. A long Hyatt roller is used for the spigot bearing and the lay shaft is carried on two bronze bushings.

Two Spicer universals are just being added to the drive. The shaft is hollow and is slightly larger in section than last year in order to take care of the greater torque of the improved engine, being increased from 1½ to 1¾ in.

An increase in gear ratio has been made this year in the touring rear axle. This is now 4 11/12 to 1; it was 4 5/12. The pitch is 4½. A truss has been added to the axle to brace it against strain. This is adjusted by a heavy turn buckle beneath the differential housing. The rear springs are the same 48-in. three-quarter elliptics in the rear, but the front springs have been flattened. A detail is that the leaves are now diamond pointed instead of straight cut as formerly.

In the frame construction, the same layout is used with the exception of the front end where the trunnion support of the engine has been given up and a special cross member used instead. The three point effect is retained, however, with the new layout. Another detail is in mounting the front springs; the castor effect is secured by mounting them ahead of center. These are 36-in. springs and 17 in. is ahead of the clip center



Plan of Oldsmobile eight-cylinder chassis, showing compactness of unit power plant, mounting of fuel tank at rear and single exhaust manifold, which is unusual for a V-type engine

with 19 in. behind. Both drive and torque are taken through the rear springs.

There are four bodies in the new series, a seven-passenger touring, five-passenger touring, four-passenger club roadster and a two-passenger roadster, the rear compartment of which can be converted into an extra seat for two passengers. Taken with the new German silver trimmed radiator, new flared mud apron and grooved lamps, matching the radiator, an attractive appearance is presented. The prices of these models are $1,295 for the seven-passenger touring and $1,295 for all the others.

Many Colors Available

The upholstery is long grain, bright finish French leather, box plaited and stuffed with close-nested, small diameter springs, incased in linen sacks. The cowlboard is Circassian walnut with silver finished instruments mounted flush. The steering column is nickeled, with a walnut wheel.

A wide variety of color is offered, the seven and five passenger cars being in royal green, the club car is royal blue and the convertible roadster in carmine, with the above colors optional for any model at a slight additional cost.

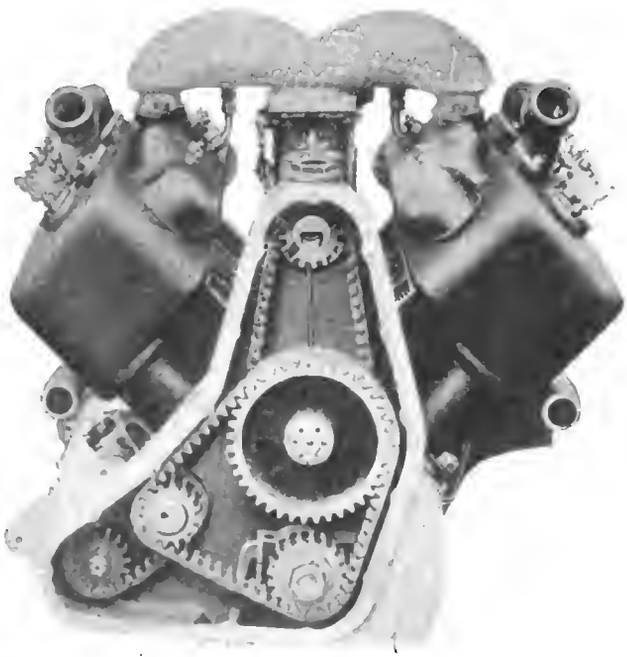
Driver's compartment of Oldsmobile eight, showing large seat, conveniently arranged instrument board and control members

Majestic Makes Two Eights

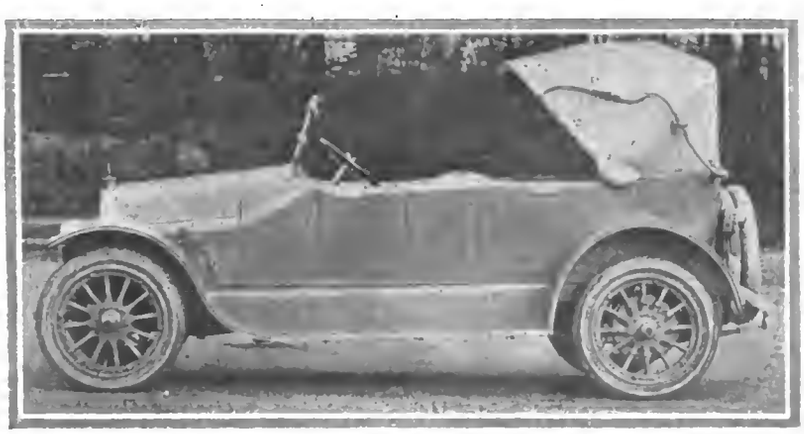
Extremely Luxurious Bodies Leading Characteristics of New Production

THE Majestic cars, made by the Majestic Motor Co., New York, are among the list of new cars announced in December. There are two chassis, one with 125-in. wheelbase and a 3 by 5-in. eight-cylinder engine selling for $1,550, and the other, which costs $3,000, has ten inches more wheelbase and an eight-cylinder engine 3¼ by 5 in. The two chassis depart but little from good conventional practice and appear to be laid out nicely, while they are of a sturdy character.

The appearance of the cars is unusually distinctive, largely because of the rounded radiator and specially designed headlights. A tilted windshield and double cowl are employed. The tonneau embodies several features which should appeal to the discriminating owner, particularly if he does much touring. The front of the rear seat is a mahogany paneled compartment, the interior of which is large enough to hold several lunch boxes, dusters and other articles. The door lifts up with lock hinges, forming a table so that the lunch may be comfortably eaten right in the car. At the right is a compartment fitted with a vacuum bottle and a cigar lighter. At the left there is a compartment containing a vacuum ice and solid food container. The tonneau equipment also includes a lady's toilet set and the usual robe rail and cushion foot rest. The carpet is lined on the bottom with a waterproof oilcloth which may be turned over in wet weather, thus saving the carpet.



The engines used on the Majestic chassis are both eights, of L-head type, and have this silent chain layout for the front ends. The idler sprocket shown on the left furnishes the adjustment for the triangular drive from the crankshaft, the sprockets for the generator and for the fan being adjustable separately



Very luxurious bodies with a lavish equipment of accessories and fittings are supplied. The car shown on the left sells for $1,550 with a one man top instead of the Victoria type illustrated

Flexibility in Hydraulic Transmission

Radcliffe Hydraulic Transmission Acts as Clutch, Eliminates Need for Intermediate Gear and Gives Electric Flexibility to Drive—Can Stop and Start on High Gear by Throttle Movement Only

THE Radcliffe hydraulic transmission may be described briefly as a hydraulic clutch which automatically gives a similar effect to that obtainable from an electric transmission. With it a car can be started from rest on high gear without any shock or difficulty, merely speeding up the motor causes the car to move forward, and the car can be stopped on the brake without stalling the engine. Its flexibility can best be demonstrated by taking the car on a grade where, without manipulating anything except the throttle pedal, it is possible to go forward, to allow the car to run backward, to arrest it and start it forward again without touching either brake or gear lever. It is anticipated that this transmission will eliminate the necessity for an intermediate gear ratio, although it is not suggested that it removes the necessity for an emergency low speed.

Replaces Clutch

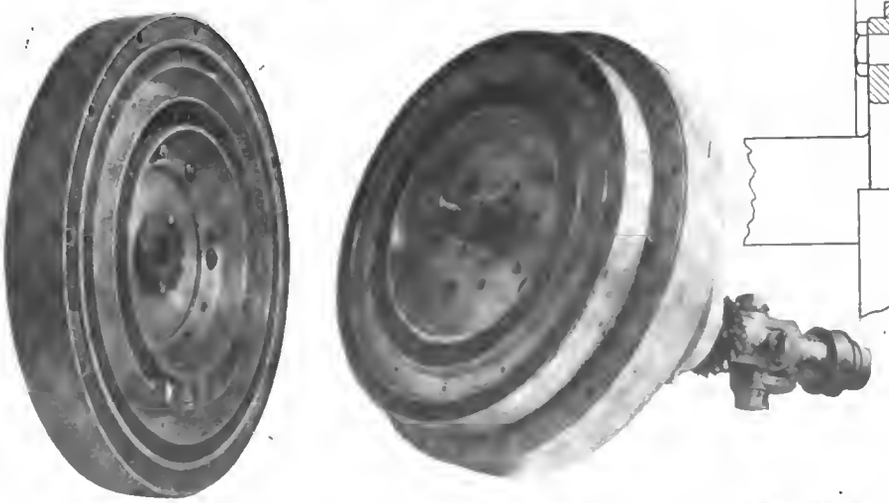
The device replaces the ordinary clutch. It consists of an aluminum or pressed steel casing provided with turbine blades in the manner shown in the illustration. The driven member has similar corresponding turbine construction and the whole case is filled with oil. Assuming the driven member to be held stationary, as it would be when in connection with the road wheels of a stationary car, if the engine is running slowly the oil will circulate around the turbine blades but will offer very little resistance. As soon as the engine speeds up the rotating part of the turbine forces the oil with considerable pressure into the stationary part, which is thereby caused to follow it, and as the car gains speed the difference in rate of revolution between the driving and driven member will gradually decrease until there is very little slip indeed.

The secret of success of the device really lies in the detail design of the turbine members. On meeting a hill the slip increases a little, thus allowing the engine to maintain its speed, and although, of course, a certain amount of power is lost in heating the oil the flexibility given in this way will provide the equivalent of an intermediate gear ratio. It is practically only when actually starting on a stiff grade that it is necessary to engage a low gear.

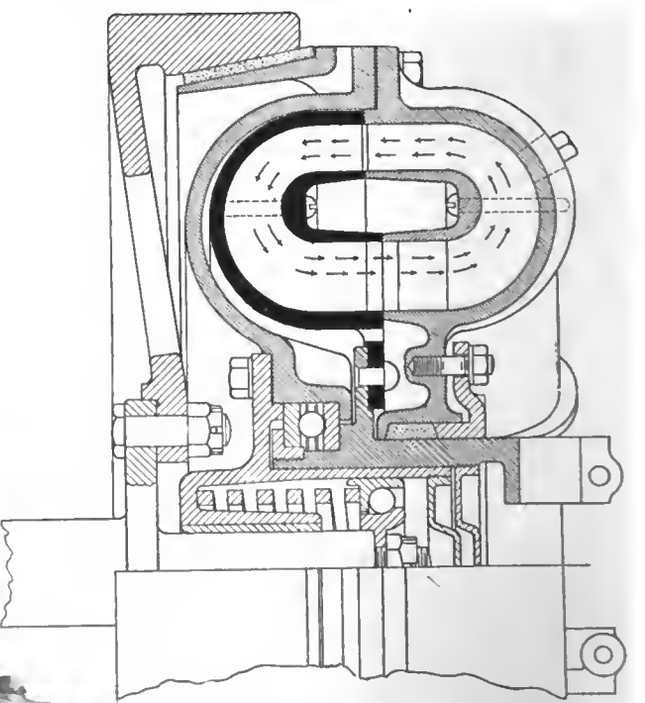
The development of the transmission has taken a good many years, experiments being directed mainly toward ascertaining the proper shape and proportion of the turbine blades. Consideration of the photographs and of the sectional drawing will show that the impeller discharges directly into the runner and that the oil then passes back again into the impeller.

It will be noticed, of course, that there is a stuffing box at the center where the driven shaft comes out through the driving casing. It might be thought that this would require to be extremely tight, but such is not the case, because the transmission is not filled completely with oil. A little air is left inside and as soon as the engine starts to run the centrifugal force carries the oil outward, thus bringing the air to the center and taking away all the oil from around the gland.

The final experimental model has been in use for over 6 months on a six-cylinder Studebaker and is being handled by the A. Elliott Raney Co., 244 West Fifty-ninth Street, New York. In the several thousands of miles of driving no hill work has ever caused the oil to heat unduly and the gasoline consumption over a long period is closely similar to the previous record of the same car with the gear transmission. The transmission is very practical for manufacturing.



Left—Impeller of Radcliffe transmission showing curved blades. Right—Back half of casing and the runner or driven member



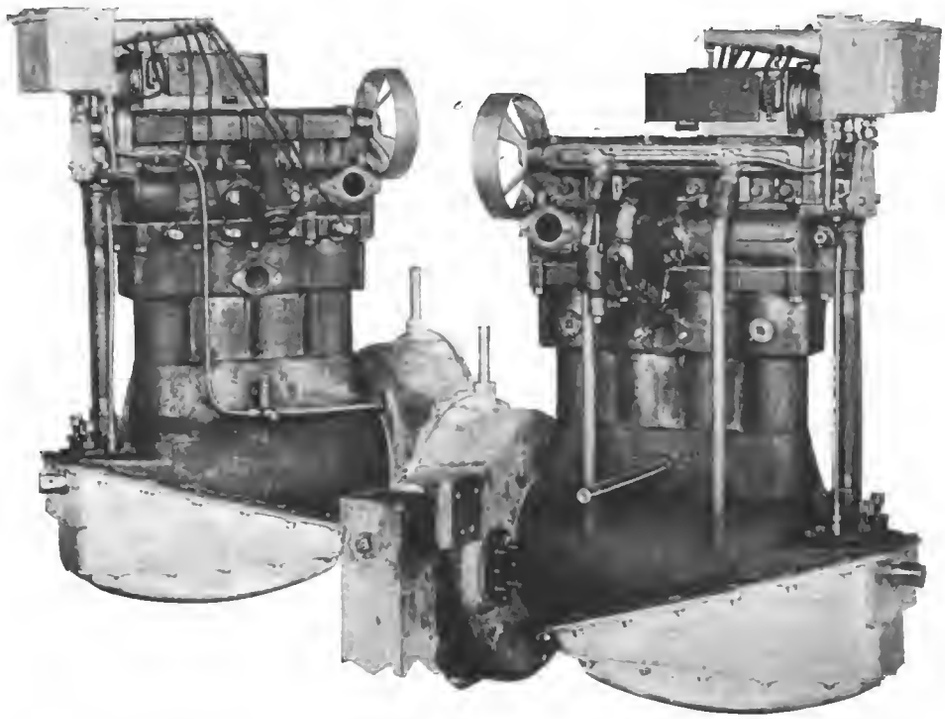
Section of Radcliffe hydraulic transmission combined with cone clutch to fit six-cylinder Studebaker car used for experiments. The arrows show the direction of oil flow

Nelson Is Unique Design

37 Miles Per Gallon Claimed for $2,200 Car—Overhead Camshaft and Original Transmission—Weight Kept Low

FOR 4 years, E. A. Nelson, the engineer who designed the well-known Hupmobile 20 runabout made during the years of 1910, 1911 and 1912 and the model 32 which succeeded it, has been working on a car of its own. This is now ready and the first finished jobs have been shipped to Eastern points, where distributors have already been engaged.

The Nelson cars are not only distinctive mechanically but otherwise also. The cars are not made by a company but by Nelson himself, financed with his own money and manufactured in his own plant in Detroit, which has a capacity of ten cars a day. There is no stock for sale and no intention of organizing a stock company. It represents the effort of an engineer desiring to place on the market a light-weight vehicle of economy, made from high grade materials, with price occupying a rather subdued position.



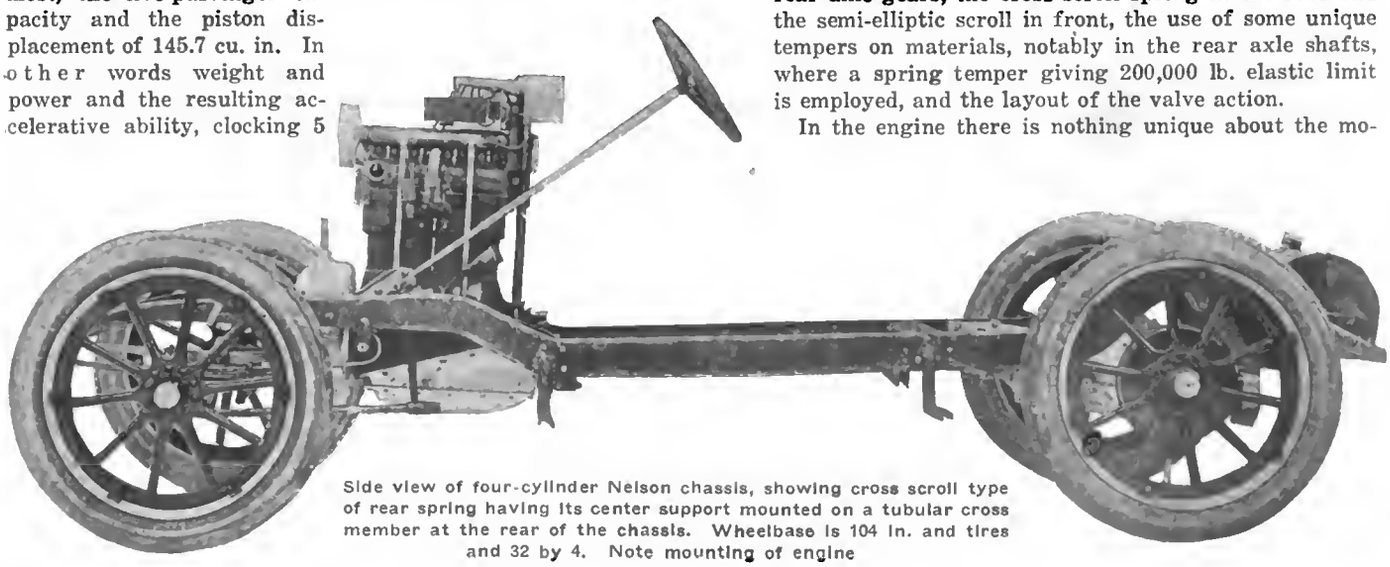
Nelson four-cylinder block power plant, which has an overhead camshaft. The unit gearbox incorporates clutch, gearset and rear axle gears. Bore is 3⅛ and stroke 4¾ in.

The result is a vehicle weighing 2200 lb. with the tanks empty, claimed to be able to travel 37 miles to the gallon and to average better than 25, selling for $2,200 with a sedan body. From one end to the other the design is distinctive, although there is nothing radical. A great number of patented features are used, however, and the finished product shows the result of a considerable amount of study of detail which has resulted in many ingenious departures.

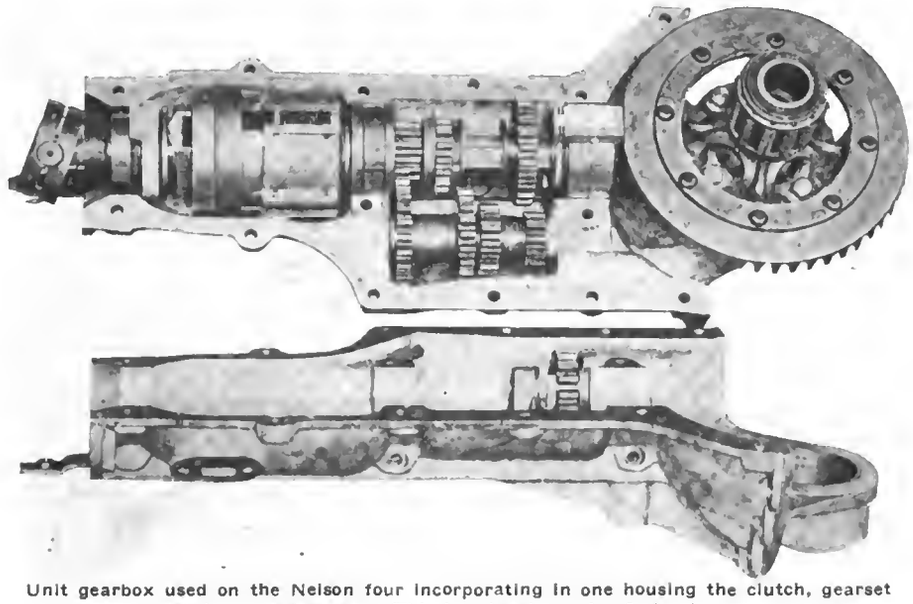
In working out this design two ideas were kept uppermost, the five-passenger capacity and the piston displacement of 145.7 cu. in. In other words weight and power and the resulting accelerative ability, clocking 5 to 35 m.p.h. in 13.5 sec., checks up the results. Throughout, the materials have been designed for this particular capacity with a particular eye toward economy, which means lightness. The finished vehicle carries only 3 gal. of water and 5 qt. of oil, 2 of which are in a reserve tank.

Some of the high spots on Nelson's car are the overhead camshaft used on the block four engine, the unit transmission incorporating in one housing the clutch, gearset and rear axle gears, the cross scroll spring in the rear and the semi-elliptic scroll in front, the use of some unique tempers on materials, notably in the rear axle shafts, where a spring temper giving 200,000 lb. elastic limit is employed, and the layout of the valve action.

In the engine there is nothing unique about the mo-



Side view of four-cylinder Nelson chassis, showing cross scroll type of rear spring having its center support mounted on a tubular cross member at the rear of the chassis. Wheelbase is 104 in. and tires and 32 by 4. Note mounting of engine



Unit gearbox used on the Nelson four incorporating in one housing the clutch, gearset and rear axle gears. This housing is made of aluminum

tor block itself. This is an iron casting with the upper part of the crankcase integral. The heads are detachable, carrying the entire valve assembly and the manifolds, and above the head there is an additional cap carrying the camshaft assembly, also acting as an oil housing for the latter which runs in a continual bath.

In the piston and rod assembly there is nothing exceptional but the rod section. This is a shallow I designed for extreme stiffness in the plane of rotation without a mass of material on the flanges for perpendicular strength. The piston is iron and carries four rings. These are in two slots, each slot carrying two rings of the ordinary eccentric type with the rings dowel pinned to the piston to hold the slots at opposite points on the circumference to avoid leakage. The rings are thus locked in pairs.

The piston pin is hollow, 1 in. in diameter, locked in the upper end of the rod by a pinch clamp and taking its bearing in the piston bosses directly without bushings. The bearing space is 1 in. in diameter and 1 in. on each side, giving a total dimension of 1 in. diameter by 2 in. length. The I-beam rod has a flange width of ⅜ in. The depth of the I is 1⅛ in. at the center with a taper toward the bottom. The stock used is 3/32 in. through the center of the web, the material being chrome vanadium steel. The rod length is 10½ in., and the weight of the entire assembly of piston and rod is 3 lb. 2 oz. Without the piston the rod assembly weighs 1 lb. 12 oz. The bearing at the lower end is 2 in. in diameter and 1½ in. long, provided with two 3½ nickel steel cap bolts.

A counterweighted crankshaft is used, the particular feature of which is the thickness of the cheeks. The thickness of these on the sides adjacent to the two center bearings is 2 7/16 in. The counterweights are made up to balance the throws, plus one-half the rod weights. The material used in the shaft is 0.40 carbon steel, with the counter-weights electrically butt-welded into place.

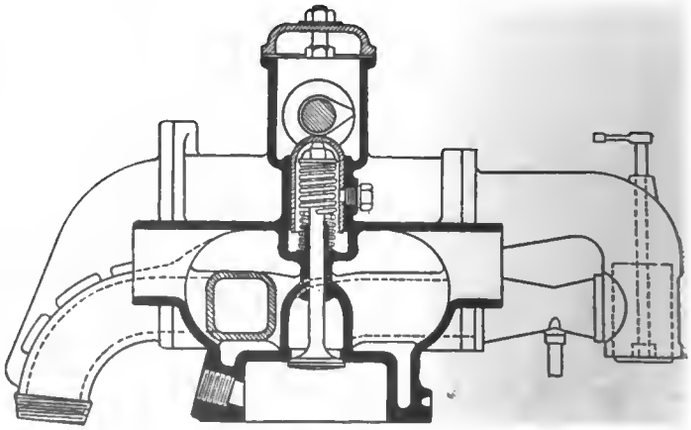
From the crankshaft the valve drive is carried to the overhead camshaft by bevel gear and vertical shaft. The bevel gear is mounted directly on the rear end of the crankshaft and housed directly in the rear main bearing. This is a chrome-silico-manganese, commonly known as C. S. M. steel gear. The vertical shaft tapers from ⅝ in. at the gear to 9/16 at the top and has a 1 to 1 ratio with the crankshaft. The helf-time ratio is secured at the top, where an adjustable spiral bevel transmits the drive to the camshaft. Back of the camshaft spiral bevel gear is a spur gear which forms the magneto drive, the instrument being mounted on the top of the engine and being a special Bosch arranged so that the magnets lie flatly on the top of the cylinder head.

The camshaft lies directly in the head piece of the engine. At the rear end is the spiral gear through which it is driven and at the forward end is the fan pulley which it drives. It is a short, stiff shaft, carried on five bearings cut directly in the cast iron. The camshaft can be slipped into place from either end and carries the cams integral. These are the true, constant-acceleration type, designed to run with 0.005 clearance and giving conventional timing with no provision for valve adjustment. The heads of the hollow tappets and the valve stems which fit into the tappet are ground to finished accuracy after which no adjustment is required. The intake opens 15 deg. after top center and closes 35 deg. after bottom center. The exhaust opens 45 deg. before bottom center and closes 10 deg. after top center.

Across the diameter the camshaft measures 1⅝ in. at the bearings. The three center bearings are ¾ in. long and the end bearings ⅞ in. This is a low carbon steel shaft hardened at the rubbing point. A piston type of tappet is used fitting around the valve stem. The tappets are pressed steel hardened and ground, 1⅛ in. diameter, with the follower ground to a true radius. The valve drive operates with a 28-lb. spring.

Full pressure oiling is used running up to 30 lb. per sq. in., with an exterior adjustable release. No splash is used to any of the bearings, the oil being circulated through the hollow crankshaft and with an independent lead directly to the camshaft housing, where it keeps the shaft bearing continually bathed in oil. This circulating system is operated by a pump formed by the drive gears at the lower end of the vertical valve shaft and has a capacity of 3 qt. In addition to this, there is a small tank mounted on the top of the engine having a reserve capacity of 2 qt. which can be allowed to flow into the main reservoir whenever the oil indicator shows no pressure.

A special adaptation of the U.S.L. starting and lighting system is used, in which the unit is mounted, as customary, as a flywheel at front end of motor. The fields are stationary, with the armature rotating and forming the flywheel. The hub for the rotating member is a standard taper fitting on the end of the crankshaft, while the stationary member is carried on a projection of the crankcase. This



Layout of the overhead valve action on the Nelson four

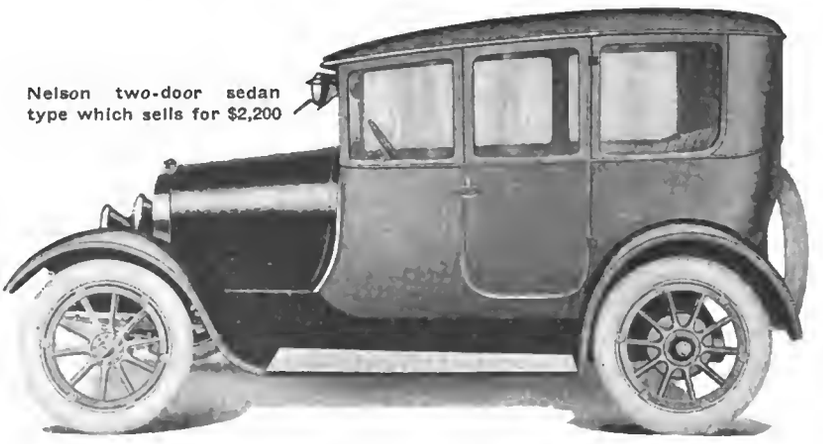
is a 12-volt system with inherent regulation. Ignition is by the specially-built Bosch instrument and the storage battery is a U.S.L.

For carburetion a Zenith instrument is used with a vertical flange directly against the cylinder head which contains the integral manifold. The carbureter is featured by an inclined header designed to eliminate the pocket found with a horizontal header at the venturi and patent has been applied for on this feature. The economy of the car focuses around the construction of the intake manifold, which is so formed that the longest draw from the carbureter to the farthest intake port is 4 in. The water around the cylinder head is kept at about boiling temperature, summer and winter, thus giving the heat required with the present grade of fuel and allowing operation with anything that is called gasoline. Another feature about the throttle linkage is that it is laid out to give a uniform opening at low throttle position.

Cooling is by thermo-syphon with a cellular radiator which has a feature of note in that the overflow pipe is carried to the bottom of the radiator, allowing the steam formed in case of a gathering of slushy ice in the bottom to thaw out the cooling system.

The clutch receives its drive from a shaft and single universal, being mounted in unit with the gearset and rear axle. The diameter of the clutch is 3¾ in. and it is comprised of thirty disks of saw steel running in oil. The axle is floating with ⅞ sq. in. chrome vanadium steel shafts, heat treated with a spring temper giving 200,000 lb. elastic limit. The housing for the clutch, gearset and transmission part is aluminum, and the gear reduction at the rear axle is 4.25 to 1. The propeller shaft is 11/16 chrome vanadium steel.

A cross scroll type of rear spring is used with the center support mounted on a tubular cross member at the rear of the chassis, giving a slight compensating or rocking action. The scrolls at the ends of the spring serve as centering devices and supplant the shackles. On the front springs the scrolls are also used and they serve to take up the shock between the frame and the spring and also give a flexible drive to the front axle.



Nelson two-door sedan type which sells for $2,200

There are six cross members in the frame, those at the front and rear being tubular. The steering gear has a divided drop arm which equalizes the bearing stresses on this point. There is also a forked wheel spindle which distributes bearing stresses and takes care of the castor effect. Additional castor is given by mounting the springs ahead of center, the distance being 16 in. front and 18 in. rear. The brake linkage also has a little kink of interest in the use of sectors for expanding the bands. The brakes are both expanding, being side by side on the same drum. The diameter of the latter is 11½ in. and the face width 1¼ in.

The wheelbase is 104 in. and the tire size 32 by 4. It is stated that upward of 12,000 miles has been shown on the test cars to a set of tires. The speed range is from 5 to 50 m.p.h.

It will be noted that in the body lines the cowl is entirely eliminated, the hood being in direct contact with the body proper. It is a two-door sedan type with divided front seats, upholstered in gray bedford cord, as is also the top lining. The cushions are tufted with real curled hair over heavy springs. All the windows can be lowered into the body sash and a double windshield is employed. Standard equipment includes a Moto-Meter, Stewart speedometer, Waltham clock and ammeter, gasoline and oil gages, dash light, tools, tire pump, etc.

Chalmers Six Hauls 15 Tons ¼ Mile

Chalmers Six-30 chassis hauling a 15-ton steam-hammer ¼ mile to factory

INSTALLATION of heavy machinery at the big automobile plants presents problems that only resourceful factory managers can solve.

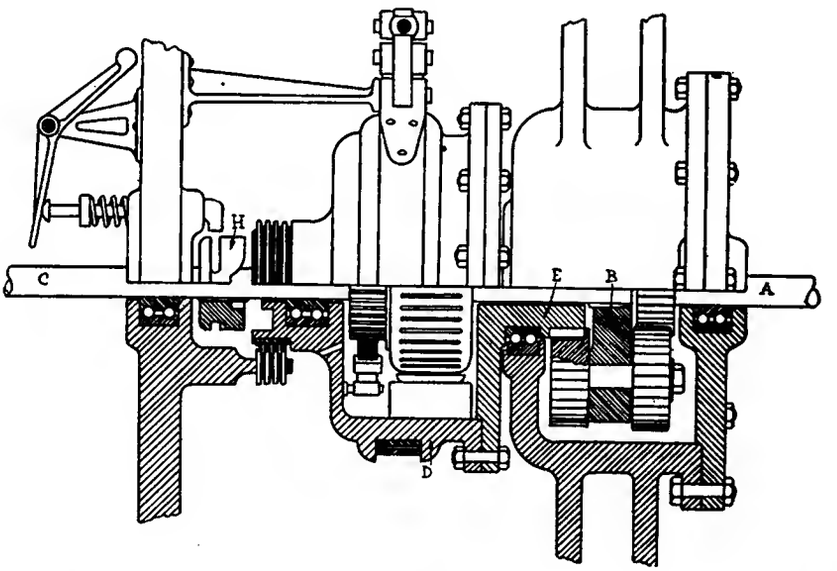
During the fall a big steam hammer arrived at the plant of the Chalmers Motor Co., Detroit, for installation in the drop-forge building. The steam-hammer weighed in excess of 15 tons, and after being unloaded from a railroad flat car, had to be moved a distance of ¼ mile.

A Chalmers Six-30 chassis was hurried over from the final test department, hooked up to the big hammer by heavy ropes and the power was turned on. So heavy was the ponderous piece of machinery that steel rollers placed under it were crushed like egg shells and the ropes lasted for only short periods.

But the 2000-lb. chassis moved its 30,000-lb. load along steadily and the hammer was in position within an hour after arriving at the factory.

A Cuban Electric Transmission

Electric Unit Combined with Planetary Gear Permits Reduction of Size and Weight — Direct Drive Given by Engaging Dog Clutch



TO the possibilities of electric and electro-mechanical transmission systems there seems to be no end. One of the most interesting is illustrated on this page. It has two special advantages; first, it gives a direct drive on high gear, both the electrical and mechanical portions then being inoperative. Second, the horsepower of the electrical portion needs only to be one-half that of the gasoline engine. The action can be very readily followed from the sectional illustration in which *A* is the engine shaft. It will be seen that this drives the sun wheel of a planetary gear. The armature of the electrical machine and the pinion carrier *B* are both fixed to the shaft *C* which is the driven shaft to which the universal joint is attached for the propeller shaft. The field magnet case *D* turns freely on the shaft *C*, but has integral with it a second sun wheel *E*, being thereby connected to the engine through the medium of the planet pinions which are both on their shaft.

Now assume *A* to be rotating and *B* stationary, then the pinions will revolve, and *D*, by means of the sun wheel *E*, will be driven in the same direction as that in which the engine is turning at a speed depending upon the numbers of teeth in the sun wheel on *A* and the sun wheel *E*. Having the field magnets revolving around the armature, as soon as a current is allowed to flow there will be resistance, so that the magnets will tend to drag the armature around with them. This is the equivalent of applying a magnetic clutch tending to start the car by means of the shaft *C*. But there is also the reaction to be considered. The field magnets tend to rotate the armature and the armature tends to stop the rotation of the field magnets. This means that equal efforts are being made, one to turn the shaft *C* and the other to stop the turning of *D*, and so to stop the turning of *E*. The effect of holding *E* is to produce another reaction which drives the pinion carrier *B* in a forward direction. But *B* is keyed to the shaft *C*; therefore, we are trying to turn this shaft both by means of the armature and by means of the pinion carrier, and the turning effort is divided equally between the armature and the planetary gearing.

As the car speeds up we shall reach a position where the shaft *C* is revolving a little slower than shaft *A*, the difference in speed being only just sufficient to maintain enough current to supply the necessary magnetic grip. When this happens the throttle is allowed to close for an instant and the dog clutch *H* is moved by any convenient means, this locking *D* to the shaft *C*. Then no current is being generated, since the armature and the magnets are revolving at the same speed and there is no relative motion between the different parts of the planetary gear.

To obtain the reverse there is a brake band surrounding *D* whereby it can be stopped from rotating and *E* being stationary will cause the pinion carrier *B* and shaft *C* to travel in a reverse direction.

This is merely the simplest expression of the invention, which is susceptible to many variations of detail. The inventor is Carlos M. Seidel, an electrical engineer of Havana, Cuba, at present residing in New York. He is anxious to make arrangements for the manufacture of an experimental outfit and may be addressed in care of THE AUTOMOBILE.

New Process Rubber—Plates Metal

Soft Rubber Attached to Steel So That It Cannot Be Torn Off—Employed for Solid Tire Making and New Flexible Coupling

THE attachment of rubber to metal is a subject which probably is not much considered by engineers, yet for many purposes a process which enables soft rubber to be fixed to steel is very useful. The first instance that occurs is, of course, an electrician's pliers where the rubber is necessary for insulation. Another place where the two dissimilar substances require to adhere is in the band type of solid tire. Yet another example is the roller skate wheel, for skates intended to be used in offices.

The old way of attaching rubber to metal was to make the metal surface very rough so that the rubber, when vulcanized in place, would be held mechanically by the rough metal. A new process has recently been developed by the Rubber Insulated Metals Corp., Plainfield, N. J., whereby soft rubber can be made to stick to metal so strongly that the rubber can be torn off afterward and will break above the junction line rather than at it.

To obtain this close adhesion, it is not necessary that the metal should be very rough. The first stage consists of plating the surface of the steel with a copper alloy having very much the appearance of brass. Then, in mixing the rubber previous to vulcanizing, certain substances are added

which have a chemical action on the copper alloy when subjected to the vulcanizing heat. Vulcanizing proceeds exactly as though the metal were not there. In the case of a pair of pliers, for instance, after they had been plated the rubber compound would be put on the mold and vulcanizing then takes place at the same temperature in about the same time required formerly. Repeated experiments show that after this treatment the rubber can only be torn off with difficulty, and when as much as possible has been removed in this way it will be necessary to scrape or cut in order to get down to the metal surface, so strong is the tie between the metal and rubber that is established during vulcanizing process.

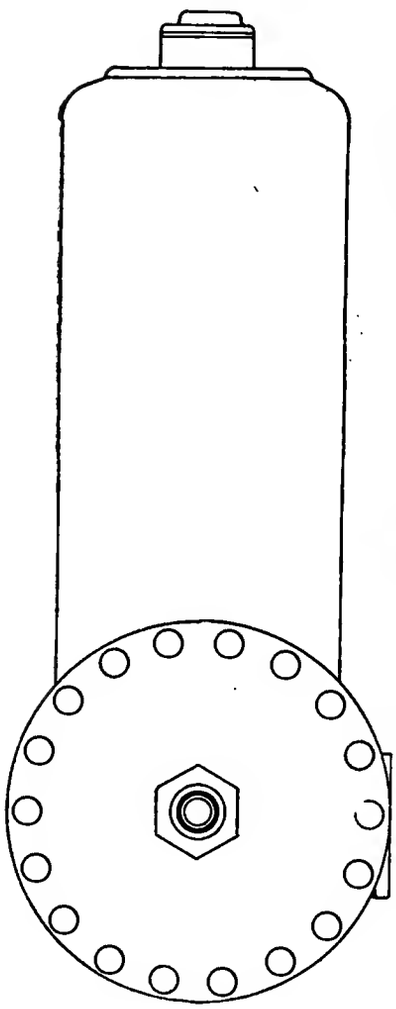
There seems to be hardly any end to the possibilities of this process. One of its most useful fields of application is claimed to be in solid tire manufacture, the Rubber Insulated Metals Co. stating that a tire with a given amount of rubber of a given quality can be produced more cheaply by their method than by any other. In other words, they think the process will effect a substantial economy in solid tire cost.

Another use for the process is for making flexible couplings, and it is anticipated that there will be a big demand for these in the automobile industry. The coupling is shown in the accompanying illustration and there is no metallic connection whatever between the two steel parts. The wave formation of the steel is carried right across and a half inch or more of rubber, according to the size of the joint, separates the two metal parts. These joints have been made in many sizes and tested in many ways and should have many automobile uses. In this coupling the rubber is normally in compression, as can be observed by looking carefully at the illustration. It is not suggested that the joint is flexible enough for use where much disalignment exists, but it will care for as much as a leather disk magneto coupling.

Rimco rubber-metal flexible coupling

Carter Tank Pumps Fuel

Diaphragm Oscillated by Cylinder Pressure—Keeps Level Constant—Action Unaffected by Throttle Position

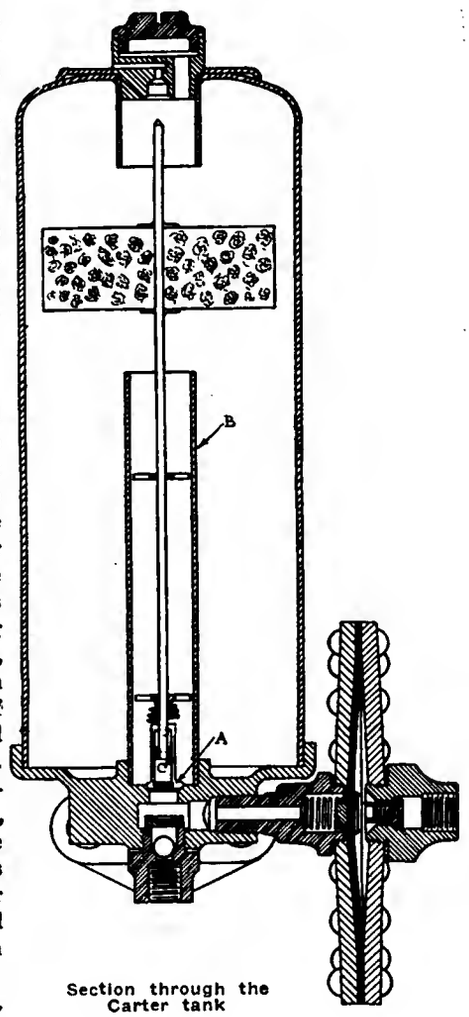


THE Carter system of fuel feed used on the American six, and applicable to any automobile, is a positive pumping system operating without regard to the depression in the intake manifold and also making no use of exhaust pressure. Its essential feature is a diaphragm something like the vibrating diaphragm of an electric horn. This diaphragm is contained in a case and on one side of it there is a spring which normally keeps it pushed back against the opposite side of the case. Here there is a small hole in which a little plunger rests, and behind this plunger is a connection for a copper pipe, of which the other end is taken to one of the cylinders of the engine, usually being fitted to a union in a valve cap or some similar convenient place.

Diaphragm Protected from Explosion

On the compression stroke the air in the pipe is compressed in proportion with that in the cylinder. This moves a little plunger and presses the diaphragm across its case against the spring. When it is pressed as far as it will go the little plunger comes against a seat in the nipple so that when the explosion follows the compression it merely holds the plunger more tightly on its seat and does not transfer any more pressure to the diaphragm. As soon as the pressure drops in the cylinder on the exhaust or suction stroke the spring drives the diaphragm back again to its original position. Thus, during each cycle in the cylinder to which the diaphragm is attached, it makes one complete oscillation. The side of the diaphragm case furthest from the engine is connected by a non-return valve to a long pipe and the gasoline tank. It is also connected with the small tank by which the carbureter is fed. As the spring pushes the diaphragm back, when the cylinder pressure falls it sucks in fuel from the main tank, then on the next compression stroke this fuel is driven upwards into the supplementary tank passing another non-return valve as it goes. It is by means of this second non-return valve that the pumping is caused to cease when the supplementary tank is full.

Referring to the illustration, the valve being shown at *A*,



Section through the Carter tank

it will be seen that it is a mushroom type and on the compression stroke of the diaphragm the fuel is forced upwards until it entirely fills the vertical tube *B* and flows out over the top into the tank. When the level in the tank lifts the float the stem of the latter raises the little plunger *C*, which is inside the mushroom valve. Thus, at the top of its travel the float lifts the mushroom valve off its seat. As soon as this happens the diaphragm, instead of sucking fuel from the main tank, merely draws it from the supplementary one and pumps it back again.

To start the tank, originally when it was first fitted the priming cap at the top of the tank is unscrewed and the gasoline poured in. Once the lower part of the tank is filled it will require no further attention.

The Carter tank is made by the Carter Carbureter Co., St. Louis, Mo.

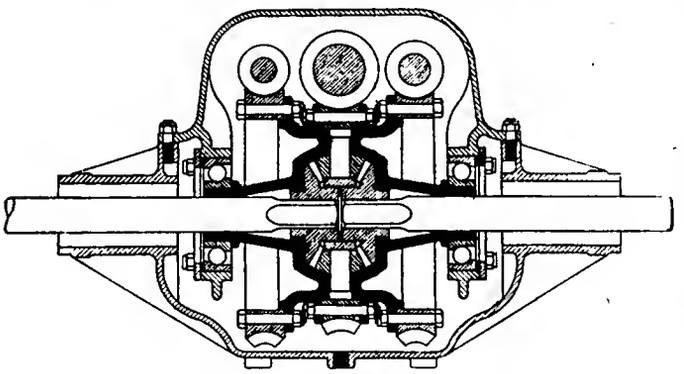
A special claim made for the Carter system is that the fuel level remains very constant. Less than ⅛ in. of movement on the float will make all the difference between the mushroom valve being closed or open, and as this leaves its seat the pump is instantly stopped and as instantly started when it once more returns to its normal position.

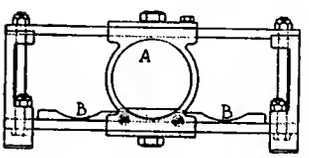
Multiple Worm Drive Axle

Two Direct Speeds and Reverse, Also Direct, Inside Axle Housing

THE illustrations on this page show a multiple worm drive axle giving two direct speeds forward and a direct reverse. The propeller shaft is inclosed within a very large diameter torque tube, and there is an ingenious device whereby the rear end of the shaft can be direct clutched to either of the three worms.

Referring to the cuts which are almost self-explanatory, the upper left shows the layout of the three worms and the triple worm wheel. The lower right view shows the three dog clutches with the propeller shaft in the middle, or high gear position. To change from one gear to another the clutch is thrown out in the usual way, and the action of pressing the clutch pedal also pulls forward the part which slides within the carrier *A*. This disengages the dog clutch and also frees the carrier for transverse movement. The gear lever is then operated, sliding the carrier across till the coupling is opposite either the low speed or the reverse worm, and letting in the clutch then engages the dog clutch before the friction surfaces of the main clutch come together.





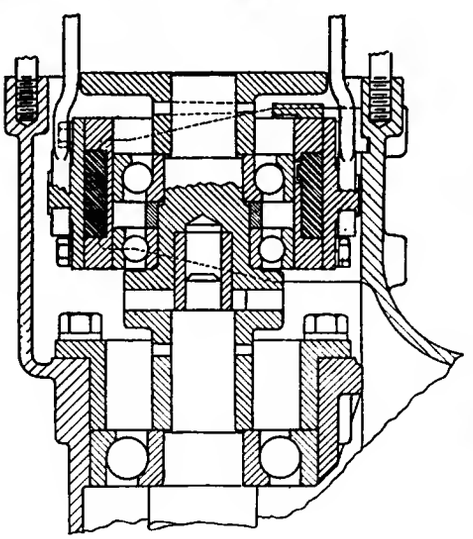
Details of Chase multiple worm drive axle as applied to a Willys-Knight four

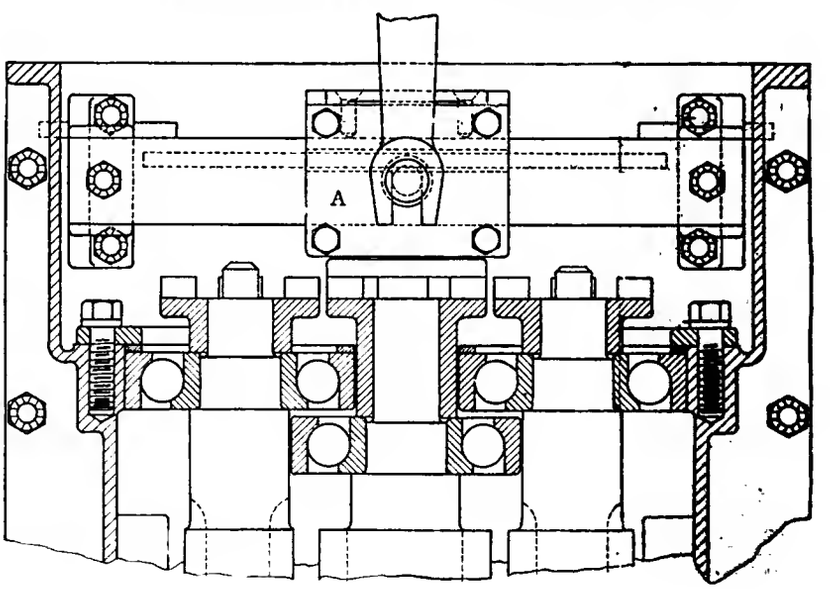
The small drawing at the center shows how the movable carrier is locked, so that it cannot move sideways while the dog clutch is in mesh. The bar *B*, *B* has three semi-circular grooves in it, and the carrier *A* cannot be moved till the clutch has been withdrawn by fully depressing the pedal.

The gear has been made and applied to an automobile. It is the invention of A. W. Chase, and the patents are held by the Multiple Worm Axle Co., whose offices are with those of the Pan American Munitions Co., Grand Central Terminal, New York.

The experimental model, the drawings for which are used for the accompanying illustrations, has been made carefully, and demonstrates in a satisfactory manner. However, it is obvious that some simplification would be possible in designing for regular production, and both weight and size reduced. At present the weight is said to be a little less than that of the original axle with three speed transmission integral.

The fact that all three worms are running continuously is probably of small importance, since there is practically no load on the worms which are running free. The coefficient of friction between a worm and worm wheel is extremely small, and the amount of power required is negligible.



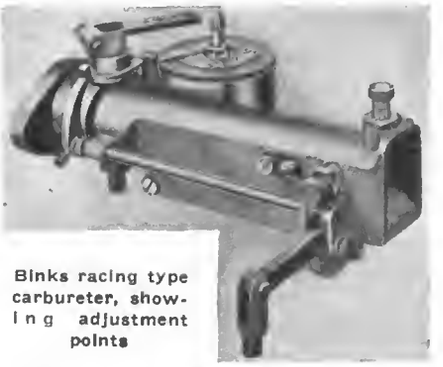


ACCESSORIES

Binks Racing Carbureter

ONE of the features of this carbureter is that the area past the jet may be varied while at the same time keeping the jet in the most constricted area with a wide-open throttle and combining a true venturi action. The instrument is said to impart strong acceleration, rendering gear shifting much less frequent in hill work and providing maximum speed for straightaway travel. There is a pilot jet for very slow running, and starting the engine when cold is made easy, no flooding being necessary, as with the flap drawn up tight fuel will spray out of the main jet owing to the high velocity past it. Under ordinary conditions starting is accomplished on the pilot jet.

Charles Binks, the inventor, is prepared to sell patents and rights of his carbureters for the United States. Binks carbureters are now manufactured in England in various styles for gasoline, kerosene and heavy fuels for both cars and trucks, prices of the instruments varying with their type and size.—C. Binks, Ltd., Eccles, England.



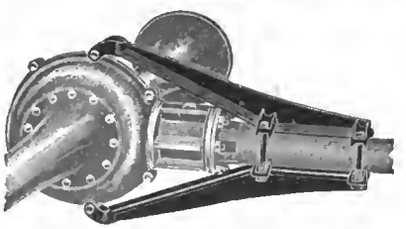
Binks racing type carbureter, showing adjustment points

King Valve-Spring Lifter

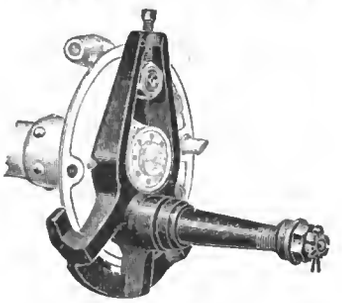
This valve-spring lifter is designed for other than Ford cars. A horizontal member is locked in the valve-cap opening, serving as a purchase for the lever and at the same time holding the valve down from the top. An adjustable chain and ring offer a fulcrum for the notched lever that is caught beneath the valve washer, the washer raised and the locking pin removed. Price, $1.50.—King Specialty Mfg. Co., Brookline, Mass.

Ekern Emergency Axle

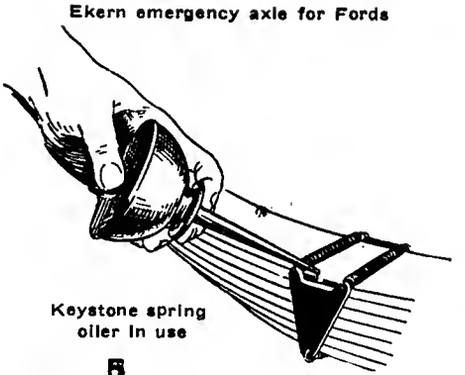
By the use of this device a Ford car with a broken rear axle can be placed on its own wheels and towed home. The emergency axle hooks under the flange on the car-axle housing and is secured by a set-screw at the top. The broken axle stub is then removed from the wheel and the wheel placed on the emergency axle. The axle sells for $5.



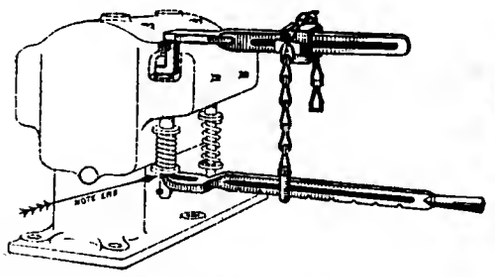
Ekern shaft support for Ford cars



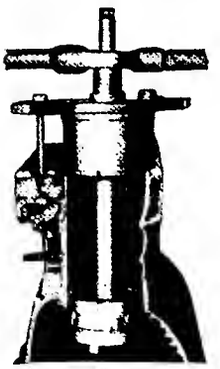
Ekern emergency axle for Fords



Keystone spring oiler in use



King valve spring lifter



Storm & O'Hair reboring tool

Malleable-iron braces are also made for clamping between the end of the drive-shaft tube and the lugs of the differential case, thus supporting the drive-shaft tube of a Ford car. It is stated that the differential housing and the drive-shaft tube are made a unit, thus prolonging the life of the entire rear assembly. The braces may be attached in 10 minutes by any one. Price, $3.50.—Ekern Bros. Mfg. Co., Flandreau, S. D.

Westmoreland Piston Ring

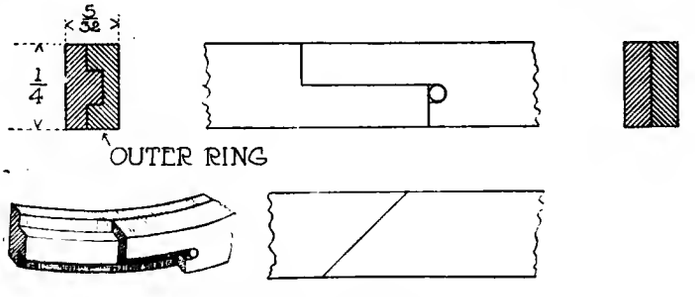
As shown in the illustration, this recently patented piston ring is a two-piece construction, with a lap joint on the outside part and a bevel cut in the inside. The two parts are prevented from moving on each other by the tongue-and-groove feature, while the two joints cannot move around together because of the dowel pin. Some of the advantages claimed are equalized pressure against the cylinder walls, sealed joints, tortuous gas passages, etc. The metal is so distributed as to get equal pressure from each ring. There are no feather edges or excessively thin sections, the inventor stating that there is no chance of wedging between the cylinder walls and the piston and that the ring works equally well either side up.—E. T. Westmoreland, Childress, Tex.

Keystone Spring Oiler

Three coiled springs hold an oil pocket tightly against the sides of the car spring. As the leaves of the spring vibrate with the motion of the car, it is claimed that the lubricant is automatically spread between the leaves. The oiler may be attached to any car, and needs to have the oil supply renewed monthly. Price, 25 cents each.—M. & M. Co., Cleveland.

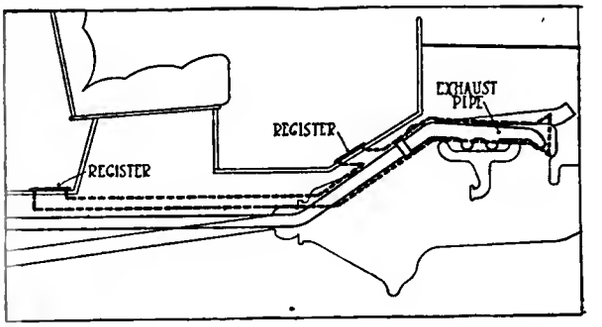
Storm & O'Hair Reboring Machine

In addition to the standard reboring machine adjustable for all makes of engines this company is now manufacturing a special type for Fords, as illustrated herewith. The cutters are universally adjustable by means of a center cutter adjuster and can be set to cut any desired amount. Each cylinder is rebored and finished to any desired oversize in one operation. The machine is simple and accurate and can be operated by hand, low-speed drill press or other power. Parts are interchangeable with



Details of Westmoreland two-piece piston ring construction

At the left is the Ottofy heater attached to an engine, the principle being illustrated in the diagram at the right



those of the standard machine, so additional equipment can be purchased at any time and at moderate cost, to make it suitable for reboring practically all makes of cylinders.—Storm & O'Hair Co., 226 Commercial Street, Thompson, Iowa.

Penfield Spotlight

This small electric spotlight is swiveled on the windshield so as to permit motion in any direction. Two styles are offered, one having a rear view mirror, and the other plain. They are finished in black with polished nickel trimmings. Price, 6-in. light with rear view mirror, $7. Without mirror, $6.50.—Penfield Mfg. Co., Meriden, Conn.

Ottofy Heater

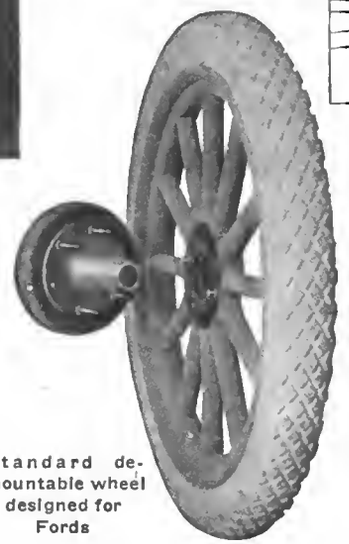
In this device a funnel just behind the radiator catches the air and passes it over the hot exhaust pipes and into the registers in the floor boards. A valve at the mouth of the funnel may be adjusted from the seat, and the desired amount of warm air reaching the registers controlled. Price, large size, touring, $15; roadster, $10; Ford type, touring, $7.50; roadster, $5.—Ottofy Auto Heater Co., 3133 Locust Street, St. Louis, Mo.

Standard Demountable Wheel Set

In converting the regular Ford wheels into demountable and interchangeable wheels, a dummy hub is substituted for the standard Ford hub and carries the wheel by means of four studs and nuts. Flanges are placed on each side of the wheel at the center of the spokes, and are held in place by two bolts. It is claimed that a tire change may be made in 4 min. Price, including a spare wheel, $12. — Standard Auto Accessory Co., Leipsic, Ohio.

Kelley Convertible Truck

For converting a Ford car into a 1-ton truck. After the removal of the body, rear wheels, rear axle, springs and driveshaft, the attachment is bolted on over the Ford frame. It comprises a special lengthened frame, two heavy semi-elliptic springs and a special rear-axle construction, including brakes, and truck wheels carrying Goodrich 32 by 3½ solid rubber tires. The extended wheelbase is 127 in., giving a loading



Standard demountable wheel designed for Fords

space of 9 ft. back of the driver's seat. Various styles of bodies for the truck are also made by this company. Price, internal gear, $365; worm gear, $385.—Kelley Convertible Auto-Truck Co., 332 Michigan Avenue, Chicago.

Pontoklene Polish

Besides acting as a polish for preserving and improving the car finish with little rubbing, Pontoklene acts as a cleanser, easily removing tar, grease and dirt. The preparation is applied by wiping it over the surface to be cleaned and polished, a little rubbing with a thin, soft cloth sufficing to bring up the gloss. Price, $1.50 per half-gallon can, delivered.—Du Pont Chemical Works, Equitable Building, New York.

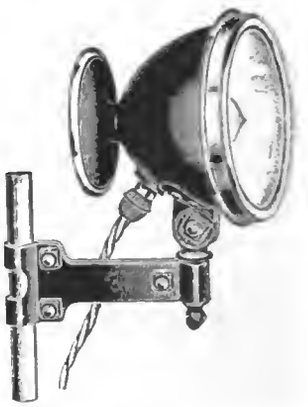
Lox-It Patch

A combination patch made of strong canvas and rubber. It is applied to the puncture or blow-out cold, allowing ½ to ¾ in. around the hole. It is said that an ordinary repair may be made in 5 min.; that the tube may be used immediately, the puncture being permanently sealed. Price, 6 by 18 in., $1.50; 4 by 16 in., $1; 3 by 17 in., 75 cents, and 2½ by 12 in., 50 cents.—Superior Fabric Patch Co., Midlothian, Tex.

Dutch Brand Varni-Brite

This compound is claimed to restore discolored varnished surfaces to their pristine brilliancy. When the car is new the original luster is preserved. The line is very complete, including a top dressing, a cushion coating paint, a black brass lacquer, and a rim paint, as well as many other products for grooming the car.—Van Cleef Bros., 7711 Woodlawn Avenue, Chicago.

Kelly truck converter applied to a Ford chassis



Penfield spotlight

Kelly truck converter assembly for Fords ready to be attached

Industrial Miscellany

Factory

Robert H. Hassler, Inc., Indianapolis, Ind., manufacturer of automobile accessories, yesterday announced the completion of a modern manufacturing plant on a 6-acre site which will be occupied by the recently incorporated Hassler Motor Co., which has a capitalization of $200,000. The new company, which expects to be in operation shortly after the first of the year, will manufacture a car of medium price, which will be placed on display for the first time at the Chicago show.

American Appliances & Machinery Mfg. Co., Brooklyn, N. Y., will occupy its new building at 161 Jamaica Avenue, on or before Jan. 1.

Fuller & Sons Mfg. Co., Kalamazoo, Mich., will erect a four-story 180 by 60-ft. addition to its plant. This will practically double the plant and increase output by more than 100 per cent.

Oliver Rubber Mfg. Co., Oakland, Cal., is erecting a new building fronting at Broadway and 21st Street, with 10,000 ft. of floor space. The company will enter the tire manufacturing field with a capacity of twenty tires daily. A specialty will be made of large size tires.

J. P. Gordon Co., Columbus, Ohio, maker of fabric goods, has been compelled to put on a night shift of over 200 power sewing-machine operators and will add to this as rapidly as new operators can be secured and trained.

Personals

W. G. Fuller, New Orleans, La., has been made sales manager of the Capital City Auto Co., Studebaker agent.

L. G. Fairbanks has become eastern district manager of the Firestone Tire & Rubber Co., Akron. He was formerly assistant advertising manager of that company. He succeeds D. C. Swander, who goes to Boston as local Firestone manager.

Fred Brandt has joined the staff of the Princess Motor Car Co., Detroit, Mich., as master electrician in charge of the electrical department. Mr. Brandt was formerly electrical expert for the Hupp Motor Car Corp.

G. E. Rason has resigned from his position as advertising manager for the Ford Motor Co., of Canada, and will join Frederick K. Stearns & Co. as assistant manager.

H. L. Walker Co., Detroit, Mich., distributor for the Woods electric in Detroit, will also handle the agency for the Princess Motor Car Corp. for Wayne, Oakland, Monroe, St. Clair, Macomb and Washtenaw counties.

Frank C. Riggs has been appointed general manager of the Pacific Coast territory of the Willys-Overland Co., succeeding A. D. Plughoff, who recently resigned. He has been president of the Oregon Motor Car Co. up to the time of this change.

R. B. Johnston has joined the American Motors Corp., Plainfield, N. J. He will help secretary P. W. Hansl in handling the advertising and assist director of sales I. Brock in his work. He started the automobile column of the New York *Sun*, ran *Leslie's* Motor Bureau for some time and gained valuable merchandising experience while working for Carl H. Page, E. R. Hollander, Harry W. Ford and the Chalmers company.

R. R. Price, formerly distributor of Chalmers cars at Jacksonville, Fla., has joined the tractor manufacturing business with which Carl G. Fisher and C. G. McCutcheon are associated.

A. G. Henderson, of Walla Walla, Wash., has been appointed the Detroiter

The Automobile Calendar

ASSOCIATIONS

Jan. 6-13—New York, Mid-Winter Meeting of Society of Automobile Engineers, Engineering Society Bldg.

Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.

Jan. 9-11—New York City, Society of Automobile Engineers' Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.

Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.

Jan. 24-26 — Chicago, Second Annual Meeting National Assn. of Automobile Accessory Jobbers. Congress Hotel.

CONTESTS

1917

April—Los Angeles to Salt Lake City Road Race.

May 19—New York Metropolitan Race on Sheepshead Bay Speedway.

May 30—Indianapolis Speedway Race, Championship.

June 9—Chicago, Ill., Speedway Race, Championship.

June 23 — Cincinnati, Ohio, Speedway Race.

July 4—Omaha, Neb., Speedway Race, Championship.

July 14 — Des Moines, Iowa, Speedway Race, Championship.

July 4—Tacoma, Wash., Speedway Race, Championship.

Aug. 4—Kansas City Speedway Race.

Sept. 3—Cincinnati, Ohio, Speedway Race. Championship.

Sept. 15 — Providence, R. I., Speedway Race, Championship.

Sept. 29—New York, Speedway Race. Championship.

Oct. 6—Kansas City Speedway Race.

Oct. 13 — Chicago, Speedway Race.

Oct. 27—New York Speedway Race.

SHOWS

Dec. 30-Jan. 6—Cleveland Automobile Accessory Show, Dreamland Auditorium.

Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.

Jan. 6-11—Milwaukee Auditorium, Milwaukee Automobile Dealers.

Jan. 6-13 — New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 12-20—Philadelphia, Show, Philadelphia Automobile Trade Assn.

Jan. 9-10 — Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.

Jan. 15-20—Fall River, Mass., Show, Casino.

Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.

Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.

Jan. 22-27—Manchester, N. H., Academy.

Jan. 22-27—Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.

Jan. 23-27 — Oklahoma City, Okla., Show, Auditorium.

Jan. 23-27 — Baltimore, Md., Show, Fifth Regiment Armory.

Jan. 25-27—Asheville, N. C., Show, Asheville Automobile Trade Assn.

Jan. 27-Feb. 3—Columbus, O., Show, Memorial Hall, Columbus Dealers' Assn.

Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Jan. 27-Feb. 5 — York, Pa., Show, York Automobile Dealers' Assn.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Jan. 28-Feb. 3 — Wilmington, Del., Show, Hotel duPont.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 5-9—Boston, 8th National Good Roads Show, Mechanics' Bldg.

Feb. 5-10—Bangor, Me., Bangor Automobile Assn., Auditorium.

Feb. 10-17 — Hartford, Conn., Show, State Armory, First Infantry.

Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.

Feb. 12-17—Bay City, Mich., Show, Armory.

Feb. 12-17 — Louisville, Ky., Show, First Regiment Armory, Louisville Automobile Dealers' Assn.

Feb. 12-19 — Indianapolis, Ind., Show, Steinhart Bldg., Indianapolis Automobile Trade Assn.

Feb. 17-24 — Newark, N. J., Show, First Regiment Armory.

Feb. 19-24 — South Bethlehem, Pa., Show, Coliseum.

Feb. 19-24 — Grand Rapids, Mich., Show, Automobile Business Assn. of Grand Rapids.

Feb. 14-17—Peoria, Ill., Coliseum, Automobile and Accessory Dealers' Assn.

Feb. 18-25 — St. Louis, Mo., Show, Automobile Manufacturers' and Dealers' Assn.

Feb. 19 — Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.

Feb. 19-24 — Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.

Feb. 19-24—Bridgeport, Conn., Show, Armory, Coast Artillery Corps.

Feb. 19-24—St. Louis, Overland Bldg., St. Louis Auto Dealers' Assn.

Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.

Feb. 24-March 3 — Brooklyn, Show, 23rd Regiment Armory.

Feb. 26-March 3—Omaha, Neb., Show, Auditorium, Omaha Automobile Show Assn.

Feb. 27-March 4—Atlanta, Ga., Show, Auditorium, Atlanta Auto Trades and Accessory Assn.

March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co. Armory of the University of Ill.

March 3-10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

March 14-17—Davenport, Iowa, Show, Coliseum Bldg., Tri-City Auto. Trade.

March 17-22 — New Haven, Conn., Show, Hotel Taft.

March 18-23—Cedar Rapids, Ia., Cedar Rapids Automobile Trades Assn.

April—Calumet, Mich., Show, Coliseum, Frank Ketchell, Mgr.

distributor for that section by the Detroiter Motor Car Co.

J. R. Fry, has been made the manager of the Becker Motor Car Co., Grand Rapids, Studebaker distributor. Mr. Fry was formerly in the wholesale department of the Studebaker Corp., Detroit.

Joseph Sairs, Ford dealer at Beloit, Wis., is preparing to establish a plant for the manufacture of brake linings, specializing in such supplies for the Ford. Mr. Sairs has purchased a site and plans to erect a two-story factory, 50 by 160 ft. Work will begin about March 15.

M. L. Helmka has been appointed superintendent of the painting department of the Buick Motor Co., Flint.

R. W. Donohue has been appointed in charge of the sales promotion department of the Regal Motor Car Co., Detroit.

Don M. Dickinson has been made director of sales of the Champion Motors Co., Fulton Ill., and Cleveland.

R. W. Lytle, formerly engineer and production manager of the Bimel Automobile Co., Sidney, Ohio, has been made production manager of the Rock Hill Buggy Co., Rock Hill, S. C.

F. F. Tilden, formerly city salesman at the Indianapolis branch has been installed as manager of the Goodyear branch at Columbus, Ohio, succeeding W. W. Magill, whose duties are to be announced later. W. S. Boone, formerly branch manager at Scranton, Pa., has been made supervisor of city sales at Philadelphia. W. G. Starnes has been made manager of the Atlanta branch, succeeding J. E. Taylor, who has been transferred to the dealer's help division of the automobile tire department at Akron. F. W. Nason, formerly manager of the Rochester, N. Y., branch, has been transferred to the export department at Akron.

J. T. Belanger, Detroit, has become Wayne County agent for the Olympian car, and has formed the Olympian Motor Sales Co.

Joseph Gardham has rejoined the forces of the Chalmers Motor Co., Detroit. He was connected with that company during the days of touring competition, and drove in several trips for the company in pathfinding.

G. F. Hare has joined the Van Cortlandt Vehicle Corp., New York distributor of the Peerless cars and trucks. He has been with the automobile industry for 15 years. For the last 3 years he has been with the Chevrolet company. W. J. Lasher, for the past 4 years district sales manager of the Mitchell Motor Car Co., has also joined the company as district manager.

Hoover Holton has been promoted to zone manager of New England for the Maxwell Motor Co., Detroit.

C. L. Guyman has been promoted to assistant truck sales manager of the Packard Motor Car Co., Detroit. He was formerly in charge of the field representatives.

W. H. Taneyhill has been appointed district manager for the Scripps-Booth Corp., Detroit, succeeding J. E. Morehouse who has been promoted to manager of the local retail store.

W. L. McCabe has been elected secretary and treasurer of the Brewer Motor Car Co., Spokane, Wash. He was formerly office manager of the firm.

Norman DeVaux has been elected general manager of the Chevrolet Co. of Cal., and D. C. Durant has been appointed sales manager of the company. Mr. DeVaux and Mr. Durant were formerly sales manager and assistant sales manager of the company, respectively.

Dealers

Carl M. Green advertising agency has opened an office in Chicago, from which it will handle the advertising account of the Nash Motors Corp. Hal Trump and Owen B. Winter, both former Detroiters, will operate the office.

Not King Factory Branch.—In THE AUTOMOBILE for Dec. 7 it was stated that the King Motor Car Co. had leased premises at 2813 Locust Street, St. Louis, vacated by the Brinkman Motor Car Co., for factory branch. Our correspondent was misinformed, as this is not a factory branch.

Maxwell Motor Co., Inc., will erect an assembly and distributing plant at Minneapolis which will cost $300,000 and will be four stories high and 132 by 330 ft. in size. It is expected that the building will be ready for occupancy and will employ approximately 200 men.

Jennings Motor Sales Corp., New York, has taken the distribution of the Hal.

Fentress Motor Car Co., Seattle, has moved into quarters at the corner of East Pine Street and Tenth Avenue. It will handle the agency for the Peerless.

Adams-Oakland Co., Cleveland, agent for the Oakland and Premier, has leased a two-story building which is to be fitted into a complete automobile sales room and service station. Mr. Adams states that the structure will be occupied by the Ohio Auto Sales Co., which handles the Oakland and Premier cars.

J. Q. Goudie, of Detroit, has been appointed the Michigan agent for the Pennsylvania Rubber Co.

Axel Anderson, president and treasurer of the Union Chain Co., Minneapolis, has bought the interests of F. A. Gahring and will continue adding new machinery and factory improvements to increase the output.

Willys-Overland Co., Minneapolis, has opened the new Northwestern retail sales department and show rooms at Hennepin Avenue and Harmon Place.

Acme Auto Truck Sales Co., Minneapolis, has opened an agency at 917 Hennepin Avenue.

Carlson Motor Car Co., Minneapolis, has opened salesrooms for the KisselKar in a new building at 1626 Harmon Place.

J. F. Lynch, St. Paul, former agent for the Kissel Kar, has been made sales manager for territory east of the Mississippi River.

W. H. Ryan, Wilmington, Del., has taken the agency for Norwalk tires and tubes.

White Brothers, Wilmington, have taken the agency for the International truck.

N. B. Stapleford, Delaware City, Del., has taken the agency for the Grant cars in New Castle County and northern Kent and for the Oldsmobile in the State south of Wilmington.

Consolidated Auto Co., Spokane, Wash., has taken the Eastern Washington agency for the Dixie Flyer cars and the Old Hickory truck.

F. P. Fentress has taken the Seattle, Wash., agency for the Knight tire.

Saunders Motor Car Co., Birmingham, Ala., has severed connection with the Hudson Motor Car Co. and has taken the agency for the Westcott.

Brown & Holland Magneto & General Repairing Co., Little Rock, Ark., has opened for business. In addition to parts for all starting and lighting systems, the company will make good guarantees on Bijur starters and Bosch magnetos.

Cadillac-Stout Co., Memphis, Tenn., has been organized to sell the Cadillac cars. J. A. Stout, formerly of Nashville, is the active partner. Temporary headquarters have been opened at 247 Monroe Avenue.

Independent Tire Co., Columbus, Ohio, has opened a branch at 336 Monroe Avenue, Memphis, Tenn., for the sale of factory seconds. J. E. Leacy, Southern manager, is in charge and will make the branch his headquarters.

Virtue & Liberty Motor Sales, Ltd., Toronto, Ont., has taken on the Ford.

Jubilee Spark Intensifier Co. of Canada, Winnipeg, Man., is handling the Jubilee spark intensifier.

McCurdy-Brainard Company recently established agents in Philadelphia for the Jordan car, has acquired selling rights in this territory for the Maxfer truck.

City Garage, Burlington, Col., Studebaker dealer, has added the Aurora demountable truck agency for Kit Carson County.

Woods-Premier Motor Co., Denver, which recently opened a Premier distributing agency for Colorado and part of Wyoming and New Mexico, has secured the Stewart truck.

V. S. Allen, Longmont, Col., has taken the Aurora demountable truck agency for Boulder County.

Harrison Motor Co., Denver, a new $10,000 corporation, has secured the distributing agency for Colorado for the Liberty and for Northern Colorado and Wyoming for the Jordan, and has opened a salesroom at 222 Sixteenth Street.

Lamar Hardware Co., Lamar, Col., has taken the Aurora truck agency for Prowers and Baca Counties.

Highway Auto Sales Co., Denver, Crow-Elkhart and Argo distributor for Colorado and Wyoming, has gone out of business.

Chandler Agency & Service Co., Greeley, Col., Chandler and Elcar dealer, has added the Aurora demountable truck agency for Weld County.

Colorado Motor Truck & Service Co., Denver, has secured the Service truck for Colorado, Wyoming and New Mexico.

Toliver Punctureproof Tube Co., Denver, has opened a salesroom and shop at 1322 Broadway.

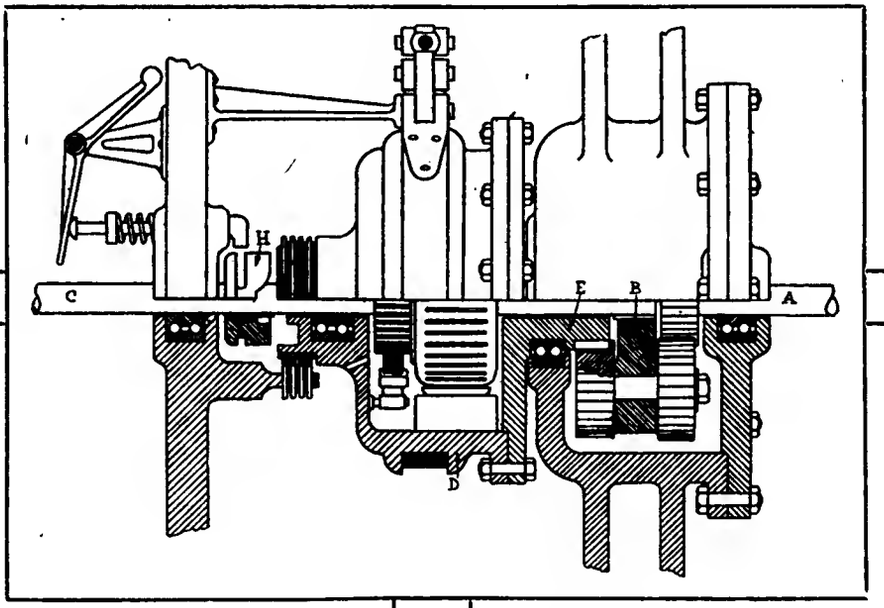
Mid-West Rubber & Auto Co., Denver, Davis distributor for Colorado and part of New Mexico, has moved to 36 East Twelfth Avenue. It has given up the Pennsylvania tire distributing agency for Colorado and will sell cars exclusively.

Merrick Motor Co., Denver, has opened the Crow-Elkhart distributing agency for Colorado and Wyoming.

De Luxe Equipment Co., Denver, has opened a distributing agency for Colorado, Wyoming and New Mexico on the De Luxe body for Ford cars.

Mollman-Mulconnery Motor Co., Denver, has secured the Apperson distributing agency for Colorado, Wyoming and New Mexico.

Flexible Transmission of Power Is the Great Objective of Automobile Manufacture



The Automobile Manufacturer has here an opportunity to obtain exclusive use of an original and effective Electro-Mechanical Transmission by co-operating with the inventor on a royalty basis.

This opportunity is not to be treated lightly. Every manufacturer knows the keen competition for selling features which exists in the automobile world today. Nothing makes a car more significant to prospective buyers than mechanically sound innovations in the power plant developing more flexible transmission of power.

He also knows that everything points to the fact that electro-magnetic transmission will be the big selling feature for several seasons to come. It is not unlikely that the old style transmission will be gradually displaced by the more sound of the electro-mechanical devices.

Here is a chance to put yourself in a position to reap the full benefit of this movement.

The model illustrated and described is merely the simplest expression of the device. It can be directly and easily developed by variations in detail into as complete, efficient and flexible a transmission as the most exacting car owner could wish. Invented and owned by

MR. CARLOS M. SEIDEL
Address care of The Automobile

Mr. Seidel's Electro-Mechanical Transmission has two special advantages: it gives a direct drive on high gear, both electrical and mechanical portions being then inoperative; and it requires for the electrical portion only one-half of the horsepower of the gasoline engine.

The operation of the transmission can be understood by a reference to the diagram in which A is the engine shaft. This drives the sun wheel of a planetary gear. B is a pinion carrier fixed to the shaft C, which is the driven shaft to which the universal joint is attached for the propeller shaft. The field magnet D turns freely from the shaft C, to which the armature of the electrical machine is fixed. The second sun wheel E is integral with the field magnet D and connects it with the engine through the medium of the planet pinion which are both solid on their shafts.

Now when A is moving and B stationary, the pinions will revolve and the sun wheel E will be driven in the same direction as the engine is revolving at a speed depending on the number of teeth in the sun wheels. The field magnet integral with E, revolves around the armature, and as soon as the current is allowed to flow there is an inter action between the magnetic field and the armature, causing the magnets to drag the armature round with them. This is equivalent to applying a magnetic clutch to the shaft C, tending to start the car.

But there is the reaction to be considered. When the shaft C is turned, the pinion carrier B revolves with it and because of the resistance of the armature which tends to hold back the field magnets and the sun wheel E, divides the driving effort equally between the armature and the planetary gearing.

As the car speeds up we reach a position where the shaft C is revolving a little slower than A, the difference in speed being only sufficient to maintain enough current to supply the necessary magnetic grip.

When this happens the dog clutch H is moved locking D to the shaft C. Then the armature and field magnet are revolving at the same speed and no current is being generated, and there is no relative motion in the planetary gear. The car is running on direct drive.

To obtain a reverse, a brake is applied to D stopping it from rotating and causing the pinion carrier and the shaft C to revolve in reverse directions.

If electric connection is made between the storage batteries and the electrical machine it can be used as a starting motor for the engine.

When the engine is idling the unit can be also used through the means of a voltage regulator to boost the charge of the storage battery.

Thus the one electric unit offers possibilities as a clutch, as a starting motor and as a charging dynamo.

The AUTOMOBILE
THE CLASS JOURNAL COMPANY
231–241 W. 39th STREET NEW YORK CITY

TABLE of CONTENTS

VOL. XXXV NEW YORK, DECEMBER 28, 1916 No. 26

Studebaker

Established 1852

Denver's Studebaker Dealer Quotes Words of Praise From Purchasers

Form 1201

CLASS OF SERVICE	SYMBOL
Day Message	
Day Letter	Blue
Night Message	Nite
Night Letter	N L

If none of these three symbols appears after the check (number of words) this is a day message. Otherwise its character is indicated by the symbol appearing after the check.

WESTERN UNION TELEGRAM

NEWCOMB CARLTON, PRESIDENT GEORGE W. E. ATKINS, FIRST VICE-PRESIDENT

CLASS OF SERVICE	SYMBOL
Day Message	
Day Letter	Blue
Night Message	Nite
Night Letter	N L

If none of these three symbols appears after the check (number of words) this is a day message. Otherwise its character is indicated by the symbol appearing after the check.

RECEIVED AT CORNER CONGRESS AND SHELBY STREETS, DETROIT. MICH. ALWAYS OPEN

23 AMP 101 COLLECT NL
DENVER COLO DEC 18 16

STUDEBAKER CORPN

DETROIT MICH

I HAVE HAD TEN STUDEBAKER CARS AND IT LOOKS AS THOUGH IN THE SERIES EIGHTEEN THE STUDEBAKER CORPN HAS REACHED A PERFECT MACHINE TOM COX OF BELLEVIEW MARKET COMPANY INCOMPARABLE IN STYLE WORKMANSHIP AND QUALITY CHRIS REITHER WITHOUT DOUBT THE GREATEST VALUE ON THE AUTO MARKET TODAY C J HELBER I BOUGHT THE SIX AFTER TRYING SIX OTHER CARS THAT COST TWICE AS MUCH AS THE STUDEBAKER BECAUSE IT WAS THE ONLY ONE THAT SATISFACTORILY NEGOTIATED VIRGINIA CANYON A GRADE OF EIGHTEEN TO THIRTY SIX PERCENT WITH FULL PASSENGER CAPACITY AND TRAILER LOADED WITH A THOUSAND POUNDS H.J WILCOX AUTOMOBILE SALES CORPN 6A19

If you are interested in a kind of dealer representation that brings prestige with profit—that offers such unlimited opportunities as indicated by the above telegram—address your request for further particulars to

South Bend, Ind.

STUDEBAKER

Detroit, Mich.

Address All Correspondence to Detroit

Walkerville, Ont.

MERCER MOTOR CARS

22-73 Series Mercer Motor Cars

IN spite of the abnormal conditions existing in the material market, the 22-73 models are absolutely held to the high standard of construction for which Mercer cars have long been recognized. No compromise of any kind has been allowed, even in the most minute detail.

Consistent with the established Mercer policy of building only a limited number of highly developed, medium-weight, *four-cylinder* cars of known quality, this latest series of cars represents our best efforts toward what we consider an "ideal" car honestly built and honestly sold.

You will better appreciate simplicity and dignity in automobile construction if you visit the Mercer Exhibit at the Shows

CLEVELAND—December 30 to January 6 **PHILADELPHIA—January 12 to 20**
NEW YORK—January 6 to 13, Grand Central Palace, Space B9—Second Floor
CHICAGO—January 27 to February 3, Coliseum, Space P1

MERCER AUTOMOBILE COMPANY **Whitehead Road, Trenton, N. J.**

When an insignificant little bronze bushing wears out—

It causes rattles or knocks, vibrations or lost power and invariably results in expensive overhauling and temporary loss of the car.

Any repairman who replaces worn bushings with bushings of ordinary bronze runs the risk of causing the owner an amazing amount of trouble and expense.

The choice of a proper bearing metal for bushings may seem, at first glance, to be a matter of small importance, but when you consider the expensive and disastrous results that may follow through the use of bushings of questionable or unproven merit, then the matter assumes vital and paramount importance, both as concerns the owner's pocketbook and the repairman's reputation.

If you have reason to believe that your repairman is both experienced and conscientious, you can safely depend upon him to overhaul your car with bushings made of highest grade bronze.

But if you have any reason to believe that he does not regard the bushing problem as serious, then, for the sake of your pocketbook and your future peace of mind, insist upon him using Non-Gran.

By so doing you will save hundreds of dollars in future repair bills because your car will be equipped with the same flawless, long wearing bushings that enable quality-built cars to deliver from two to five times the service of ordinary cars.

Non-Gran differs radically from all other bearing bronzes.

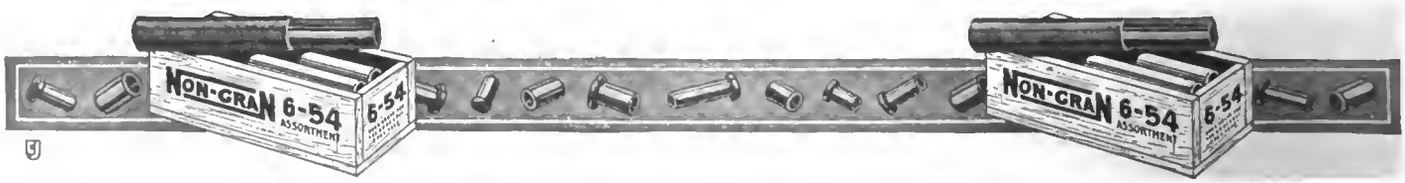
Non-Gran excels any known metal used for bushings in its combination of wear-resisting qualities, toughness, unfailing uniformity, molecular cohesion and freedom from flaws.

Practically all manufacturers of high-grade cars and motors make their bushings of Non-Gran.

These men know that a car can last only as long as its wear-subjected, non-adjustable bushings. Consequently, they take no chances but use the best metal they can get—Non-Gran.

American Bronze Company
Berwyn · · · Pennsylvania

HIGH SPEED
NON-GRAN
BEARING BRONZE



STAR HAND-MADE TIRES

Are You Ready To *Control* the Sale in Your Territory!

The successful tire merchant of tomorrow must absolutely control in his territory the selling of the goods he offers and be in a position to make a profit consistent with his efforts. The margin of profit now received from the quantity tire manufacturer does not exceed the overhead expenses of a well conducted distributing agency and he finds himself simply swapping dollars with the manufacturer. More and more service is being demanded by the tire buyer and in order to extend this necessary service the dealer must receive a larger margin of profit.

During 1917 it is estimated that over $350,000,000 will be spent in the purchase of tires for pleasure cars alone. It will be the golden opportunity for the beginning of a permanent business with continuous profit for tire dealers who sell the right tire at the right price and with a substantial net profit. Our organization has established a fixed policy for selling its entire output through

Exclusive Dealers

There will be no branches and we offer a most unusual proposition for the dealers who become associated with us for putting unlimited effort behind their sales—receiving in return absolute territorial protection.

The **"ALL STAR"** tread (and its kindred styles) promises to be a sensation in the tire field and will be produced by Akron's most experienced capital, its best manufacturing brains and by the most expert labor with years service in the perfection of tire making.

If you are ready to accept this exclusive agency for the newest **Star** in tiredom, write us immediately. We pledge you the most liberal proposition ever made to tire dealers; we pledge the men who buy a better tire—a value received in full; and the most perfect tire that money, brains, material and workmanship can build. The various styles of tires and tubes will be complete and with

5000 MILES GUARANTEED SERVICE

Quick action necessary to secure your territory.

ALL STAR TREAD

THE STAR RUBBER CO.

STAR HAND-MADE TIRES

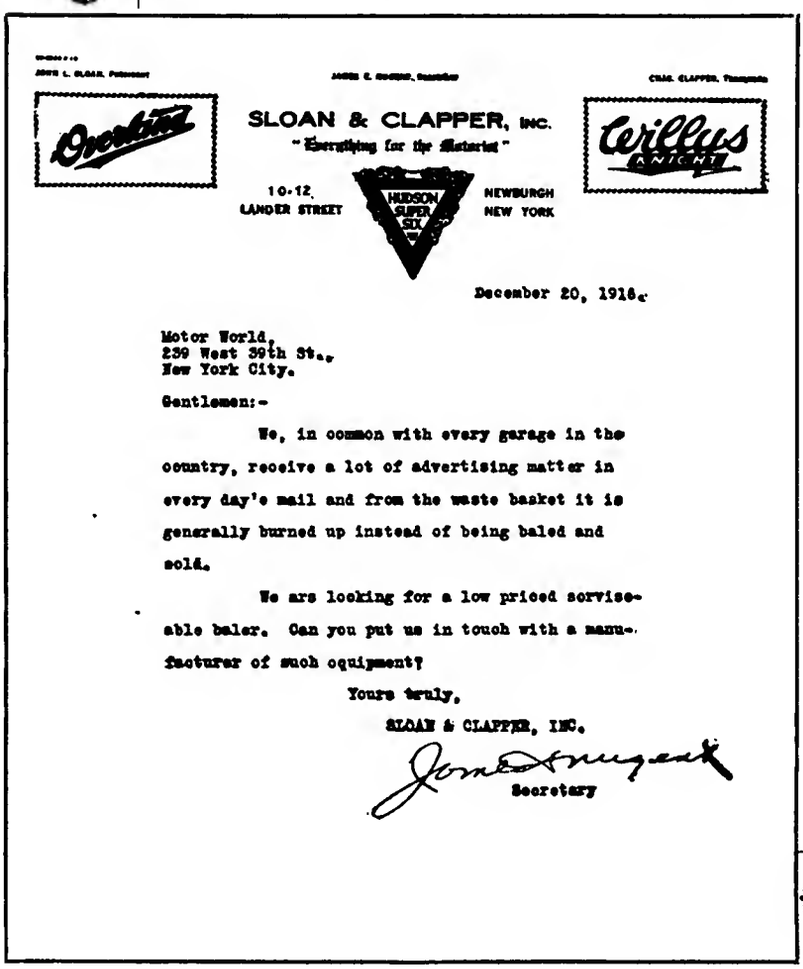
DEPT. 3
AKRON, OHIO

New York Auto Show Exhibit—Hotel Astor
Chicago Auto Show Exhibit—Auditorium Hotel
In personal charge of O. L. Weaver, Secretary

What Constitutes 100 Per Cent Business Success?

(1) To produce an article that is salable	40%
(2) To organize channels for selling and distribution	25
(3) To create demand that will absorb the product, with a fair percentage of profit for the manufacturer	35
	100%

The advertising man represents 35% in the success of every business. Greatest success in the car and accessory industry is where the advertising man lives up to the limit of his possibilities—where he measures up to the full 35%.



SLOAN & CLAPPER, INC.
"Everything for the Motorist"
10-12 LANDER STREET NEWBURGH NEW YORK

December 20, 1916.

Motor World,
239 West 39th St.,
New York City.

Gentlemen:-

We, in common with every garage in the country, receive a lot of advertising matter in every day's mail and from the waste basket it is generally burned up instead of being baled and sold.

We are looking for a low priced serviceable baler. Can you put us in touch with a manufacturer of such equipment?

Yours truly,
SLOAN & CLAPPER, INC.
Secretary

The advertising man has two major responsibilities: (1) to prepare forceful and impelling "copy," and (2) to present that copy to potential purchasers in such manner as will insure direct interest in the product advertised by those to whom the copy appeal is directed.

The reproduced letter on this page bears a significant message to those advertising men who are anxious to become 35 per centers. It proves the unwisdom of contributing to that seemingly inexhaustible flood that goes over the desks and into the waste baskets in thousands of establishments in every section of the country.

And now that we have given you the more important facts about the AMERICAN SIX, let us tell you something of the Sales Policy behind it

LIKE the car itself, the sales policy behind the AMERICAN SIX has been carefully developed by men of experience who are using all the lessons of the past to provide the largest and most permanent satisfaction for the future. Three cardinal principles will dominate the selling policy of the AMERICAN SIX.

FIRST—*To build up a real Merchandising organization*—an organization of automobile merchants who recognize opportunity, know possibilities, and look to the future not less than the present. In the AMERICAN SIX Dealer-organization the man counts most. Ample capital and complete sales arrangements have their places in our estimation but they are secondary to the integrity and intelligence of the man.

SECOND—*To create a permanent organization. From the* profit standpoint permanence is as vital to you as it is to us. We are building an organization for tomorrow as well as today, and we want our Dealers to share in all the future profits to be derived from the increased sales and production of the AMERICAN SIX. We will stand by our Dealers.

AND FINALLY—*We propose to co-operate with our sales organization to the best of our ability.* We recognize that the Dealer is the best judge of sales conditions in his territory and therefore we cannot do his selling. But, in-so-far as we can, we will lend our aid and co-operation in service and merchandising. To this end an extensive advertising campaign in the *Saturday Evening Post* and other influential national publications is already under way, and by every other effective means this Company is pledged to put its full resources behind its Dealers.

New York Show
4th Floor D1 & D2

Chicago Show
Greer Building G12

To a Limited Number of automobile merchants whose ideas harmonize with ours and who see in the AMERICAN SIX a permanent and profitable opportunity we are now ready to offer a contract for its sales representation.

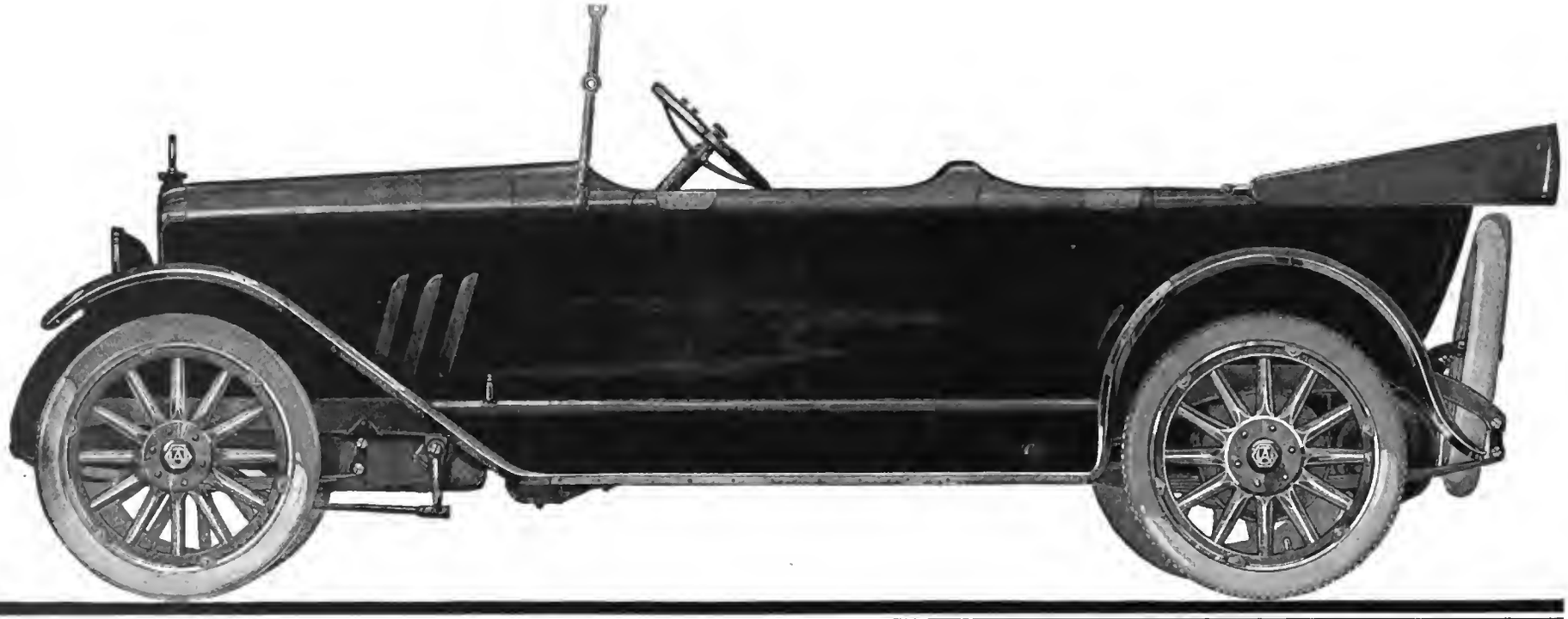
We will build only 3000 cars this season. You may have your share of this total—provided you act promptly. Applications for territory will be considered in the order of their receipt.

Production of the AMERICAN SIX is so far advanced that we can assure deliveries in quantity by January—demonstrators immediately.

The AMERICAN SIX will be displayed at the New York and Chicago Automobile Shows. Reservations of Territory may be entered now.

A Car to Compare with Costlier Cars

AMERICAN SIX $1285



A Car to Compare with Costlier Cars

AMERICAN SIX

IN THESE DAYS almost any automobile manufacturing concern can sell its *first year's* output. The real test comes in the *second* year. If the car is right, if its performance measures up to its promise, other things being equal, it will have a *good* second year—and just as likely many better years to come. But if it doesn't meet the test, look out for trouble. *The AMERICAN SIX is built for the Second Year.* Looking at it, you say "This is a *fine*-looking car." But there is more to it than looks. Down inside, where the wear and tear comes, it is built right. Mechanically and structurally, it is as good as it looks.

And the *Reason* is this: The AMERICAN SIX was planned and is built by *men who know;* there has been no guess work in its development. Behind it is an organization of engineering and manufacturing experts whose skill and ability are known and recognized wherever automobiles are made. This is a sure guaranty that the AMERICAN SIX is not only a good-looking car but is also a *perfect mechanism,* smooth running and efficient in operation.

And it is to this fact that we look for *bigger* sales the SECOND year and in all the years thereafter.

A car is only as good as its engine

The AMERICAN SIX power plant is a revelation of efficiency. The motor block casting—suspended at three points—is designed for even cooling of *all* parts of the cylinder walls by having water surrounding each piston pocket. The 1 9/16 inches valves are a size usually found only in far larger motors, and the valve seats are so thoroughly water-cooled that pitting is made impossible. The 1¾ inches crank-shaft revolves on three wide plain bearings. The circulating splash type lubrication is certain and positive. Oil is easily put into the engine base through the accessible breather top. The water-pump, distributor generator and tire pump are driven by one shaft. To assure lightness the upper portion of the motor casting is aluminum and the base pressed steel. The bore is 3 inches, the stroke 5 inches. Heated air enters the Zenith carburetor and the vaporized fuel is sent directly into a manifold integral with the engine block. In operation this powerful and efficient motor, built under the immediate direction of the engineers of the American Motors Corporation, is quiet and smooth running, flexible and economical in the consumption of gas. It puts the AMERICAN SIX in a class by itself.

Brief Particulars of the AMERICAN SIX

EQUIPMENT:—Engine-driven tire pump; Boyce motometer; one-man top, quick detachable curtains; rain-vision windshield; dash lamp lighting speedometer, ammeter, carburetor adjustment, lighting and ignition switches; starter button on toe-board; button of motor-driven horn at steering wheel center; complete set of tools.

GASOLINE SYSTEM:—Tank at rear and Carter gravity tank over engine.

RADIATOR:—Cellular, shallow but high and broad.

IGNITION:—Generator-storage battery, Gray & Davis coil and distributor.

ELECTRICAL SYSTEM:—Gray & Davis two-unit, starting motor has Bendix drive to fly wheel, generator on pump shaft, 6-volt, 100 ampere hour Willard battery; double bulb headlights, wiring of one-wire type.

CLUTCH:—Three dry-plate discs, ball bearing throw-out collar.

TRANSMISSION:—Selective sliding gears, three speeds and reverse.

AXLES:—Front, one-piece drop forged I-beam; rear, three-quarter floating, spiral bevel gears, gear ratio, 4 5/12 to 1.

WHEELS:—32″ with 4″ straight side tires on demountable rims, extra rim in tire carrier at rear.

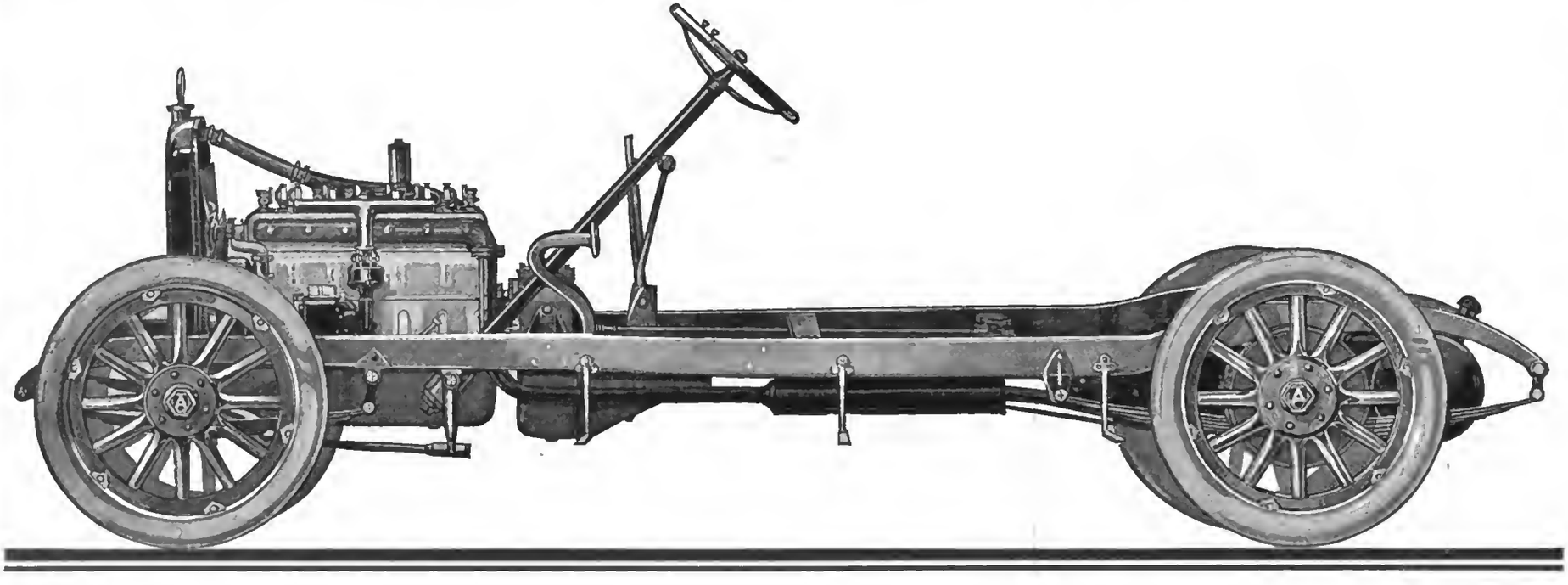
WHEELBASE:—122″; tread 56″.

BRAKES:—On rear wheels; hand emergency expanding, foot service contracting, drum 14″ diameter, 2½″ wide.

SPRINGS:—Semi-elliptic, front 38″ x 2″, rear 52″ x 2″, Hotchkiss drive.

CONTROL:—Left drive, center control.

WEIGHT:—Car and equipment, 2700 pounds distributed equally front and rear.



WHEN you are going into business with other men it is a good plan to know who they are. These three men are a big part of the organization that builds and sells the AMERICAN SIX. There are other good men in the American Motors Corporation but, first of all, you will want to know Speirs, Chevrolet and Brock

PRODUCER

JOHN C. SPEIRS, General Manager and Construction Engineer, is recognized in the automobile industry as "a man who makes a reality out of visions." He is a practical plant executive of vast and diversified experience without a superior—and mighty few equals—in the entire motor vehicle field. Speirs knows thoroughly every best method of making an automobile that gives service and lasts long. From the inception of automobile building in this country he has been directing the work of men and building the materials that went into the making of good cars—Locomobiles, Autocars, S. G. V's and Mercers—and his ripe experience is entirely at the command of the AMERICAN SIX. Speirs is in direct charge of the factory and all matters of production.

ENGINEER

LOUIS CHEVROLET, Vice-President and Chief Engineer, is widely known as an automobile expert and engineer. His technical knowledge and training have been enriched in that severest laboratory of automobile engineering—the racing course, where he won his early fame. He is the holder of many famous trophies, having finished in first place ten times out of twenty-five starts in national road races since 1909. In the course of this experience Chevrolet has racked automobiles over rough roads and smooth, to the tops of mountain peaks, and at breath-taking speed over all sorts and conditions of speedways and dirt tracks and, although his personal interest is largely confined to automobile construction, even now he occasionally takes his place at the wheel in important racing events.

MERCHANDISER

MARCUS I. BROCK, Director of Sales, is one of the business veterans of the great—although young—automobile industry in this country. He had charge of the sales department of the Autocar Company in the earliest days of motoring in America. He also performed a similar service for the E. R. Thomas Company and for some time was Assistant General Manager of the Association of Licensed Automobile Manufacturers. Brock is known to the trade as a builder of dealer organization—not as a driver—in his relations with merchants who have been agents for the cars he was selling. And in his present capacity he is welding together a permanent selling organization of automobile merchants who look to the AMERICAN SIX for fair dealing and substantial profits now and in the future.

To Dealers

AS stated on the first page of this announcement, applications for the limited territory to be allotted for the AMERICAN SIX are now being considered. You will have ample opportunity to see the AMERICAN SIX at the NEW YORK and CHICAGO AUTOMOBILE SHOWS, but reservations of territory may be entered now. Address all communications to MARCUS I. BROCK, Director of Sales

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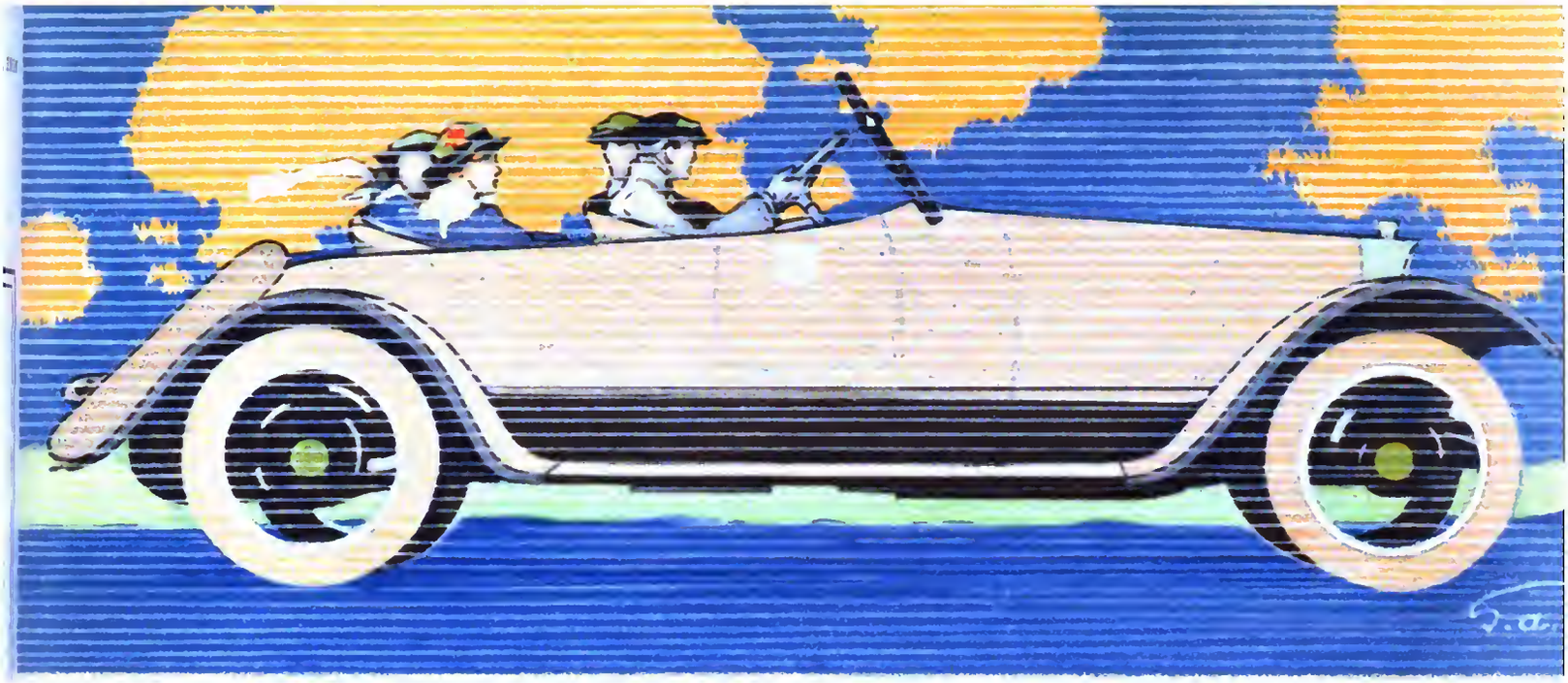
AMERICAN MOTORS CORPORATION

Executive Offices: 141 Broadway New York

LOUIS CHEVROLET, *Vice-President and Chief Engineer* JOHN C. SPEIRS, *General Manager*

MARCUS I. BROCK, *Director of Sales*

Factory: PLAINFIELD, New Jersey *Sales Offices:* PLAINFIELD *and* NEW YORK



Driving Through Air ~

What Makes the Owen Magnetic Run So Smoothly?

Men who have ridden in Owen Magnetic cars owned by their friends are constantly coming to us asking, "What makes this car FEEL so differently in the way it rides? What makes it FLOAT along the road as though it were being drawn forward by some force outside of itself?"

The answer is, because when you ride in an Owen Magnetic, you are driving by magnetism through air space.

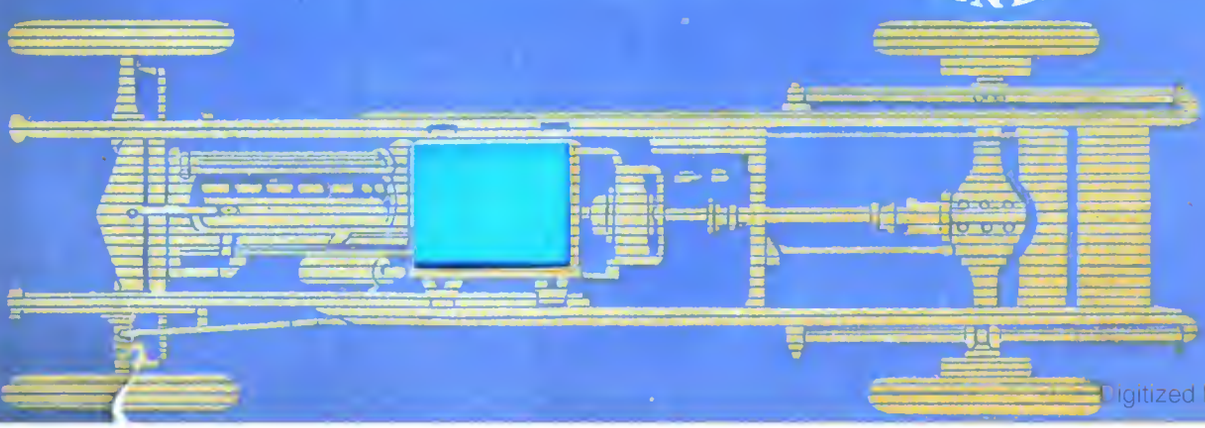
Unique Comparisons

By referring to the drawings at the bottom of these pages you will see that we have an explanation of the operation of this transmission as it appealed to a youth of fifteen. Here is shown a magnet mounted on a pedestal that can be revolved by its hand crank. Between the ends of the magnet a piece of steel attached to a shaft is mounted on a similar pedestal.

The Cause of Smooth Action

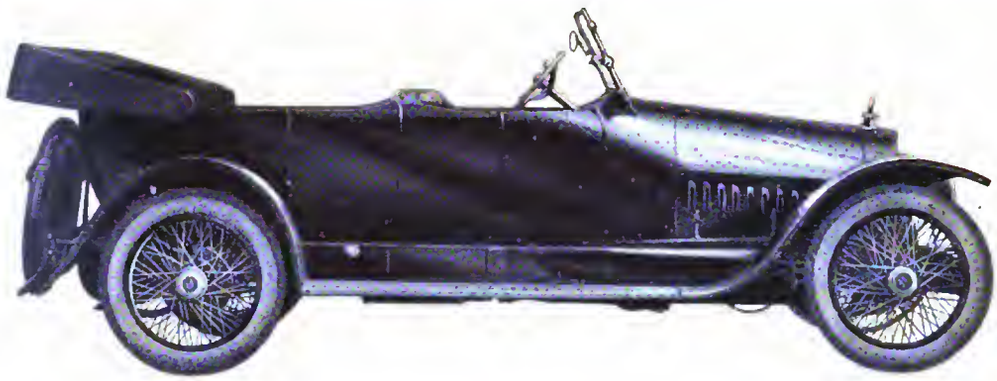
Now if you turn the hand crank and so revolve the magnet you will find that the piece of steel also revolves, although there is an air space between the steel and the magnet. You will notice that even if you should start the hand crank

OWEN MAGNETIC



Here you see the princi ple of the Owen Magneti Transmission reduced t its simplest form. A magnet turning a piec of steel with it, as it re sponds gradually to it magnetic power.

DRIVING THROUGH AIR



with an abrupt jerk, the piece of steel would not start with a jerk, but will begin to move gradually, starting with an imperceptible gradation of movement—so gentle—so slight—that the eye scarcely can register it. That is because there is no rigid mechanical connection between the magnet and the steel—because the steel is revolved by an invisible, intangible magnetic force flowing across an air space.

The Mission of the Magnet

Now turn again to the illustration at the bottom of the page and you will find instead of a hand crank to revolve the magnet, we have a gasoline engine. Then note that the piece of steel is still between the ends of the magnet, but is now mounted on the drive shaft of the car. Here you will see that the engine revolves the magnet, the magnet revolves the steel, and of course revolves the drive shaft with it—and you will see also that when the magnet revolves, although it may start with a jerk, the piece of steel—and therefore the drive shaft—cannot start with a jerk, but will be gradually, softly drawn around with an imperceptible motion by this elastic magnetic field acting across an air space. You will note that there cannot be a sudden jump in driving effort from engine to drive shaft, to rear wheels, to tires, as when the clutch is let in and a rigid connection made between power plant and rear wheels as in the ordinary type of car.

Owen Magnetic Means Car Longevity

There is just the gentle drawing forward, due to the magnetic force, acting across an air space, which starts the drive shaft revolving and in turn starts the car forward so smoothly that it is actually in motion before the passengers can feel the motion—and its speed accelerates with such a smooth but perfect gradation, that there is no jerk, no jar, to mar its exquisite softness of riding—no harsh impact of power impulse to wear out differentials, axles, their bearings, and also the tires.

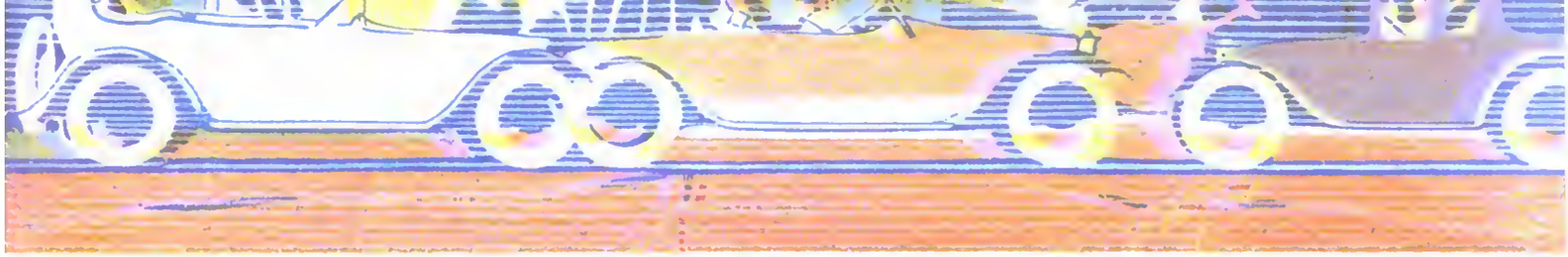
Coasting Qualities

Only when the engine is running faster than the propeller shaft is driving effort applied to the wheels. With the throttle closed the engine slows down to its idling speed and the car coasts perfectly free. The power is again applied by merely opening the throttle when the engine will increase its speed until it overtakes the propeller shaft and the magnetic lock again becomes effective.

Delightful Sensation — Safe

The coasting ability of the Owen Magnetic is not only a delightful sensation but is a wonderful aid in driving on slippery roads without the danger of skid-

Owen Magnetic Transmission permits the driver to run his car at any speed he desires, and control his clutch and brake as well, by simply moving a lever on the steering wheel. This gives an entirely new form of speed control, independent of the spark and throttle.



DRIVING THROUGH AIR

ding. Where there is a positive connection as in the ordinary type of car between engine and driving wheels, the engine upon closing the throttle acts as a brake on slippery roads—the change from driving effort to braking almost invariably means skidding.

In the Owen Magnetic car, closing the throttle does not produce a braking effect—it allows the car to coast perfectly free without driving effort or braking at the wheels. Because of this the danger of skidding on slippery pavements is very much reduced and the car can be driven with greater confidence and a greater sense of security than is true of the ordinary type of car.

Electric Brake

In the neutral position the motor is connected to act as an electric brake—here it becomes a generator, taking power to drive it and so braking the car. It will hold the car on any mountainous grade without wear of any parts. It cannot hold the wheels, thereby practically eliminating skidding. The electric brake holds the car down to an absolutely safe speed on the worst hills. The electric brake is an addition to the regular foot and emergency brakes.

Owen Magnetic Transmission Eliminates

The friction clutch, clutch pedal, transmission gears, fly wheel, separate starting and lighting systems and their clutches, gears, chains, connections and automatic devices are eliminated because the Owen Magnetic system does the work of all.

What It Does for the Engine

It cleans up the power plant, makes it more accessible. Makes all of its parts, such as valves, valve springs, carburetor, magneto, water pump, hose connection, tire pump and steering gear case most accessible.

In the Owen Magnetic Is Offered

ease of control, elasticity of power, constant torque, smooth riding at a thousand speeds—qualities which other manufacturers have sought in vain by multiplying cylinders.

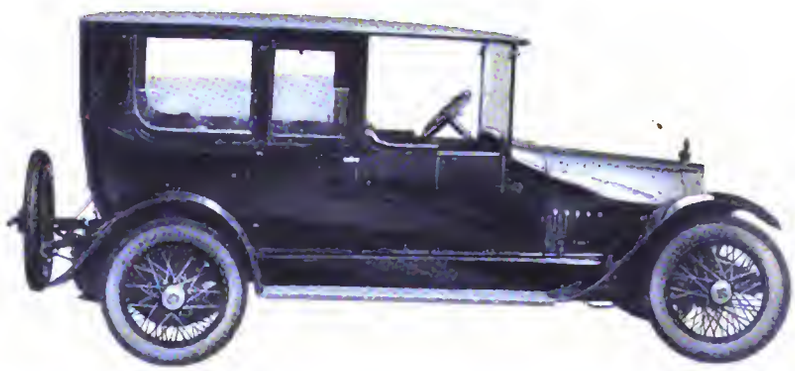
Unparalleled coach work, of the design and quality individual to only the highest priced foreign cars, characterizes the Owen Magnetic.

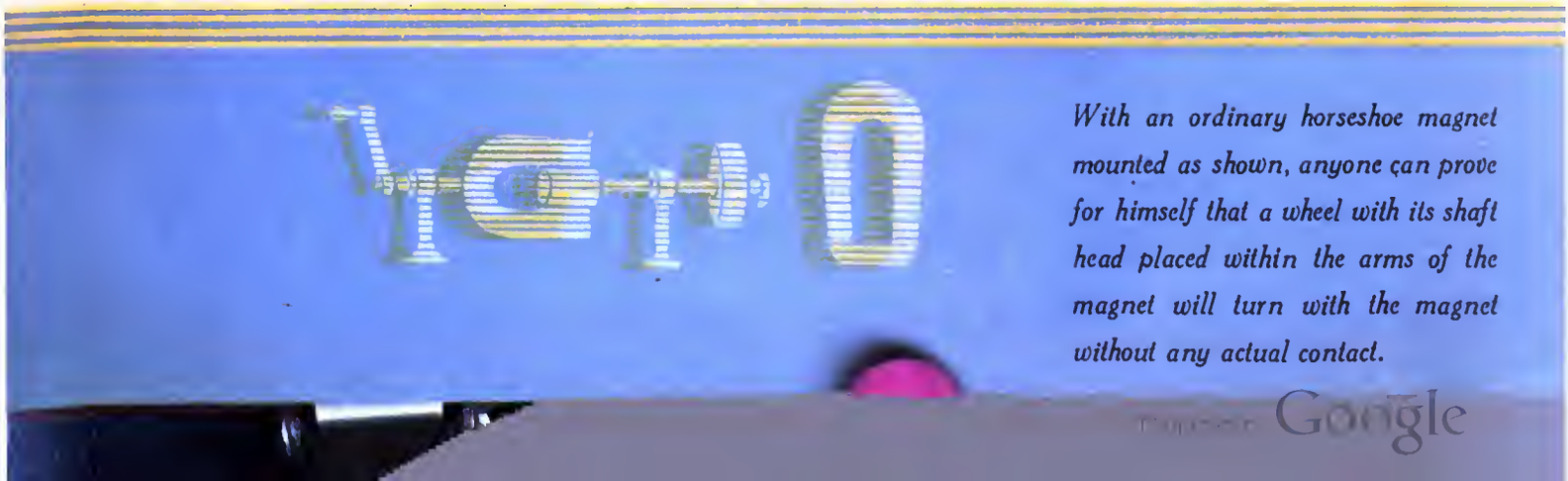
The Wonderful Control

The different controls of a motor car are accomplished on the Owen Magnetic by one small finger lever on the top of the steering wheel. This moves a drum controller to different positions and there can be no interference between any of these positions. You start, stop, increase, diminish or float along at any speed. No jerk nor jars like other cars. Only the smoothest riding action.

Complications Eliminated

There are no automatic cut-outs, regulators or roller ratchets, no chain or gear drives for any of the parts. Simply two ample sized dynamo machines direct connected and a drum controller, and require practically no





With an ordinary horseshoe magnet mounted as shown, anyone can prove for himself that a wheel with its shaft head placed within the arms of the magnet will turn with the magnet without any actual contact.

DRIVING THROUGH AIR

attention or adjustment. These replace the separate starting and lighting systems with their complicated means of driving and regulation—the friction clutch and its actuating mechanism—and the fly wheel.

Simple and Clean

The system is as simple and clean as it is possible to imagine. It accomplishes more desirable things than have ever before been accomplished with a motor car and with an infinitely less number of parts. Outside the simplicity of the system and the fact that it displaces forever the most complicated and objectionable parts of the prevailing type of motor car, there are many features that appeal to those that drive and ride in an Owen Magnetic car.

Action as Smooth as that from an Electric Motor

All power impulses of the gas engine are eliminated—the turning effort impressed upon the propeller shaft is exactly as uniform and smooth as that from an electric motor. No shocks nor jars can be transmitted through this absolutely elastic means of transmitting power.

Power Never Disconnected

From a standing start to maximum speed through all the range of power required from level road to the worst hill, the power between the engine and the propeller shaft is never disconnected, as is the case where clutch is thrown out, a gear change made and clutch engaged again. The car may be easily manipulated in traffic, on level roads, winding irregular grades, through the operation of the small finger lever which calls forth all the power of the engine for an instant or as long as is necessary.

It Performs Surprisingly

The car may be held on a grade by its engine power, the clutch generator slipping and holding with the aid of the electric motor ready to at once go forward upon opening the throttle. By closing the throttle slightly the car will move backward slowly and then at the will of the driver be stopped—then sent forward up to the maximum speed the grade will allow and all without disconnecting the power of the engine from the driving shaft.

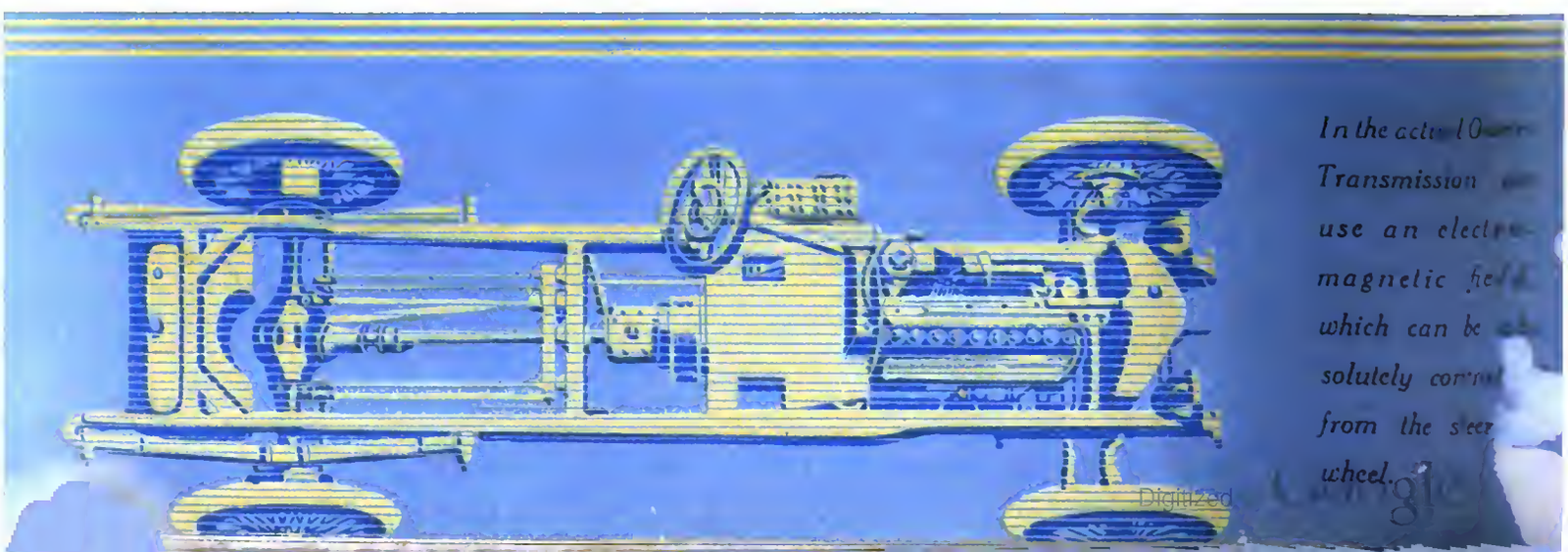
Owen Magnetic Builders

The electric apparatus in the Owen Magnetic car is built by the General Electric Company, which concern has acquired a large interest in the patents covering this transmission. The combination of the General Electric Co. with The Baker R & L Company, manufacturers of chassis and body, whose history in building fine coaches for over sixty years is synonymous with quality, guarantees to the owner a product of the highest possible quality.

BAKER R & L COMPANY CLEVELAND, OHIO

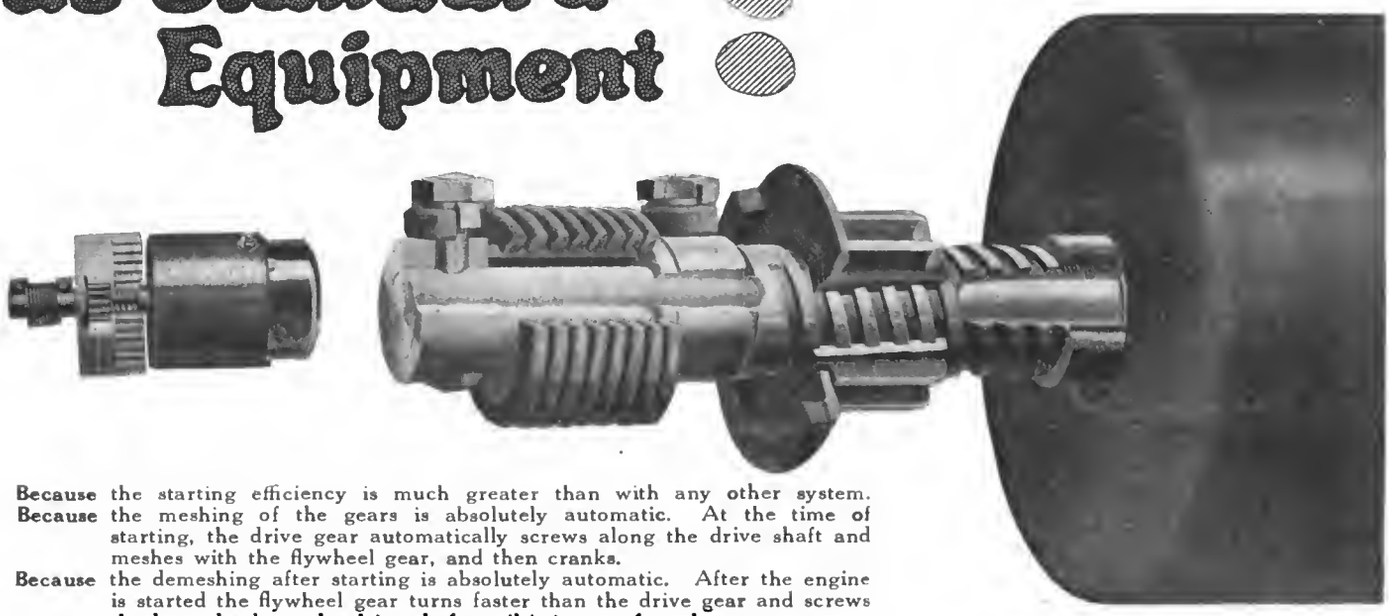
Manufacturers of OWEN MAGNETIC MOTOR CARS

Salesrooms: *New York* *Boston* *Philadelphia* *Chicago* *San Francisco*



In the actual O... Transmission ... use an electro-magnetic field ... which can be ... solutely control... from the steer... wheel.

Why have 125 Car Builders adopted the ECLIPSE-BENDIX DRIVE as Standard Equipment?



Because the starting efficiency is much greater than with any other system.

Because the meshing of the gears is absolutely automatic. At the time of starting, the drive gear automatically screws along the drive shaft and meshes with the flywheel gear, and then cranks.

Because the demeshing after starting is absolutely automatic. After the engine is started the flywheel gear turns faster than the drive gear and screws the latter back on the drive shaft until it is out of mesh.

Because cast iron teeth without any chamfer not only make a great saving in cost, but are actually superior, being the simplest, most efficient and durable construction possible. The teeth are cut in the flywheel, which is a natural gear blank. Stripping of these teeth by accidental starting when the engine is running is impossible, because of the automatic demeshing action.

Because back-fires are automatically protected by the shock absorbing spring drive.

Because there is no over-running clutch to stick or slip.

Because there is no resistance or two-point switch to burn out.

Because there are no shifting levers and pedals, with their complications.

Because it is simpler and has fewer parts than any other starting system.

Because it eliminates chains, which stretch, break and get noisy.

Because it minimizes gear noise in cranking by driving through a spring.

Because it is absolutely silent when the engine is running, being absolutely disconnected.

Because it permits of using a simple, small generator for constant running.

Because it permits of cranking the engine with the most efficient of all starters—a separate electric starting motor—and also more evenly.

Because it makes the two-unit type of starting and lighting system superior to any other and the most popular of all.

Because it requires the minimum of care and attention during the life of car.

Because it is regularly supplied and used as standard equipment with the following starting and lighting systems, on over 125 different makes of motor cars, and also on a large number of marine and aeroplane motors:

A-B-C	Detroit	John O. Heinze	North Western	Splitdorf
Allis-Chalmers	Disco	Kemco	Remy	Wagner
Auto-Lite	Dyneto	Leece-Neville	Robbins & Myers	Ward-Leonard
Delco	Gray & Davis	North East	Roth Bros.	Westinghouse

Eclipse Machine Company, Elmira, N. Y.

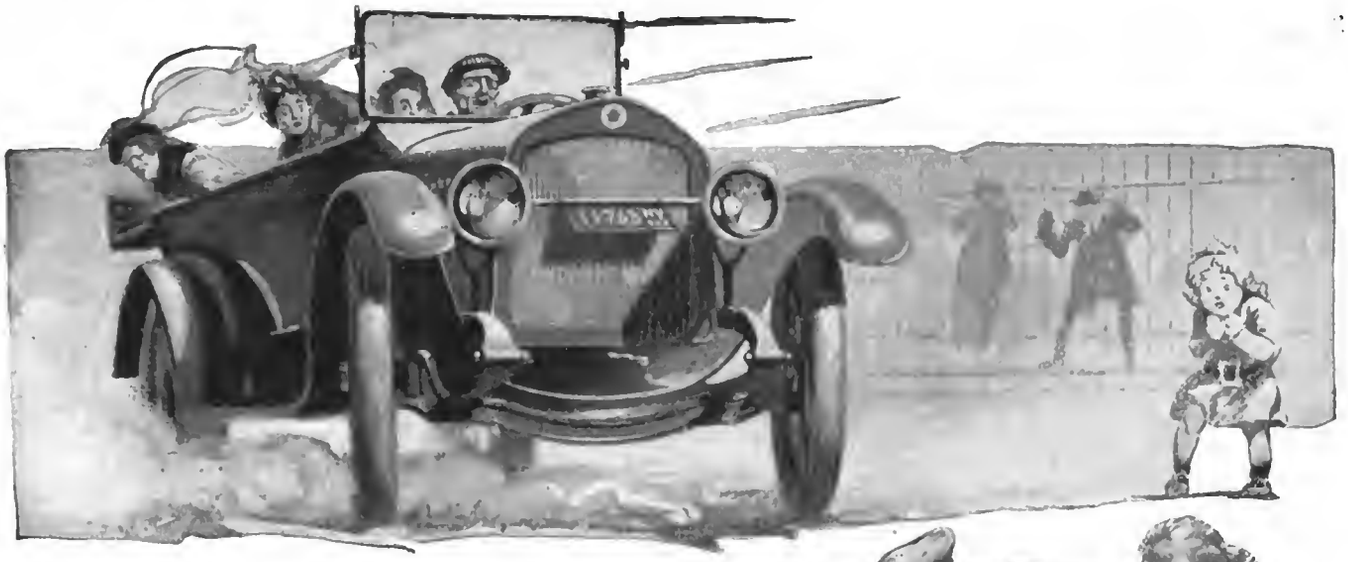
New York Show Headquarters - - - - - The Biltmore Hotel

Sales Agents: **Brandenburg & Company**

New York: 57th St. and Broadway Detroit: Dime Bank Bldg. Chicago: 1112 Michigan Ave.

The following makes of cars are using the Eclipse-Bendix Drive as regular equipment;

Abbott-Detroit	Gramm-Bernstein	Owen Schoeneck
Allen	Grant	Paige
All Steel	Gray-Dort	Partin Palmer
Alter	G. V. Truck	Paterson
American	Hal	Pathfinder
Amea	Halladay	Peerless
Anderson	Harroun	Penny
Apperson	Haynes	Pierce Arrow
Auburn	Heney	Pilliod
Austin	Imperial	Pilot
Barley	International	Premier
Biddle	Interstate	Prinass
Bimel	Jackson	Pullman
Bour-Davis	Jordan	Regal
Briscoe	Kelly-Springfield	Remington
Canadian-Regal	King	Republic
Case	Kissel	Roamer
Chalmers	Kline	Rockhill
Chandler	Lenox	Ross
Cherrolet	Lescina	Russell
Cole	Lexington	Saxon
Columbia	Liberty	Scripps-Booth
Commonwealth	Lippert-Stewart	Service
Crawford	Little Giant	S. G. V.
Crow-Elkhart	Lozier Bros.	Singer
Cummings	Madison	South Bend
Daniels	Marion-Handley	S & S
Davis	McFarlan	Stearns
Demno	Meteor	States
Detroiter	M. H. C.	Standard
Dixie	Mitchell	Stegeman
Dorris	Moline-Knight	Stephens
Dort	Moline Plow	Sterling
Drummond	Monarch	Stewart
Duplex	Monitor	Sun
Elcar	Monroe	Thomas
Elgin Six	Moon	Touraine
Emerson	Murray	Trumbull
Empire	Mutual	Union
Enger	Napoleon	U. S.
Erie	National	Velie
Federal	Nelson LeMoon	Vulcan
Fostoria	Northway	Wealthy-Heights
Genera	Nusco	Wescott
Gerlinger	Oakland	Willys-Knight
Glide	Ogren	Winton
Ghent	Oldsmobile	Wolverine
G. M. Truck	Overland	



What would have prevented most of the auto-mishaps you know of?

Wouldn't good brake lining have done it?

Careful drivers know or they are fast learning the false economy of friction-shy brake lining.

They are learning the advantage of Thermoid 100% brake lining—an advantage that may any time mean the difference between a close shave and a crumpled car—a narrow miss or a crushed body.

Thermoid HYDRAULIC COMPRESSED Brake Lining-100%

Brake lining that is not 100% is like a heart failure. A sudden shock—a Big Emergency—may mean death.

Thermoid Brake Lining has 100% gripping and holding power even when it is worn paper thin.

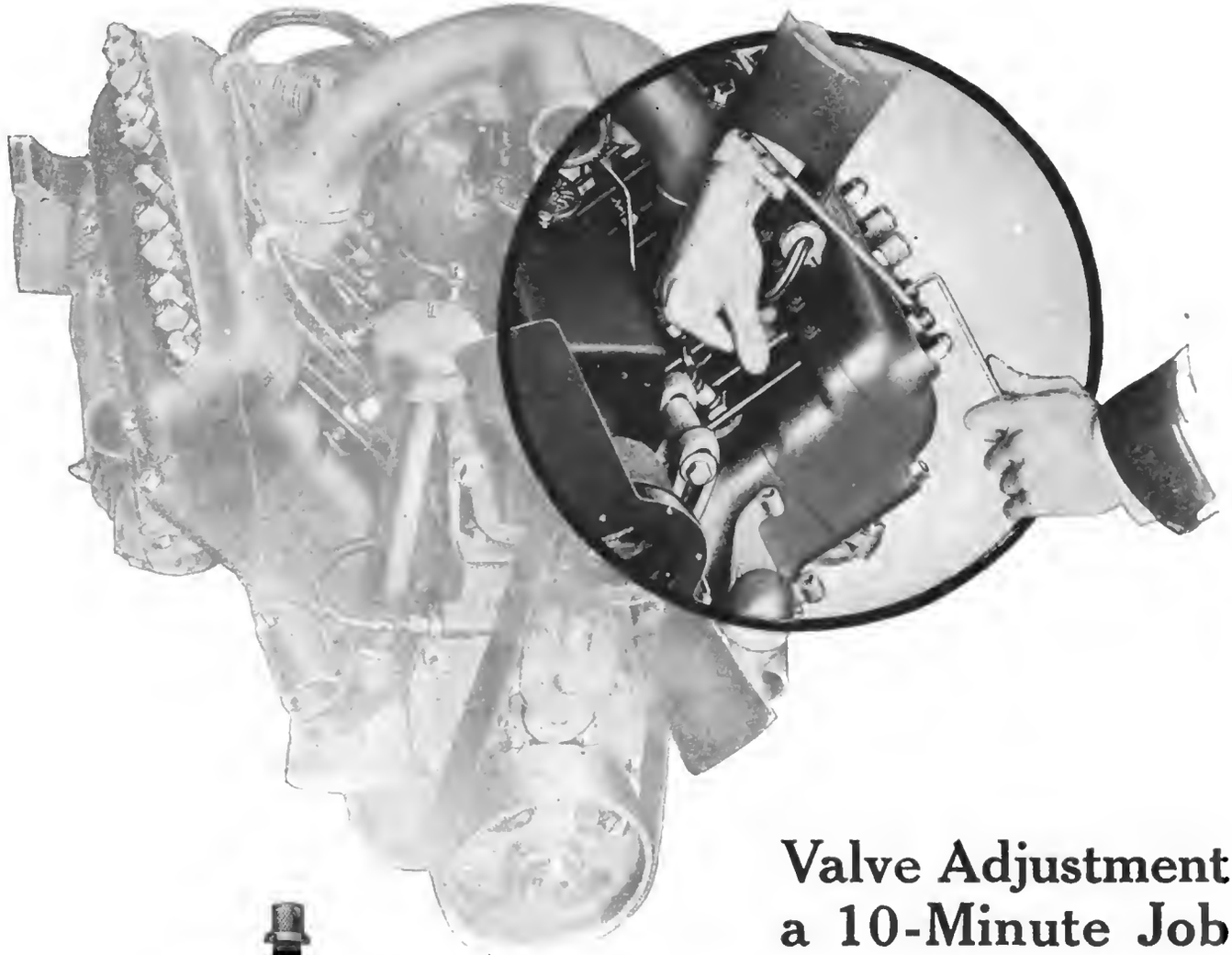
That means that, lined with Thermoid, brakes will hold, not only when the car is just being stopped but when it must stop quick or hit something.

Thermoid wears because it is cured under hydraulic compression into a solid substance of uniform density. It contains 50% more material foot for foot than do other kinds. Watch the brakes—remember that without a lining they are not brakes at all. Consider, too, how much better it is to see they are lined with Thermoid Brake Lining than to have a finely equipped motor crumpled into junk in an instant, or to have to race to a hospital with a child or adult that would not have been hit if the brakes had held.

Thermoid Brake Lining is absolutely guaranteed to give more satisfactory results and to outwear any other lining manufactured. Not affected by heat, oil, water, gasoline or dirt

OUR GUARANTEE:
Thermoid will make good or we will

Thermoid Rubber Company
Trenton, N. J.



Assembling of valve reciprocating parts. Note adjusting screw and spherical fulcrum at top, roller valve-lifter at bottom.

Valve Adjustment a 10-Minute Job

In Ferro V-Type Motors, the valve adjusting screws are on the top of the cylinder-head cover, right within easy reach.

All that is required for taking up valve clearance is to unscrew a cap, loosen a locknut and turn the adjusting screw.

The car-owner himself can adjust all the valves in ten or fifteen minutes.

This big improvement was made possible by placing the valves in the head and using detachable heads without valve cages.

It is but one of a number of features that make Ferro V-Type Motors so desirable.

Write for booklet

THE FERRO MACHINE & FOUNDRY CO.
1293-S Hubbard Avenue Cleveland, Ohio

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Reg. U.S. Pat. Off.

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Blackmore Door Curtain Openers give you all the advantages of a car enclosed in wood or glass. When curtains are attached, they enable you to open your doors all the way up. No buttons to fuss with, no curtains to bother you. No "ducking" or stooping to enter or leave the car. These patented Blackmore Openers are simple inexpensive steel supports for automobile door curtains. They enable the open body to offer every advantage of the closed limousine. Once you have attached them you can forget all about your curtains until spring. The openers can be instantly detached and put away with your curtains.

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DOOR CURTAIN OPENERS

DON'T PUT UP YOUR CAR THIS WINTER
TAKE IT TO YOUR NEAREST TOP MAKER

and have Blackmore Openers attached in an hour's time

Standard Equipment on 1917 Models

Packard	Reo	Jackson
Cadillac	White	Locomobile
Studebaker	Franklin	Chalmers

With the Blackmore Door Curtain Openers

DAYTON TOP IMPROVEMENT COMPANY, DAYTON, OHIO

PATENT NOTICE: We control basic patents on door curtain openers, and will vigorously prosecute any infringers

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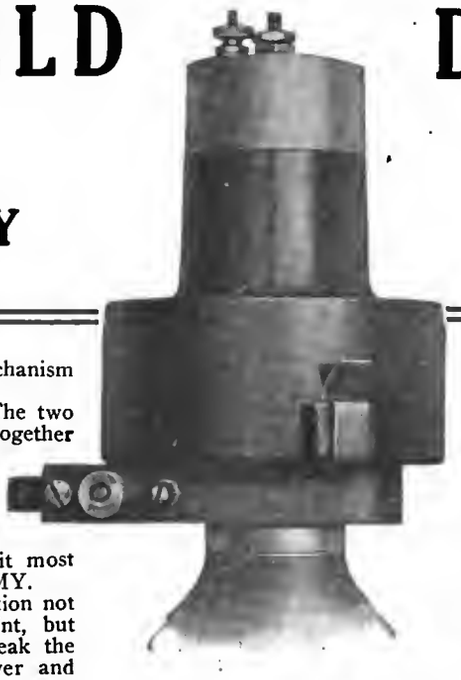
SIMPLE DURABLE ABSOLUTELY FOOL-PROOF



An open circuit and a breaker mechanism independent of springs.

Look at these three illustrations. The two small platinum points are forced together and then forced apart by the revolving cam. The cam is so shaped that while the "make" or contact is firm it is of much shorter duration than the "break" action, thus leaving an open circuit most of the time. This means ECONOMY.

Notice particularly that the cam action not only drops the lower contact point, but pushes up the contact point, to break the contact; also that it lifts the lower and drops the upper to make contact. This means POSITIVE UNFAILING ACTION—MECHANICAL ACTION.

The cam action in Fig. 1 is designed for a 4-cylinder engine; the cam action in Fig. 2 is designed for a 6-cylinder engine; the cam action in Fig. 3 for an 8-cylinder engine. Count the cams!

Electrical and mechanical lags are practically eliminated by this simple, positive action, and timing synchronization made as nearly perfect as is humanly attainable.

The whole ignition outfit is simple, compact, and made into a single unit, including the coil.

Write for complete details

Pittsfield Spark Coil Company
Pittsfield, Massachusetts

Fig. 1

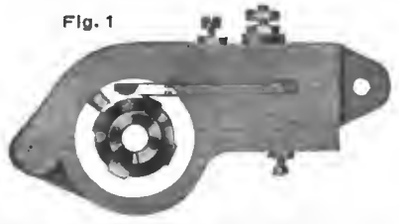


Fig. 2

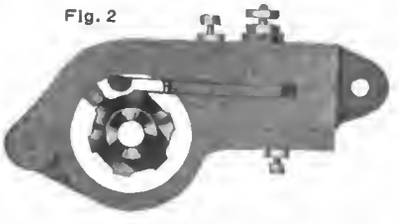
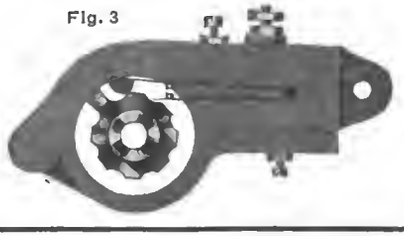


Fig. 3



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We will, commencing Wednesday, January 3d, 1917, and continuing Thursday, January 4th, 1917, at 10:00 A.M. each day at Waterloo, Iowa, sell at public auction entire plant of L. C. Erbes. Inventory value over $350,000.00.

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400 sets Lewis springs, 100 sets Timken, Hess and Lewis front and rear axles, Warner transmissions, 500 truck and touring car frames, aluminum crank and transmission cases, 250 Warner and Lavigne steering gears.
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33x4..... 8.00		3.45	36x5.....11.00		5.45
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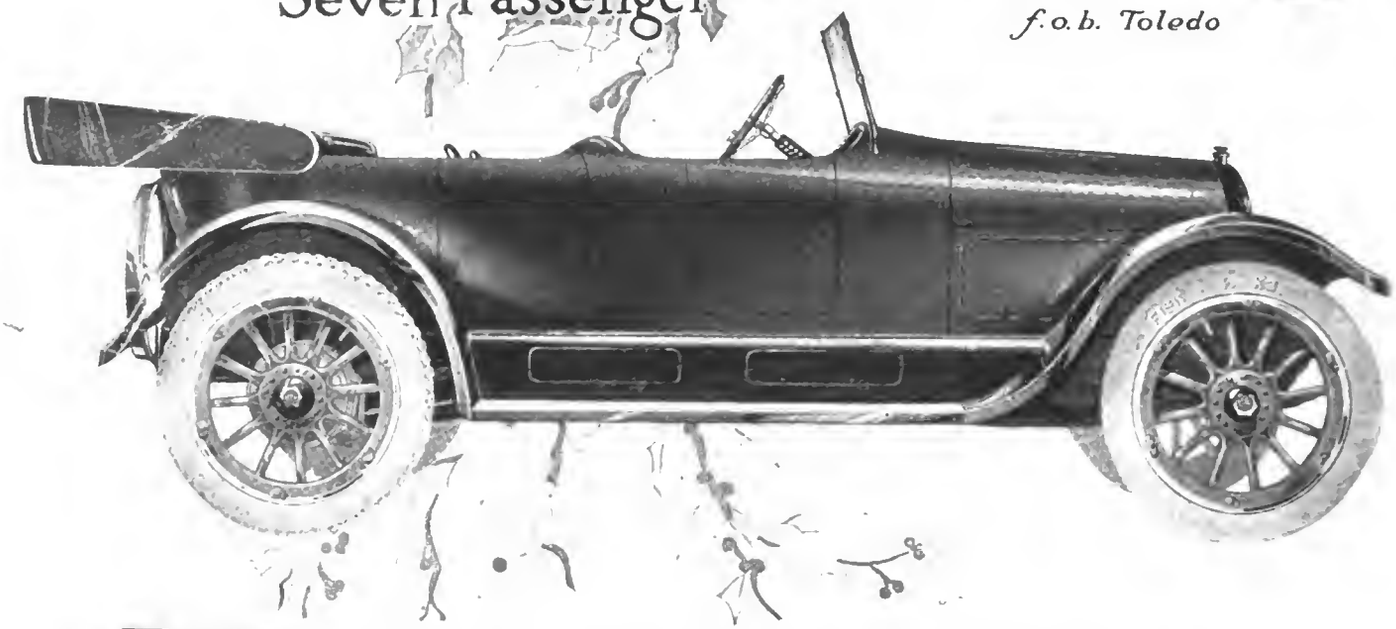

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